National Park Service

U.S. Department of the Interior

Everglades National Park

Florida

Pilot Spreader Swale Project

Environmental Assessment

October 2008

EXECUTIVE SUMMARY

The U.S. Army Corps of Engineers (USACE) proposes a pilot project to construct spreader swales immediately south of two culverts found along a 10.7- mile stretch of the Tamiami Trail at the northeastern boundary of the Everglades National Park. The National Park Service (NPS) is the lead agency for preparation of this environmental assessment (EA) and the USACE is a cooperating agency under the National Environmental Policy Act (NEPA). The purpose of this project is to determine if pilot spreader swales would increase hydrologic flow into Everglades National Park and if so, determine the level of increased conveyance. These data will provide decision- makers with sufficient information to decide whether construction of additional swales on Everglades National Park land is worth the financial cost and potential environmental effects. Additional NEPA analyses and documentation would be prepared prior to constructing additional swales.

Completion of the Tamiami Trail roadway and canal in 1928 was heralded as an engineering feat and allowed access into a vast wetland wilderness that greatly influenced development of South Florida. Today, the Tamiami Trail remains an important transportation and commercial corridor along the northern boundary of Everglades National Park. However, largely unforeseen during the Trail's construction were the environmental consequences of essentially building a dam across the Everglades ecosystem. Eighty years later, environmental impacts of the Tamiami Trail are readily observable.

As part of the Modified Water Deliveries (Mod Waters) Project several initiatives are in motion to restore ecological balance to Everglades National Park. In this EA, the potential effects of a pilot spreader swales project are examined. Spreader swales were suggested originally by the USACE as a potential means of providing increased water deliveries; however, the effectiveness and potential level of benefits remains unknown.

Neither the 1992 General Design Memorandum for the Mod Waters project, several reevaluation reports, nor the 2008 Final Limited Reevaluation Report for the Tamiami Trail component included authorization for construction of spreader swales at the outlets of the existing culverts under Tamiami Trail. Questions remain on how much the swales would improve the flow in the culverts under Tamiami Trail. To date, no conclusive study has been done that substantiates the benefits of these features relative to their cost and ecological impacts.

The purpose of this pilot spreader swale project is to determine if installation and functioning of spreader swales would be effective in contributing to the overall restoration goals of the Mod Waters project by taking steps to restore the natural hydrologic conditions (increased flow and natural distribution) of Northeast Shark River Slough. Public scoping resulted in identification of four project objectives for meeting the project purpose:

1. The pilot spreader swale project will provide data and information to the NPS and USACE to guide future planning and compliance efforts for enhancing flows and assessing potential ecological benefits in Northeast Shark River Slough.
2. The pilot spreader swale project will establish criteria for determining compliance with restoration goals of the Mod Waters project, including thresholds for water quality, quantity, and distribution of flows in Northeast Shark River Slough.

3. The pilot spreader swale project will define what monitoring, measurements, and modeling should be used to verify environmental benefits or degradation resulting from installation.
4. The pilot spreader swale project will determine the beneficial effects needed to justify the impacts to park natural and cultural resources from project implementation.

Four alternatives were analyzed for meeting these objectives:

1. **Alternative A, the No Action Alternative** / Environmentally Preferred Alternative. The no action alternative includes no changes to Tamiami Trail culverts or associated conditions. Changes in flow through the culverts to the park would not occur until additional components of the Mod Waters Project, such as the tentatively selected 1- mile bridge, recommended in the 2008 Tamiami Trail Limited Reevaluation Report/EA, are complete. Total Cost: $0
2. **Alternative B, the Structural Alternative**. The structural alternative includes construction of two pilot spreader swales located downstream of two existing Tamiami Trail culverts. Flows would be monitored from the existing and adjacent control culverts to assess any potential hydrologic improvements provided by the swales. Total initial cost: $5,322,345 to $7,084,105; in the event that the pilots are not effective, the cost of compensatory wetland rehabilitation would be $322,000.
3. **Alternative C, Non- Structural Alternative**: Hydrologic Modeling/Environmentally Preferred Alternative. For this non- structural alternative, existing or new hydrologic models would be used to simulate potential hydrologic effects of the pilot spreader swales. The modeling would take into account local conditions at each culvert site. Various numerical models would be considered for this approach. Total Cost: $51,781
4. **Alternative D, the Preferred Alternative**. This alternative would take an adaptive management approach to evaluate the potential hydrologic effects of the pilot spreader swales. This alternative contains a non- structural hydrologic modeling step (as described for Alternative C) and potentially, a structural component (as described for Alternative B) to build the pilot spreader swales within Everglades National Park. Total initial cost: $5,374,126 to $7,135,886; in the event that the pilots are not effective, the cost of compensatory wetland rehabilitation would be $322,000.

Environmentally Preferred Alternative and Preferred Alternative

Based on evaluations associated with the project objectives, Alternative C is the Environmentally Preferred Alternative. Improving information related to the performance of spreader swales using enhanced hydrologic modeling would be more effective in meeting the six criteria of Section 101 of NEPA than Alternatives A, B and D. The degree of uncertainty regarding the ability of spreader swales to provide measurable ecological benefits, coupled with the introduction of new disturbance associated with spreader swale construction, would make Alternatives B and D less able to meet the criteria.

Alternative D is recommended as the Preferred Alternative. This decision is based on a combination of factors. First, there remains a wide difference of professional opinion and, therefore, large uncertainty in the ability of pilot swales to improve water deliveries to Everglades National Park. Second, when the uncertainty of the benefits is coupled with the

known adverse impacts to the wetlands affected by their construction, the National Park Service feels there is value derived from proceeding both cautiously and in an iterative manner. Development of a simple hydrologic model for purposes of improving the park's confidence in the decision to build the pilot swales will provide a much firmer basis for proceeding with their construction. Additionally, modeling could provide insights into the function of the swales and would allow for design improvements that could reduce the known adverse impacts.

None of the alternatives analyzed in this EA would result in major environmental impacts or impairment to park resources or values.

Public Review and Comment

This draft EA will be on public review for **30** days. If you wish to comment, you are encouraged to submit your comments directly on the NPS Planning, Environment, and Public Comment (PEPC) website. The other option is to mail comments to the name and address provided below.

Please **e- mail comments** through the NPS PEPC planning website: http://parkplanning.nps.gov/ever, and follow the links for the Pilot Spreader Swale Project / EA. The "Open for Public Comment" link on the left column provides access to the draft EA.

Copies of the draft Pilot Spreader Swale Project/EA will also be available for review at public libraries throughout South Florida.

Go to the "Document List" link on the left hand column of the NPS PEPC planning website to find a listing of the libraries.

Please **mail written comments** to:

Everglades National Park
Attn: Dave Sikkema, Pilot Spreader Swales Project
40001 S.R. 9336
Homestead, FL 33034

Before including your address, phone number, e- mail address, or other personal identifying information in your comments, you should be aware that your entire comment – including your personal identifying information – may be made publicly available at any time. While you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so.

The NPS will hold a public workshop to present information about the Pilot Spreader Swale Project/EA and solicit public comment. The workshop will include a presentation by Everglades National Park staff. Before and after the presentation, the public will be able to view informational displays, meet with park staff, and provide comments.

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CHAPTER 1: PURPOSE AND NEED

PARK PURPOSE AND SIGNIFICANCE

On May 30, 1934, Congress passed an act authorizing a park to be acquired through public and private donations. Everglades National Park was to be "…wilderness where no development…or plan for the entertainment of visitors shall be undertaken which would interfere with the preservation of the unique flora and fauna of the essential primitive natural conditions now prevailing in the area." In 1947 Everglades National Park was established and today totals 1,509,000 acres.

The intermingling of plant and animal species from both the tropical and temperate zones, plus the merging of freshwater and saltwater habitats, provide the vast biological diversity that make Everglades National Park unique. The area's significant attributes, features, and resources resulted in the Everglades becoming the first national park established to preserve an ecosystem. Everglades National Park's purpose and significance are outlined as follows:

Purpose:

Park purpose statements are by definition, based on the specific legislation and associated legislative history for each park.

Everglades National Park is a public park for the benefit and enjoyment of the people. It is set apart as a permanent wilderness preserving essential primitive conditions, including the natural abundance, diversity, behavior, and ecological integrity of the unique flora and fauna.

Significance:

Significance statements capture the essence of the park's importance to our country's natural and cultural heritage. Significance statements represent the park's distinctiveness and help to place the park within its regional, national, and international context.

1. Everglades National Park is a unique subtropical wetland that is the hydrological connection between central Florida's freshwater ecosystem and the marine systems of Florida Bay and the Gulf of Mexico. It is the only place in the United States jointly designated as an International Biosphere Reserve, a World Heritage Site, and a Wetland of International Importance.
2. Everglades National Park comprises the largest subtropical wilderness in North America. The park contains vast habitats, including freshwater marshes, tropical hardwoods, pine rockland, extensive Mangrove estuaries, and sea grasses that support a diverse mixture of tropical and temperate plants and animals.
3. Everglades National Park serves as a sanctuary for the protection of more than 20 federal and 70 state- listed threatened and endangered species as well as numerous species of special concern. Many of these species face tremendous pressure from natural forces and human influences while trying to survive in the limited geographic area of the South Florida Ecosystem.

4. Everglades National Park provides important foraging and breeding habitat for more than 400 species of birds (including homeland to world- renowned wading bird populations), and functions as a primary corridor and refuge for migratory and wintering wildlife populations.
5. Everglades National Park includes archeological and historical resources spanning approximately 5,600 years of human history revealing adaptation to and exploitation of its unique environment.
6. Everglades National Park preserves natural and cultural resources associated with the homeland of American Indians of Florida (including Miccosukee Tribe of Indians of Florida, the Seminole Tribe of Florida, and the Seminole Nation of Oklahoma).
7. Everglades National Park preserves the remnants of a nationally significant hydrologic resource that sustains south Florida's human population and serves as a global experiment in restoration.
8. Everglades National Park provides the public with the opportunity to experience the Everglades wilderness for recreation, reflection, and solitude in proximity to a major metropolitan sector.

In addition, Everglades National Park also:

- has been designated as an Outstanding Florida Water;
- supports the largest stand of protected sawgrass prairies in North America;
- serves as a crucial water recharge area for south Florida through the Biscayne aquifer;
- supports the largest mangrove ecosystem in the Western Hemisphere;
- functions as an internationally significant estuarine complex in Florida Bay and the park's western coast, providing a major nursery ground that supports sport and commercial fishing;
- encompasses resources that directly support significant economic activities;
- engenders inspiration for major literary and artistic works; and
- offers a place where recreational, educational, and inspirational activities occur in a unique subtropical wilderness.

Everglades National Park's mission is the combination of its purpose and significance and is accomplished through pursuit of the following goals:

- preserving the resources of Everglades National Park, including native flora and fauna;
- maintaining the hydrological conditions, including water quality, quantity, distribution, and timing, within Everglades National Park and the south Florida ecosystem, which are characteristic of the natural ecosystem prior to Euro- American intervention;
- providing for public use and enjoyment and a quality visitor experience at Everglades National Park;
- allowing visitors to Everglades National Park to experience the park's unique subtropical wilderness values;

- assisting the public in understanding and appreciating Everglades National Park and its role in the south Florida ecosystem and providing support in achieving the park's purpose;
- strengthening and preserving natural and cultural resources and enhancing recreational opportunities managed by partners; and
- assuring that the Seminole and Miccosukee Tribes have the opportunity to exercise their existing tribal rights within Everglades National Park to the extent and in such a manner that does not conflict with the park purpose .

PROJECT BACKGROUND

The Everglades National Park Protection and Expansion Act of 1989 (Expansion Act), 16 United States Code (USC) Section 410r- 5 *et seq.*, expanded the boundaries of the Everglades National Park to include 109,600 acres south of the Tamiami Trail, in Miami- Dade County. The Expansion Act authorized the National Park Service (NPS) and the U.S. Army Corps of Engineers (USACE) to acquire lands within the designated area "Everglades National Park Expansion Area." The purposes of the expansion of Everglades National Park include:

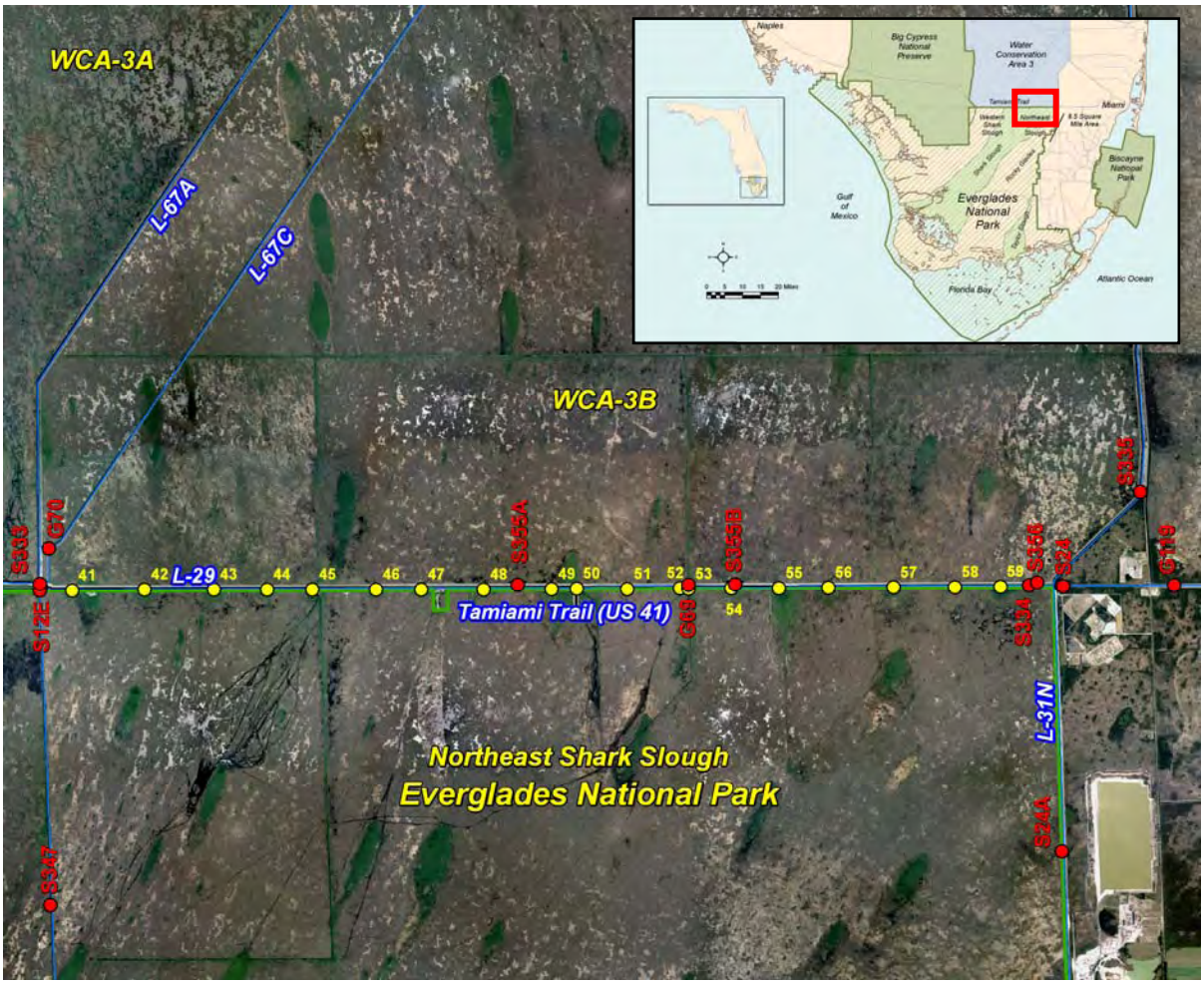
- preservation of the outstanding natural features of the park;
- enhancement and restoration of the ecological values, natural hydrologic conditions, and public enjoyment of such area by adding the area commonly known as the Northeast Shark River Slough and the East Everglades; and
- assurance that the park can maintain the natural abundance, diversity, and ecological integrity of the ecosystem.

The Expansion Act also authorized the Modified Water Deliveries (Mod Waters) Project "…to improve water deliveries into the park and shall, to the extent practicable, take steps to restore the natural hydrologic conditions within the park." A specific goal of the Mod Waters project is to restore the historic hydrologic conditions within the Shark River Slough basin by redistributing flows from West Shark River Slough to Northeast Shark River Slough. The proposed swale project study area includes the northeast portions of Shark River Slough, the major ridge and slough system in the southern Everglades. The project features are located adjacent to portion of U.S. Highway 41, commonly referred to as the Tamiami (Tampa to Miami) Trail, which connects Miami and Tampa. The project location is a 10.7- mile stretch of the Tamiami Trail just west of Miami, bordered by Water Conservation Area (WCA) 3B on the north side, and Everglades National Park on the south side (hereinafter referred to as the project area). The road is bordered on its northern edge by the L- 29 canal and levee, which comprises the southern boundary of WCA- 3B.

Together, both the roadway and levee act as a physical barrier that separates WCA- 3B from the Park. The L- 29 canal (also known as the Tamiami Canal), runs along the north side of the Tamiami Trail and is definitively marked at each end by two water- control structures across the canal, S- 334 on the east and S- 333 on the west. These structures, in addition to S- 355 A & B in the L- 29 levee, control the transfer of water into and out of the L- 29 canal from the regional system. The S- 355 structures are not currently authorized for use. Water transferred from the regional system into the Tamiami Canal flows through the existing culvert system south under the Tamiami Trail into Northeast Shark River Slough (Figure 1).

The 2008 Limited Reevaluation Report EA (LRR/EA) was conducted to assess needed roadway modifications and included alternatives containing bridges, additional culverts, and swales downstream of the existing culverts. This report also identified the tentatively Selected Plan (TSP) as a 1- mile bridge coupled with elevation of the remainder of the highway section to improve hydrologic conditions. Swales were not included in this plan. The modeling associated with the LRR provided adequate technical justification for the use of bridges and additional culverts, but the use of swales remains in question. Additional technical information provided by the USACE, the South Florida Water management District (SFWMD), and the NPS differ as to the degree of benefit that can be attributed to these features. Therefore, Everglades National Park has agreed to undertake an evaluation of the efficacy of these features through potential modeling and/or construction of pilot swales to more accurately assess the hydraulics of the swales. Since construction of pilot spreader swales would take place within Everglades National Park, the NPS must have assurance of the technical efficacy of these features.

FIGURE 1. VICINITY MAP OF PROPOSED PILOT SPREADER SWALE PROJECT AREA



The USACE has recommended to the NPS that construction of spreader swales downstream of existing culverts under Tamiami Trail between levees L67 and L30 may provide benefits for improved flow into Northeast Shark Slough. (A swale is a structural feature that distributes water from culverts more evenly across the landscape, theoretically improving water flows downstream.) There are 19 sets of culverts. Most of the culverts contain three equally sized pipes ranging from 42 to 60 inches in diameter depending on location.

It is the intent of this EA to identify an approach to investigate the efficacy of these controversial features that, when implemented, would provide sufficient data for the development of a policy position on the utility of spreader swales in improving flows to Northeast Shark Slough.

PROJECT PURPOSE

"Purpose" is an overarching statement of what the proposed pilot spreader swale project must do to be considered a success. The following draft purpose statements are based on internal and external project scoping and background materials provided in advance of the project scoping meetings.

The purpose of this pilot spreader swale project is to determine if installation and functioning of spreader swales would be effective in contributing to the overall restoration goals of the Mod Waters project by taking steps to restore the natural hydrologic conditions (increased flow and natural distribution) of Northeast Shark River Slough.

The purpose of the pilot project is to define the framework for making two management decisions:

- Is there ample evidence to justify implementation of the pilot spreader swales? To achieve this, the project must determine the criteria and thresholds for implementation of an action alternative.
- If implemented, what indicators and standards would be used to judge success of the pilot spreader swales? To achieve this, the project must define what would be measured and monitored, and the thresholds used to judge success of the project in enhancing flows into the Northeast Shark River Slough.

NEED

One of the objectives of the Mod Waters project is to improve conveyance of water to the park's Expansion Area, which would require modifications to the Tamiami Trail. Early planning efforts to achieve these objectives resulted in alternatives that were incompatible with long- term sustainability of the Tamiami Trail and had rapidly escalating construction costs, making them difficult to fund and implement.

Certain alternatives identified in the 2008 Tamiami Trail Limited Reevaluation Draft Report (LRR/EA) completed by the USACE, had spreader swales associated with the existing or proposed additional culverts in some of the proposed alternatives. However, the selected alternative for implementation under the draft LRR/EA did not include spreader swales at any culvert locations. The reason for dismissal of the spreader swales in the LRR/EA stems from language provided by Congress (WRDA 2007 Conference Report) to the Chief of

Engineers to "pursue immediate steps to increase flows to the Park of at least 1,400 cfs, without significantly increasing the risk of roadbed failure." The WRDA Conference Report also stated that the flows to the park should have "a minimum target of 4,000 cubic feet per second so as to address the restoration envisioned by the 1989 Act." Subsequent modeling and evaluation of the LRR/EA alternatives suggested that spreader swale implementation would have minor hydrologic benefits towards meeting the immediate 1,400 cfs requirement and much less capability in improving conditions needed to attain the 4,000 cfs target. The minor benefits associated with the swales were also thought to not be ecologically significant (USACE 2008).

There are considerable differences of opinion on the best solution to improving flows beneath the Tamiami Trail, which range from merely adding spreader swales to each culvert set to construction of a 10.7- mile bridge. The analysis presented in the LRR/EA objectively considered the full range of options and the costs necessary to complete them. To meet the Congressional directive of delivering just the 1,400 cfs without harm to the Tamiami Trail, construction of the 1- mile bridge and elevation of the roadbed, with subsequent increases in stage in the L- 29 canal, was found to be the most cost- effective method to achieve this goal (USACE 2008). Meeting the 4,000 cfs target will likely require additional modifications to the roadway.

There are differing technical opinions on the degree of improved hydrologic conveyance (see Appendix C, Hydrologic Considerations/Modeling Deficiencies) provided by the spreader swales when compared to the conveyance capacity of the existing features. Opinion supporting installation of spreader swales assumes they would replace lost overland flow and partially compensate for the reduction in groundwater seepage by redistributing available surface water entering the area (USACE and SFWMD 2008). Conversely, there is the potential for backwater flooding (reverse flow), questions about water quality effects, and the potential for swale benefits to be overwhelmed by other conditions such as locally or regionally altered drainage patterns. These conditions could combine to make the spreader swales ineffective (USACE and SFWMD 2008).

The need for the pilot spreader swale project includes:

- Resolving the divergence of opinions concerning the effectiveness of spreader swales in enhancing flows in Northeast Shark River Slough.
- Testing the ability of spreader swales to contribute to the overall restoration goals of the Mod Waters project.
- Analyzing the potential environmental costs and benefits to support sound decision-making.
- Investigating the effectiveness of small- scale, incremental water deliveries.

ISSUES

Issues describe problems or concerns associated with current impacts from environmental conditions or current operations, as well as problems that may arise from the potential implementation of pilot spreader swales. These concerns are used to guide development of alternatives and identify impact topics to be addressed in the environmental analysis. Issues

for this EA have incorporated input from internal and public scoping, and consideration of potential impacts. The issues related to the proposed pilot spreader swale project focus largely on project performance, park resources, and authority to act, as described below:

Project Performance

There are differing technical opinions as to whether pilot spreader swales would substantially increase flow through the Tamiami Trail culverts. Issues include the following:

- Are spreader swales capable of improving flow to Northeast Shark Slough and, if so, are they cost- effective?
- Are the proposed pilot spreader swale features consistent with Water Conservation Area 3 Decompartmentalization and Sheet Flow Enhancement (DECOMP) project components? (See a description of DECOMP in "Relationship to Other Plans, Policies, and Actions.")

Park Resources

The construction of spreader swales would affect resources within the project area, and these effects need to be determined. For example:

- What effect would pilot spreader swales have on water quality, quantity, and distribution?
- What effects would pilot spreader swales have on the project area ecosystem?
- What effect would pilot spreader swales have on native plant and animal species in the park?
- What effect would pilot spreader swales have on non- native plant and animal species in the park?
- What are the effects of pilot spreader swales on federal and state- listed threatened and endangered species in the area of potential effect?
- What effect would pilot spreader swale maintenance have on park resources?
- Is construction of the pilot spreader swales in the park reversible?
- What effect would pilot spreader swales have on cultural resources?
- Where would dredged material be disposed?

Authority to Act

Questions have arisen regarding the legal authority of the NPS to construct spreader swales on park lands. The NPS has the authority to implement the spreader swale pilot project under Modified Water Deliveries Project legislation.

OBJECTIVES

Objectives are specific statements of purpose; they describe what must be accomplished to a large degree for the project to be considered a success. To be able to measure success of the project, criteria such as hydrologic and ecologic parameters and thresholds of acceptability

and cost- effectiveness must be identified. This will allow the NPS to make a decision on alternative selection. The following objectives were developed by the planning team and will be used in the analysis of alternatives in the EA. The pilot spreader swale project will:

1. Provide information to the NPS and USACE regarding the potential for spreader swales to enhance flows.
2. Establish criteria for determining compliance with restoration goals of the Mod Waters project, including thresholds for water quality, quantity, and distribution of flows in Northeast Shark River Slough.
3. Define what monitoring, measurements, and modeling shall be used to verify hydrologic conditions resulting from installation.
4. Determine acceptable levels of impact to park resources should swales prove effective.
5. Provide information to determine the level of potential beneficial effects needed to justify the adverse impacts to park natural and cultural resources from project implementation.
6. Provide information required to determine if any potential benefits are worth the short-term and long- term costs incurred by the project.

LAWS, REGULATIONS, AND POLICIES

Numerous laws, regulations, and policies at the federal, state, and local levels guide the decisions and actions regarding the pilot spreader swale project. Some of the primary examples of these legal and regulatory constraints and bounds follow.

National Park Service Legislation

National Park Service Organic Act (1916) and Management Policies

In the *National Park Service Organic Act of 1916* (Organic Act), Congress directed the U.S. Department of the Interior and the NPS to manage parks "to conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations" (16 USC §1). Congress reiterated this mandate in the Redwood National Park Expansion Act of 1978 by stating that the NPS must conduct its actions in a manner that will ensure no "derogation of the values and purposes for which these various areas have been established, except as may have been or shall be directly and specifically provided by Congress" (16 USC §1 a- 1).

Despite these mandates, the Organic Act and its amendments afford the NPS latitude when making resource decisions that balance visitor recreation and resource preservation. By these acts, Congress "empowered [the NPS] with the authority to determine what uses of park resources are proper and what proportion of the park resources are available for each use" (*Bicycle Trails Council of Marin v. Babbitt,* 82 F.3d 1445, 1453 [9th Cir. 1996]).

Management Policies

Management Policies (NPS 2006a) establishes service- wide policies for the preservation, management, and use of park resources and facilities. These policies provide guidelines and direction for management of resources within the park. The alternatives considered in the EA would incorporate and comply with the provisions of these mandates and policies.

Management Policies, section 4.4.1 "General Principles for Managing Biological Resources" directs parks to preserve and restore native plant and animal populations and minimize human impacts on native plants, animals, and the ecosystems that sustain them. In section 4.4.4 ,"Management of Exotic Species," park managers are directed not to allow non- native species to displace native species, if this can be prevented.

The NPS requires the containment, control, and management, to the greatest degree possible, of exotic species – especially those with serious ecological threats (NPS 2006a). In addition, introduction of new exotic species into parks is prohibited, unless required to meet specific management needs and when all prudent measure to minimize harm have been taken (section 4.4.4.2).

Director's Order #12 and Handbook: Conservation Planning, Environmental Impact Analysis, and Decision- Making

Director's Order #12 and the accompanying handbook (NPS 2001a) lay the groundwork for how the NPS complies with NEPA. Director's Order #12 and the handbook set forth a planning process for incorporating scientific and technical information and establishing a solid administrative record for NPS projects.

Director's Order #12 requires that impacts to park resources be analyzed in terms of their context, duration, and intensity. It is crucial for the public and decision- makers to understand implications of those impacts in the short and long- term, cumulatively, and in context, based on an understanding and interpretation by resource professionals and specialists. Director's Order #12 also requires that an analysis of impairment to park resources and values be part of the NEPA document.

Park- Specific Legislation

Everglades National Park Enabling Legislation, Purpose, and Significance

On May 30, 1934 Congress passed an act authorizing a park of 2,164,480 acres to be acquired through public and private donations. Everglades National Park was to be "…wilderness where no development…or plan for the entertainment of visitors shall be undertaken which would interfere with the preservation of the unique flora and fauna of the essential primitive natural conditions now prevailing in the area." It took another 10 years, but in 1947 Everglades National Park was established.

Everglades National Park is a public park for the benefit and enjoyment of the people. It is set apart as a permanent wilderness preserving essential primitive conditions, including the natural abundance, diversity, behavior, and ecological integrity of the unique flora and fauna.

Everglades National Park Protection and Expansion Act of 1989.

The following legislative direction is contained within the Expansion Act:

- Congress determined that there are significant adverse effects to the ecosystem from external sources and that the ecosystem should be restored.
- Directs the Secretary of the Army's water programs for the Park to improve water delivery and to restore natural systems in conjunction with the Central and Southern Florida Project.
- Directs the Secretary of the Army to protect natural values in all work on the C- 111 canal.
- In the East Everglades addition, acquisition is to be accomplished by 80 percent federal and 20 percent State of Florida funds.
- Provides for assistance to the State of Florida in land acquisition of the park.
- No federal license, permit, approval, right- of- way, or assistance shall be granted or issued with respect to the West Dade Wellfield until the Secretary of the Interior, the Governor of Florida, the South Florida Water Management District, and Dade County, Florida, enter into an agreement providing that certain conditions are met.
- Requires the Secretary of the Interior to consult with the USACE on the Central and Southern Florida Project.
- Authorized the implementation of the Modified Water Deliveries Project to restore, to the extent practicable, the natural hydrologic conditions of Everglades National Park. The park would implement the pilot spreader swales project under this authority.

Other Federal Laws and Executive Orders

National Environmental Policy Act, 1969, as Amended

Section 102(2)(c) of this act requires that an environmental analysis be prepared for proposed federal actions that may significantly affect the quality of the human environment or are major or controversial federal actions. NEPA is implemented through regulations of the Council on Environmental Quality (CEQ) (40 CFR 1500- 1508). The NPS has, in turn, adopted procedures to comply with the act and the CEQ regulations, as found in *Director's Order 12: Conservation Planning, Environmental Impact Analysis, and Decision Making*, and its accompanying handbook (NPS 2001a). Section 102(2) (c) of this act requires that an EIS be prepared for proposed major federal actions that may significantly affect the quality of the human environment.

National Parks Omnibus Management Act of 1998

This act (16 USC 5901, et seq.) underscores NEPA in that both are fundamental to NPS park management decisions. Both acts provide direction for articulating and connecting the ultimate resource management decision to the analysis of impacts, using appropriate technical and scientific information. Both also recognize that such data may not be readily available and provide options for resource impact analysis in this case.

National Historic Preservation Act of 1966, as Amended

Section 106 of this act requires federal agencies to consider the effects of their undertakings on properties listed or potentially eligible for listing on the National Register of Historic Places. All actions affecting the parks' cultural resources must comply with this legislation.

Clean Water Act

The Federal Pollution Control and Prevention Act of 1972, commonly known as the Clean Water Act, is the primary federal law in the United States governing water pollution. The purpose of the act is to make our nation's waters "fishable and swimmable" by 1983 by eliminating releases of toxic substances, controlling wastewater and storm water pollution of waterways, and instituting water quality standards and associated permitting systems.

The principal body of law currently in effect is based on the Federal Water Pollution Control Amendments of 1972, which significantly expanded and strengthened earlier legislation. Major amendments were made to the Clean Water Act of 1977 enacted by the 95th United States Congress and the Water Quality Act of 1987 enacted by the 100th United States Congress.

Endangered Species Act

The Endangered Species Act provides a program for the conservation of threatened and endangered plants and animals and the habitats in which they are found. The U.S. Fish and Wildlife Service of the Department of the Interior maintain a worldwide list which includes endangered species of animals and plants. Species include birds, insects, fish, reptiles, mammals, crustaceans, flowers, grasses, and trees.

The law requires federal agencies, in consultation with the U.S. Fish and Wildlife Service and/or the U.S. National Oceanic and Atmospheric Administration Fisheries Service, ensure that actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of designated critical habitat of such species. The law also prohibits any action that causes a "taking" of any listed species of endangered fish or wildlife. This EA addresses requirements of the act by incorporating analyses and impact findings for special- status species that could potentially be affected by the project.

Executive Order 11988 - Floodplain Management

This Executive Order directs federal agencies to avoid to the extent possible the long- and short- term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct or indirect support of floodplain development wherever there is a practicable alternative.

Executive Order 11990 - Protection of Wetlands

This Executive Order directs federal agencies to avoid to the extent possible the long- and short- term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative.

Executive Order 13112 – Invasive Species

This Executive Order requires federal agencies to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species may cause.

State Laws

Outstanding Florida Waters

All waters that are a part of Everglades National Park are defined as Outstanding Florida Waters (OFW). Section 403.061 (27), Florida Statutes, grants the Florida Department of Environmental Protection power to: Establish rules that provide for a special category of water bodies within the state, to be referred as "Outstanding Florida Waters," which shall be worthy of special protection because of their natural attributes. In general, the Florida Department of Environmental Protection cannot issue permits for direct pollutant discharges to OFWs that would lower ambient (existing) water quality or indirect discharges that would significantly degrade the waters. Permits for new dredging and filling must be clearly in the public interest, taking into consideration whether the:

- activity would adversely affect the public health, safety, or welfare or property of others;
- activity would adversely affect the conservation of fish and wildlife, including endangered or threatened species, or their habitats;
- activity would adversely affect navigation or the flow of water or cause harmful erosion or shoaling;
- activity would adversely affect the fishing or recreational values or marine productivity in the vicinity of the activity;
- activity would be of a temporary or permanent nature;
- activity would adversely affect or enhance significant historical and archaeological resources under the provisions of Sec. 267.061 F.S.; and
- current condition and relative value of functions being performed by areas affected by the proposed activity (373.414(1)(a), F.S.).

RELATIONSHIP TO OTHER PLANS, POLICIES, AND ACTIONS

Actions undertaken in association with the proposed pilot spreader swales project have the potential to contribute to the cumulative effects of other plans and projects in or near the park. The following projects and plans with the ability to contribute to cumulative effects of the pilot spreader swale project have been identified. These are included in analyses of the cumulative scenario for the various impact topics addressed in the EA.

- **Exotic Vegetation Management Plan.** The park prepared an Exotic Vegetation Management Plan to control non- native plant species to benefit the entire park. The project will result in the continued control and reduction of non- native plant species in the project area.

- **Tamiami Trail Vista Clearing Project.** This project's goal is to remove non- native vegetation, specifically from areas immediately south of Tamiami Trail, and to also trim vegetation near the road to improve views into the park.
- **Everglades National Park General Management Plan/East Everglades Wilderness Study.** Everglades National Park is in the process of developing the Draft General Management Plan / East Everglades Wilderness Study / Environmental Impact Statement (GMP/EIS)- a 20- year vision for the park's resource protection and management. As part of the GMP process, information was collected from the general public and interested parties regarding future management concerns. The park is currently analyzing public input received on the preliminary management alternatives and is revising the alternatives for the park's marine areas. The scope of the GMP was expanded in 2006 to include a Wilderness Study for the East Everglades Expansion Area lands. The expanded GMP process will fully consider all legislated uses and designations and will result in a viable management plan for the entire park, including the expansion area.

Regional water management projects in South Florida have the potential to alter or improve hydrology and water quality in or near the project area. Should all these projects be successfully implemented, their cumulative impact is expected improve the now degraded ecological conditions. These projects include:

- **Modified Water Deliveries Project.** This project involves construction of modifications to the Central and South Florida Project to improve the hydrologic conditions of the Northeast Shark River Slough, the largest drainage basin within the park. By removing some existing structures and installing new features, the project would recreate a more functional hydrologic system between the conservation areas north of the park and the wetlands within the park. The project features should improve the quantity, quality, timing, and distribution of water flows into Northeast Shark River Slough. Some project features have been completed and other components are scheduled for implementation over the next several years. In June 2008, the USACE identified modifications to the Tamiami Trail in the Final Limited Reevaluation Report. The selected plan includes construction of a 1- mile bridge and the raising of the remainder of the 10.7- mile highway corridor.
- **C- 111 Project.** This project separates Everglades National Park from highly productive subtropical agricultural lands to the east. Because of the extreme permeability of the Biscayne Aquifer in the Dade County area, the project canals have a direct impact on water levels in adjacent areas. The C- 111 General Reevaluation Report (GRR) with integrated EIS was completed and approved in 1994. It recommended project modifications designed to maintain existing flood protection and other Central and South Florida(C&SF) project purposes in developed areas east of C- 111 while restoring natural hydrologic conditions in the Taylor Slough and eastern panhandle areas of the park. Increased freshwater flows in these areas will also help conditions in Florida Bay, a part of Everglades National Park.
- **Comprehensive Everglades Restoration Plan**. The comprehensive plan is a framework and guide to restore, protect, and preserve the water resources of central and southern Florida. The plan is a component of the world's largest ecosystem restoration effort encompassing 16 counties and an 18,000- square- mile area. The

Comprehensive Everglades Restoration Plan (CERP) includes more than 60 elements designed to capture, store, and redistribute fresh water previously lost to tide and to regulate the quality, quantity, timing, and distribution of flows. Eight CERP projects are intended to provide improvements to flows in and around Everglades National Park. Implementation of CERP will take more than 30 years to complete and will cost an estimated $11 billion.

- **The Water Conservation Area 3 Decompartmentalization and Sheet Flow Enhancement Project.** The DECOMP project is an important component of CERP. Decompartmentalizing the Everglades, that is, restoring the historic "river of grass" through the Water Conservation Areas (WCA) and into Everglades National Park, is a critical component of Everglades restoration. It is the natural flow of water – volume, direction, speed, and depth – that helps create the unique characteristics of the Everglades ecosystem. Restoring natural water flows will require removing or modifying levees, canals, and other barriers to sheet flow. The DECOMP project area includes WCA3 and Everglades National Park within Broward and Miami- Dade Counties. Potential modifications to the Miami, North New River, L- 67- A, L- 67- C, L- 28, and L- 29 canals and associated levees will be analyzed. Additional project implementation reports will address barriers to sheet flow in other parts of the ecosystem.

PUBLIC SCOPING

Public scoping is an early and open process to solicit public and internal concerns relating to a proposed action. The Council on Environmental Quality (CEQ 1978) guidelines for implementing NEPA, and the NPS NEPA guidelines contained in *Director's Order # 12: Conservation Planning, Environmental Impact Analysis and Decision Making Handbook* (NPS 2001a), require public scoping of federal actions that would require an EIS. Although public scoping is not required for an EA, the NPS conducted scoping for the pilot spreader swale project to ensure input from all interested stakeholders.

A public hearing was held in May 2008 to give interested parties an opportunity to learn more about the pilot spreader swales project, ask questions of NPS representatives, and voice opinions in a public forum. Topics in the presentation included resource sensitivity, physical and financial limitations, and necessity of facilitating water flow. Five responses were received in opposition to installation of the spreader swales. Reasons for opposition of the pilot spreader swale project included:

- the use of swales is an unproven habitat restoration technique;
- spreader swales are unnatural features in the Everglades;
- spreader swales are an inappropriate use of time and money; and
- the NPS is not adhering to its restoration schedule.

Eleven responses supported construction of spreader swales and included several reasons for encouraging the project. Most reasons for the support of construction of the swales were focused on the potential improvements to flow these features could provide.

IMPACT TOPICS

Impact topics were used to focus evaluation of the potential environmental consequences of the alternatives. Candidate impact topics were identified based on legislative requirements, executive orders, topics specified in Director's Order #12 and Handbook (NPS 2001a), *Management Policies* (NPS 2006a), guidance from the NPS, other agencies, public concerns, and resource information specific to Everglades National Park.

Derivation of Impact Topics

Specific impact topics were developed for a focused discussion and to allow issues to be addressed and environmental consequences of the alternatives to be compared. These impact topics were identified based on federal laws, regulations, and executive orders; 2006 NPS *Management Policies*; and NPS knowledge of limited or easily impacted resources. A brief rationale for the selection of each impact topic is given below, as well as the rationale for dismissing specific topics from further consideration.

Impact Topics Analyzed in this Environmental Assessment

Impact topics are the resources of concern that could be affected by the range of alternatives. Specific impact topics were included to ensure that alternatives were compared on the basis of the most relevant topics. All resources described in the impact topics included in this document are included and described in Chapter 3: Affected Environment and Environmental Consequences.

Each retained topic has issues that merit discussion. Impact topics include the following:

Hydrology was retained because the potential for spreader swales to increase water flow into the park is the primary issue surrounding potential installation of the pilot spreader swales.

Water Quality was retained because installation of spreader swales may affect local water quality over the short and long- term.

Soils was retained because of the potential short and long- term disturbance to soil profile and productivity associated with construction activities and the presence of the pilot spreader swales.

Vegetation and Wetlands were retained because of the potential short and long- term disturbance to wetlands, and subsequently native and non- native plant species, associated with construction activities and the presence of the pilot spreader swales.

Wildlife was retained because of the potential short and long- term disturbance to native and non- native wildlife and aquatic species.

Special- status Species was retained because of the potential for these species to occur within or near the project area.

Cultural Resources was retained as disturbance along the Tamiami Trail corridor could potentially affect historic, archeological, or ethnographic resources. The Tamiami Trail and Canal both have been deemed eligible for listing on the National Register of Historic Places (NRHP).

Transportation was retained because construction activities along the Tamiami Trail may affect traffic flow during the construction period.

Visitor Use and Experience was retained because construction may have short- term effects on the quality of visitor experience, and the presence of the swales may provide new visitor experience opportunities along the Tamiami Trail corridor.

Impact Topics Dismissed from Further Analysis (Rationale for Dismissal)

All resources described in impact topics dismissed in this document are **NOT** included or described in Chapter 3: "Affected Environment and Environmental Consequences" of this EA.

Air Quality: Everglades National Park enjoys a Class I clean air status. Lands with this designation are subject to the most stringent regulations. Very limited increases in pollution are permitted in the vicinity. This high air quality is a valuable park resource, enhancing visitation by providing clean air and high visibility to match the unique ecosystem experience. The Clean Air Act of 1963 (42 USC 7401) requires federal land managers to protect air quality, and the 2001 NPS Management Policies direct air quality to be analyzed when planning park projects and activities. If the pilot spreader swales were to be constructed, equipment fumes would be mitigated and would not measurably contribute negatively to air quality conditions, or adversely affect visitors or staff. Because of the high water table, it is unlikely that large quantities of dust would be generated, and any occurrence of construction dust would be localized and very transient. If dust were generated during construction, best management practices for dust suppression would be initiated. Emissions from construction vehicles would be kept to a minimum by restricting idling time. In the context of activities and facilities along the project area, no appreciable effects to air quality would be anticipated.

Ecologically Critical Areas: Everglades National Park does not contain any designated ecologically critical areas, wild and scenic rivers, or other unique natural resources, as referenced in 40 Code of Federal Regulations (CFR) 1508.27.

Prime and Unique Agricultural Lands: Prime farmland has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops. Unique agricultural land is land other than prime farmland that is used for production of specific high- value food and fiber crops. Both categories require that the land is available for farming uses. Lands within the park are not available for farming and therefore do not meet the definitions.

Conflicts with Land Use Plans, Policies, or Controls: Refer to the section "Relationship to Other Plans, Policies, and Projects" for a discussion of the conflicts with other plans.

Energy Requirements and Conservation Potential: The NPS reduces energy costs, eliminates waste, and conserves energy resources by using energy- efficient and cost-effective technology. Energy efficiency is incorporated into the decision- making process during the design and acquisition of buildings, facilities, and transportation systems that emphasize the use of renewable energy sources. The alternatives do not include actions that would require increased energy usage.

Wilderness: The Wilderness Act, passed on September 3, 1964, established a national wilderness preservation system, "administered for the use and enjoyment of the American

people in such manner as will leave them unimpaired for future use and enjoyment as wilderness, and so as to provide for the protection of these areas, the preservation of their wilderness character, and for the gathering and dissemination of information regarding their use and enjoyment as wilderness" (16 USC § 1131). Lands identified as being suitable for wilderness designation, wilderness study areas, proposed wilderness, and recommended wilderness (including potential wilderness) must also be managed to preserve their wilderness character and values in the same manner as "designated wilderness" until Congress has acted on the recommendations (NPS 1999).

The Wilderness Act defines a wilderness as "an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable, has outstanding opportunities for solitude or a primitive and unconfined type of recreation, has at least five thousand acres of land or is of sufficient size as to make practicable, its preservation and use in an unimpaired condition; and may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value."

In 1978, Congress designated approximately 86 percent of Everglades National Park as the "Everglades Wilderness." The area was renamed in 1997 after Marjory Stoneman Douglas (PL 105- 82), in honor of the famous Everglades activist. The wilderness area contains 1,296,500 acres of the Park's total 1,509,000 acres and is the largest wilderness area in the southeastern United States. These lands are now shielded from development encroachment and are managed to protect the flora and fauna of the Everglades ecosystem.

In 2006, the NPS initiated the East Everglades Wilderness Study (EEWS) and integrated it into the Everglades National Park General Management Plan (GMP) process that was already underway. That planning process is ongoing and expected to be completed in 2010. Approximately 106,000 acres of the 109,600 acres (or 97 percent) of East Everglades were determined to contain (or potentially possess) wilderness values and characteristics. The management alternatives that will be included in the GMP/EEWS Environmental Impact Statement (EIS) will include a range of options for East Everglades wilderness taking into account a wide range of issues regarding management of this area of the park. Following the approval of the GMP/EEWS/EIS with a signed Record of Decision, there would be a recommendation from the NPS Director to the Secretary of the Interior on East Everglades lands proposed for wilderness designation.

Areas determined not to be eligible included developed areas along the Tamiami Trail, the Chekika developed area, and roads within the expansion area. These areas total approximately 3,600 acres. Because the project area is not within wilderness, this impact topic has been dismissed.

Environmental Justice: Executive Order 12898, "General Actions to Address Environmental Justice in Minority Populations and Low- Income Populations," requires all federal agencies to incorporate environmental justice into their missions by identifying and addressing disproportionately high and/or adverse human health or environmental effects of their programs and policies on minorities and low- income populations and communities. Guidelines for implementing this executive order under NEPA are provided by the CEQ.

According to the U.S. Environmental Protection Agency (USEPA) (1994), environmental justice is

> *The fair treatment and meaningful involvement of all people, regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people, including racial, ethnic, or socioeconomic group, should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and policies. The goal of this "fair treatment" is not to shift risks among populations, but to identify potentially disproportionately high and adverse effects and identify alternatives that may mitigate these impacts.*

There are both minority and low- income populations in the general vicinity of Everglades National Park. However, based on the initial environmental screening process for the project, environmental justice is dismissed as an impact topic because:

- NPS staff actively solicited public participation as part of the planning process and gave equal consideration to input from all persons, regardless of age, race, income status, or other socioeconomic or demographic factors.
- Impacts associated with implementation of each alternative including the Preferred Alternative, would not disproportionately affect any minority or low- income population or community.
- Implementation of each alternative, including the Preferred Alternative, would not result in any identified effects specific to any minority or low- income community.
- The NPS staff does not anticipate that any adverse impacts on public health and/or the socioeconomic environment would appreciably alter the physical and social structure of the nearby minority or low- income populations or communities.

Floodplains: Executive Order 11988 instructs federal agencies to avoid, to the extent possible, the long- and short- term, adverse impacts associated with the occupancy and modification of floodplains and wetlands, and to avoid direct or indirect support of development in floodplains and wetlands wherever there is a practicable alternative. Director's Order # 77- 2 (NPS 2002a) addresses development in floodplains. Floodplains have not been delineated for the park by the Federal Emergency Management Agency through the National Flood Insurance Program. Floodplains within the project area have been altered over time and would experience no more than negligible adverse effects by the actions of the alternatives; actions taken in floodplains would be short- term and support long- term floodplain functions. As a result, floodplains were not retained for further analysis.

Indian Trust Resources: Indian trust assets are owned by American Indians but held in trust by the United States. Requirements are included in the Secretary of the Interior's Secretarial Order No. 3206, "American Indian Tribal Rites, Federal – Tribal Trust Responsibilities, and the Endangered Species Act," and Secretarial Order No. 3175, "Departmental Responsibilities for Indian Trust Resources." According to park staff, Indian trust assets do not occur within Everglades National Park. There are no Indian trust resources downstream of the project area. Therefore, there would be no downstream effects on Indian trust resources from any of the proposed alternatives.

Natural or Depletable Resource Requirements and Conservation Potential: The NPS uses sustainable practices to minimize the short- and long- term environmental impacts of development and other activities through resource conservation, recycling, waste minimization, and the use of energy- efficient and ecologically responsible materials and techniques. Project actions would not compete with dominant park features or interfere with natural processes, such as the seasonal migration of wildlife or hydrologic activity associated with wetlands.

Park Operations: This impact topic concerns park staffing levels and workloads, costs, and operational activities. Changes being proposed in the alternatives that would affect park operations include staff and materials associated with monitoring pilot spreader swales and control culverts. Some workloads and staff needs could increase depending on the alternative, but this would not be expected to have greater than a negligible adverse impact on park operations.

CHAPTER 2: THE ALTERNATIVES

DEVELOPMENT OF THE ALTERNATIVES

NEPA implementing regulations provide guidance on the consideration of alternatives in an EA. These regulations require the decision- maker to consider the environmental effects of the proposed action and a range of alternatives (40 CFR § 1502.14). The range of alternatives includes reasonable alternatives that must be rigorously and objectively explored, as well as other alternatives that are eliminated from detailed study. To be "reasonable," an alternative must meet the stated purpose of and need for the project.

The purpose of including a No Action Alternative in environmental impact analyses is to ensure that agencies compare the potential impacts of the proposed action to the known impacts of maintaining the *status quo*. Current conditions are used as a benchmark. By using the current conditions as the No Action Alternative, impacts of the proposed alternatives can be directly compared to the existing baseline.

The No Action Alternative represents the current conditions present in the project area. Action alternatives considered in this EA were developed by the NPS and USACE after careful assessment by subject- matter experts, including hydrologists, resource specialists, and park planners and managers, and input by the public during project scoping. The collective efforts of these individuals in documenting the requirements for the pilot spreader swale project formed the basis for development of the proposed action alternatives, including the Preferred Alternative.

The Preferred Alternative represents the NPS proposed action and defines the rationale for the action in terms of resource protection and management, visitor use and operational use, and other applicable factors.

NEPA regulations require that the action proponent assess means to mitigate adverse environmental impacts associated with implementation of the proposed alternatives (40 CFR § 1502.16). Each alternative analyzed in this EA includes mitigation measures intended to reduce the environmental effects of installing the pilot spreader swales. Mitigation measures, such as Best Management Practices and Standard Operating Procedures that would be implemented under any of the proposed actions are included in the description of the alternatives.

DESCRIPTION OF THE ALTERNATIVES

Alternative A: The No Action Alternative

The no action alternative includes no changes to Tamiami Trail culverts or associated conditions. Maintenance of the existing culverts would be continued by the state of Florida using approved mechanical and chemical weed and sediment control methods. Flow through the culverts to the park would continue unaltered until additional components of the Mod Waters project and other authorities are complete.

The Tamiami Trail and its associated right- of- way are maintained and managed by the Florida Department of Transportation. Within the project area, routine maintenance would continue, including periodic inspection of the culvert sets, sediment removal and clearing of the structures, as needed, and repair of the culverts themselves, as needed.

In the vegetation haloes downstream of the culverts, the NPS would continue to manage exotic plants under the *South Florida and Caribbean Exotic Plant Management Plan*. The purpose of this plan is to improve ecologic function and habitat conditions throughout Everglades National Park by controlling the spread and presence of non- native plant species. Under this plan, a variety of methods are used to control invasive vegetation in all areas of the park.

Cost

There would be no cost for implementing Alternative A. Ongoing culvert maintenance is performed and paid for by the Florida Department of Transportation. There is no additional cost to the park of controlling exotic plants in the vegetation haloes because this plan is implemented park- wide and is not specific to operation of the Tamiami Trail culverts.

Alternative B: Structural Alternative

The structural alternative includes construction of two spreader swales located downstream of two existing Tamiami Trail culverts. The location of the spreader swales would be based on evaluation criteria that include:

- Avoidance of culverts in the primary and secondary restriction zones of the endangered Wood Stork colonies (eliminates culverts 54, 55, 56, and 59).
- Avoidance of culverts with outlets close to private property, tribal residences, man made features, or properties of historical/cultural significance (eliminates culverts 41, 45, 47, 48, 49, 50, 52, and 53).
- Avoidance of the construction footprint for the 1- mile bridge associated with the LRR's Selected Plan (eliminates culverts 56, 57, 58).
- Availability of a nearby culvert (or culvert with similar flow conditions) to serve as the control condition against which the effectiveness of the constructed spreader swale would be evaluated.
- Other culvert- specific conditions (hydrologic or ecologic) that could contribute to meeting the purposes of the pilot spreader swale project.

Culverts considered feasible for construction of the pilot spreader swales based on the above criteria are culverts 42, 43, 44, 46, and 51(Figure 2). (Other culverts adjacent to culverts 42, 43, 44, 46, and 51 could potentially be used as controls in the project as well.)

If the pilot spreader swales are constructed, all materials within the footprint of the spreader swale, such as peat and vegetation, would be excavated down to limestone. Flows through both the test and control culverts would be monitored to assess any potential effects of the

spreader swales Establishing relationships between paired culverts would allow these analyses to proceed.

Pilot spreader swales would be aligned parallel to Tamiami Trail in an east- west orientation approximately perpendicular to marsh flow. Each spreader swale would extend laterally from the culvert outlet and parallel to the Tamiami Trail (Figure 3). There are three potential configurations of this concept:

A. Surface dimensions of approximately 1,000 long by 60- foot wide, placed at location with culvert approximately mid- length of the spreader swale;

B. Length and width depend on the topographic survey but the total surface dimensions would not exceed approximately 62,000 ft2 and the length would not exceed 100 feet.

C. Sixty feet wide and extending on each side of each culvert set to the farthest lateral extent of the vegetation halo. The vegetation halo is defined as the distinct plume of bay heads, willowheads, pond apples, and other marsh vegetation (including some non-native species) directly south of the culvert sets that eventually transition into the downstream sawgrass community.

The final configuration of the pilot spreader swales would be determined upon completion of the detailed topographic survey and the baseline hydrologic modeling.

Construction Methods

In each alternative, the swale(s) would be constructed from the edge of the road embankment into Everglades National Park. All slopes would be approximately 1 on 3 to a maximum excavated depth to limestone with a 10- foot bench for stability of the road.

The construction method used would be to come from the roadway through the guard rail, clearing the first 10 feet with a bulldozer. Trucks would haul off vegetation, and the bulldozer would continue scraping the material into a wind row for removal by an excavator and trucks. The trucks would utilize the road with flagmen to remove the material to an offsite location.

FIGURE 2. PILOT SPREADER SWALE PROJECT AREA ALONG TAMIAMI TRAIL

(Culverts are indicated by the yellow numbers. Potential Culverts selected for pilot spreader swales are indicated by green arrows.)

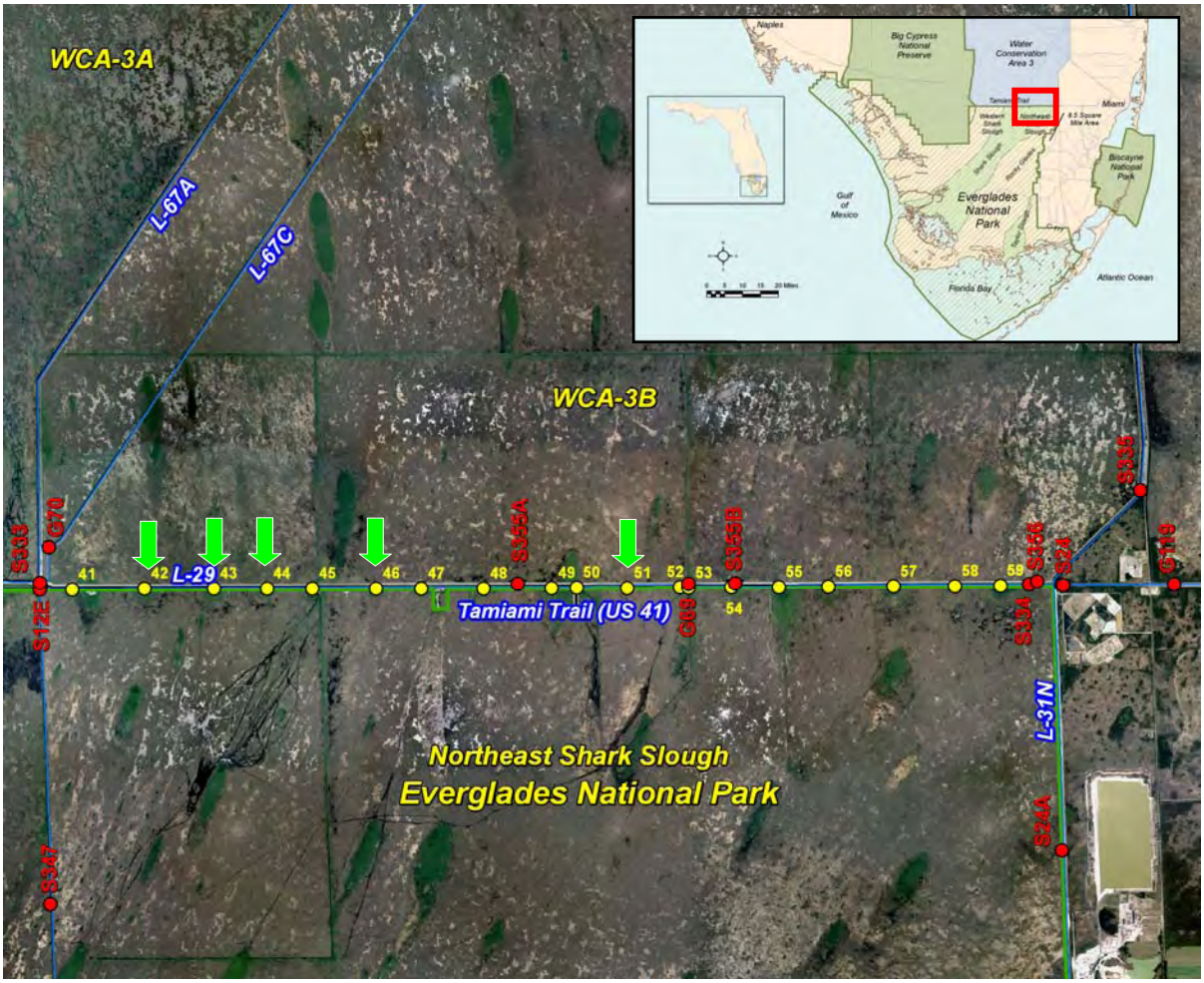
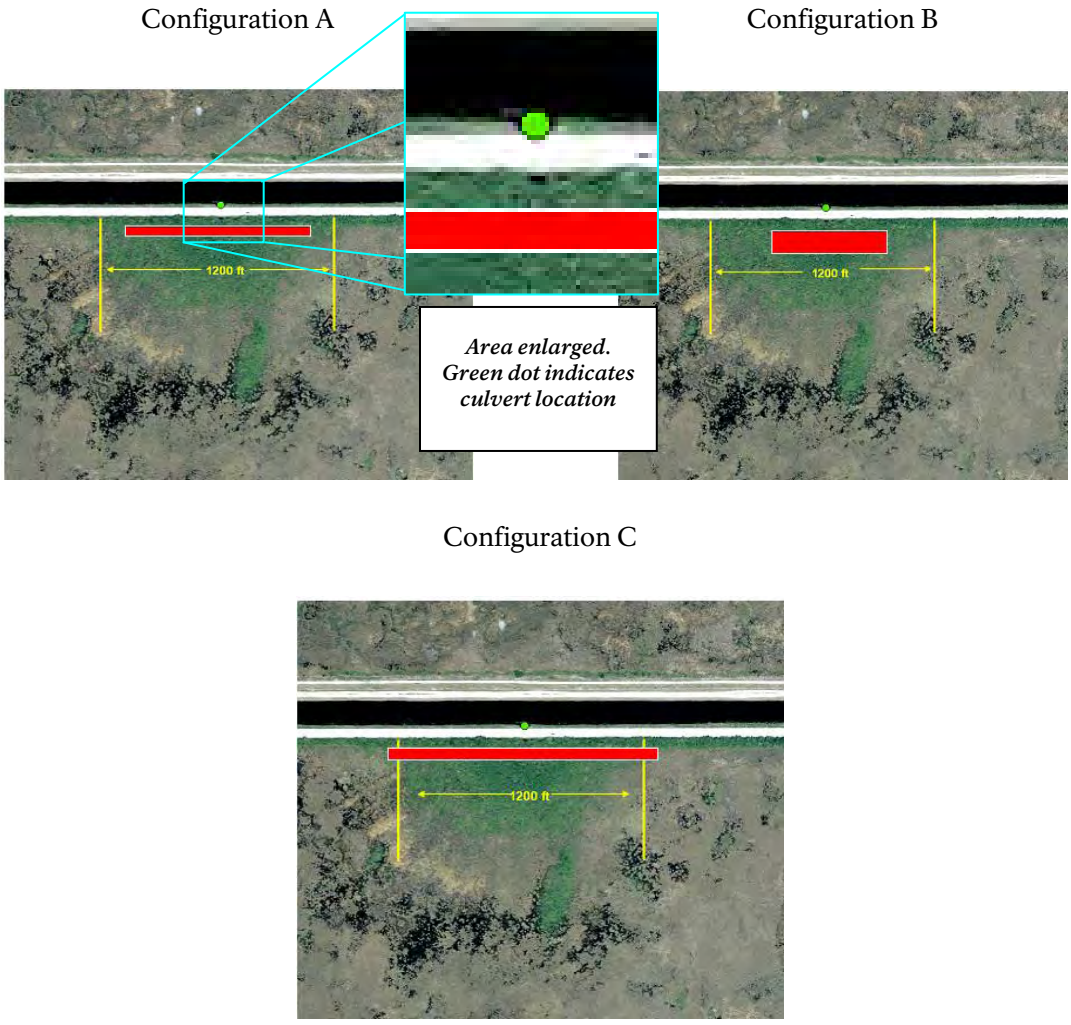


FIGURE 3. PROPOSED CONFIGURATIONS OF PILOT SPREADER SWALES



A summary of the possible characteristics of the spreader swales is presented below in Table 1.

TABLE 1. COMPARISON OF POTENTIAL PILOT SPREADER SWALE DESIGNS

Design Configuration	Surface Swale Dimension (in feet)	Bottom Swale Dimension (in feet)	Side Slope (rise/run)	Estimated Swale Depth
Configuration A	60 by 1,030	30 by 1,000	1:3	Up to 5 feet*
Configuration B	To be determined based on topographic survey and existing cultural resources survey limits; swale length will not exceed 100 ft; top dimensions will not exceed a total of 61,800 ft^2	To be determined based on topographic survey; swale length will not exceed 100 ft; bottom swale dimensions will not exceed a total of 30,000 ft^2	1:3	Up to 5 feet*
Configuration C	60 by 1555 Swale width (1555 ft) assumes the maximum size, and is based on the largest vegetation plume width for an available build culvert.	30 by 1525	1:3	Up to 5 feet*

* Gaiser et al (2007) observed an average soil depth in the Northeast Shark River Slough study sites to be approximately 1.67 feet with a maximum soil depth greater than 3.28 feet. Therefore, the 5- foot estimated depth provides a maximum depth for cost estimation purposes.

Resource Protection Measures

Under Alternative B (and potentially under Alternative D, described below) specific resource protection measures would be implemented during construction of the pilot spreader swales. These measures would also be implemented in the event the pilot study swales were found to be ineffective and site rehabilitation would be necessary. Table 2 below summarizes these measures.

TABLE 2: RESOURCE PROTECTION MEASURES OF ALTERNATIVE B

Potential Adverse Effect	Mitigation Measure or Best Management Practice
Direct effects from construction activities	Protection of all construction areas to confine potentially adverse activities to the minimum area required for construction. All protection measures would be clearly stated in the construction specifications, and workers would be instructed to avoid conducting activities beyond the construction zone.
Erosion resulting from construction- related surface disturbance	The contractor would be required to control erosion prior to, during, and following ground- disturbing activities. Standard erosion control measures would be used to minimize soil erosion. Erosion barriers would be inspected and maintained regularly to ensure effectiveness. The primary measure used to control storm water runoff would be installation of temporary silt fencing. Silt fences are made of synthetic fabric and are placed in drainage contours to trap sediment generated during construction.
Construction would affect areas previously undisturbed	Construction activities would take advantage, where possible, of sites where previous disturbance has already had adverse effects.
Contamination of soil by petrochemicals from construction equipment	Areas used for equipment maintenance and refueling would be minimized, and surface runoff in these areas would be controlled. Equipment would be checked frequently to minimize leaks and potential contamination.
Direct effects from construction on threatened and endangered species, wildlife, and habitat	All construction personnel would be advised of the potential presence of the Florida panther, Eastern indigo snake, Everglades Snail Kite, and wood stork to avoid disturbance or injury to these federally listed species. The NPS would use its best professional judgment in applying standard protection measures for the federally- listed species.
Wildlife disturbance resulting from construction activities, including noise	To reduce potential impacts on wildlife, construction activities occurring near sensitive habitats would be scheduled to minimize potential impacts during periods of breeding, nesting, and rearing of young. Construction would occur only during daylight hours to reduce effects on nocturnal foraging or rest.
Protection of cultural resources	To avoid damage to previously unknown archaeological resources, the Southeast Archaeological Center would conduct archaeological surveys and testing activities in previously un- surveyed and/or undisturbed areas prior to ground- disturbing activities. If any resources are encountered, adequate mitigation of project impacts (in consultation with appropriate agencies) or adjustment of the project design would take place to avoid or limit the adverse effects on prehistoric and historic archaeological resources. Include stop- work provisions in construction documents should archaeological or paleontological resources be uncovered.
Discovery of unknown archeological resources or human remains	If previously unknown archaeological resources are discovered, work would be stopped in the area of any discovery and the NPS would consult with affiliated tribes, pursuant to NAGPRA and the *Draft Park NAGRPA Plan of Action for Inadvertent Discoveries , Everglades National Park and Associated Tribes* (May 2008)
Public health and safety	Standard traffic control highway construction safety plans would be implemented. Traffic flow control, signage and flagging to protect visitor and staff safety during construction activities would be provided.
Wetland impacts	The NPS would maintain and operate the pilot spreader swales under the Exotic Vegetation Management Plan, and the Everglades National Park Hurricane Plan. Continued implementation of these resource management plans would minimize effects of swale maintenance on wetland resources.

Monitoring and Evaluation Program

If the swales are constructed, the park would implement resource monitoring and evaluate any hydrologic effects and potential impacts to park resources. The basic concepts and components of these plans are described below.

Hydrologic Monitoring

The purpose of the pilot project is to quantify the potential increase in flows associated with the implementation of spreader swales. Therefore, the hydrologic monitoring component is the heart of the pilot project monitoring plan. Proposed hydrologic monitoring for the pilot study includes collecting continuous stage and flow data at the pilot spreader swales as well as associated control culverts. Continuous stage data would be collected at each culvert set. A continuous flow measuring device, such as an Acoustic Doppler Current Profiler (ADCP), would be installed downstream or within each culvert set. Discharge measurements would be made under various stage and flow conditions to provide information needed to convert the ADCP measurements into continuous discharge data. Staff gauges would be installed at several locations downstream of each culvert set being monitored to collect instantaneous water level readings with each discharge measurement.

An evaluation of data collected from 1983 to 2008 indicates a strong relationship for most adjacent culvert flows. (Appendix C). These relationships will allow the testing of swale efficacy by using one outlet as the control and the adjacent outlet as the experimental. The exception is for culverts connected to a downstream canal such as culverts 45 and 53.

Everglades National Park proposes to evaluate the success of the pilot spreader swale project by comparing data collected before and after construction of the swales at two pairs of culverts; one set of culverts would act as the control (no swales) while the other would act as the experimental (with swales). The success of the proposal to detect differences between treated and untreated culverts requires a good understanding of the relationship between the two outlets prior to swale construction coupled with high accuracy continuous flow measurements. Historical data was collected with less accurate techniques; experimental data associated with swales will be collected using newer technology that provides more accurate results. Figures 4 and 5 show the correlation between two different paired culvert discharges. The clustering of data points along the lines shows that flows through adjacent culverts are similar. This relationship can be used to select the culvert pairs to be used as the control and test sites for potential installation of pilot spreader swales.

FIGURE 4. RELATIONSHIP OF FLOWS THROUGH CULVERTS 43 AND 44

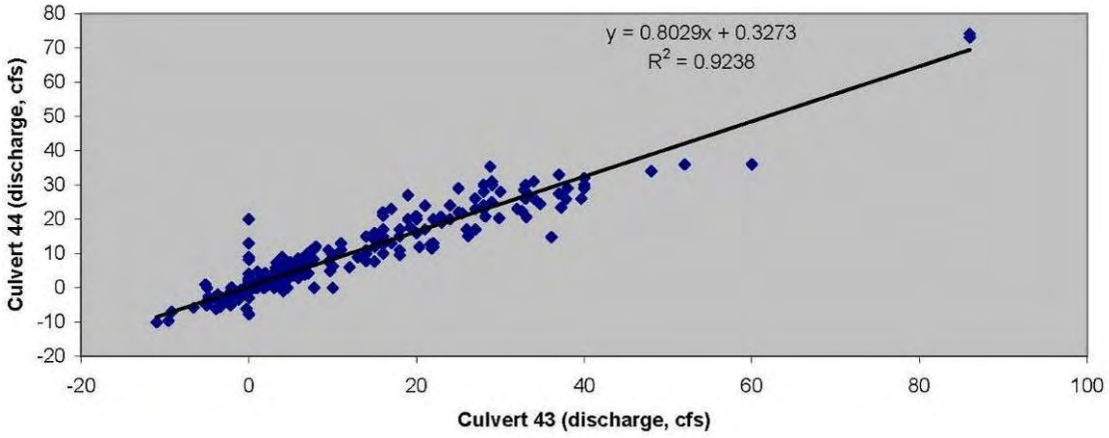
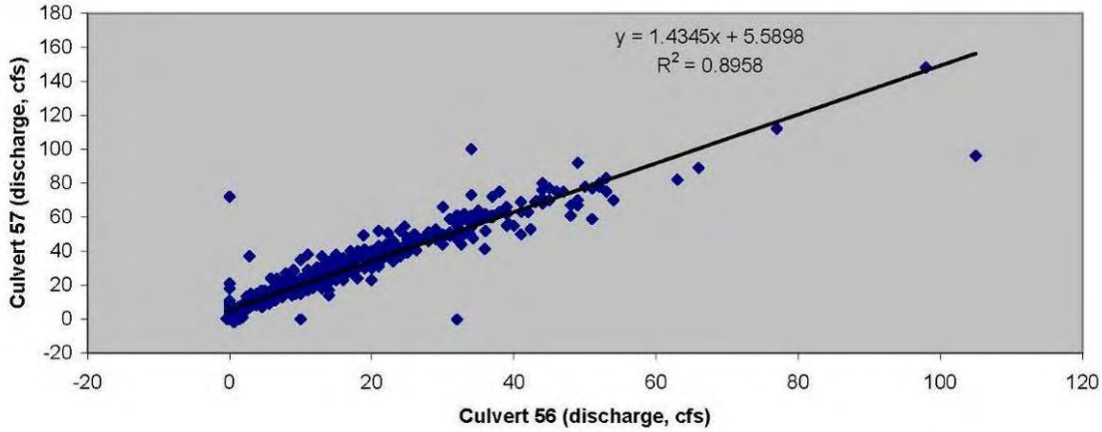


FIGURE 5. RELATIONSHIP OF FLOWS THROUGH CULVERTS 56 AND 57



Water Quality and Soils Monitoring

If the swales are constructed, the monitoring plan would include the ability to assess any potential effects of the pilot spreader swales on water quality and soil conditions within the immediate project area and downstream marsh. Soil conditions and/or water quality parameters would be evaluated upstream of the spreader swale sites, within the spreader swales, and downstream of the spreader swales at control sites. Monitoring would be conducted during baseline (pre- spreader swale construction) and post- spreader swale construction conditions. The soil/water quality monitoring plan would include all Florida Department of Environmental Protection (FDEP)- required permit sampling parameters.

Soil parameters expected to be analyzed include total phosphorus, total nitrogen, bulk density, and ash- free dry weight. Water quality parameters expected to be assessed would include flow, color, depth, dissolved oxygen, turbidity, total suspended solids, pH, specific conductivity, temperature, ammonia nitrogen, total nitrogen, nitrite- and nitrate- nitrogen, total phosphorus, orthophosphate, and total nitrogen. Water column concentrations of these parameters, particularly phosphorus and nitrogen, would be monitored to determine if

soil disturbance and loss of emergent and submerged vegetation associated with swales results in downstream effects.

Existing representative water quality monitoring stations would be used whenever feasible. Collection and analysis of all samples would be performed and analyzed using FDEP- and USEPA- approved sampling, analytical, and statistical methods. The soil/water quality monitoring program is expected to span a five- year timeframe and would begin prior to construction of the pilot spreader swales to ensure an adequate baseline is captured.

Vegetation and Periphyton Monitoring

If the pilot swales are constructed, a monitoring program would be designed and implemented to study potential effects of the pilot spreader swales on the abundance, diversity, and distribution of native and exotic plants within the immediate project area and downstream natural marsh areas. It is anticipated that construction of the pilot spreader swales, if they result in increased flow, would lead to the expansion of vegetation haloes already associated with the existing culverts. Therefore, the monitoring program would be designed to track the extent of this vegetation. It is also anticipated that construction of the pilot swales would result in an increase in abundance of native nuisance species (cattail) and exotic invasive species (water hyacinth and others) already found downstream of the culverts. The monitoring program would also be designed to measure changes in the abundance and distribution of these species. The initial monitoring program would span over a two- year timeframe and would be reassessed at that time to determine if additional monitoring would be required. Monitoring would begin prior to construction of the swales to ensure an adequate baseline. An experimental flume study conducted in the Northeast Shark River Slough illustrated that changes in the macrophyte community from controlled phosphorus additions did not occur until the 5^{th} year of the study, indicating that long- term monitoring of macrophytes may be needed to detect ecological change (Gaiser et al. 2005; Gaiser et al. 2007).

Periphyton is of critical importance in the Everglades ecosystem, and responds rapidly to environmental changes. This community is considered a key indicator of ecosystem change. Under experimental conditions, addition of phosphorus (a nutrient found in fertilizer and wastewater) slightly above natural background conditions of 5µg L^{-1} caused alterations in the periphyton and floc community within Northeast Shark River Slough after two months (Gaiser et al. 2005). Periphyton has been shown to respond much more rapidly than other indicators in the ecosystem, such as vegetation and fish communities (Gaiser et al. 2005; Gaiser et al. 2007). If the pilot swales are constructed, a monitoring program to study any potential effects the pilot spreader swales have on the periphyton community would be designed and implemented. Monitoring components of the program are expected to include, but would not be limited to, periphyton type, cover, biovolume and total phosphorus content. The initial monitoring program would span over a two- year timeframe and would be reassessed at that time to determine if additional monitoring would be required. Monitoring would begin prior to construction of the swales to ensure an adequate baseline.

Exotic and Native Fish/Applesnail Monitoring Program

The spatial patterns of large native and non- native fish movement and habitat usage within the project area would also be examined to help evaluate effects (if any) of the spreader

swales. If the pilot spreader swales are constructed, the monitoring program would be designed and implemented to study effects of the spreader swales on the abundance, diversity, and distribution of native and exotic fish and apple snails within the immediate project area and downstream natural marsh areas. Key environmental parameter data essential to understanding the fish and apple snail population dynamics, such as hydroperiod, water depth, dissolved oxygen, and water temperature, would also be collected and analyzed as part of the pilot spreader swale project. A variety of sampling methods, including trapping and electrofishing, would be employed to ensure appropriate members of the fish community and size classes are monitored. Fish data should include density or catch per unit effort estimates, size structure, relative abundance, and movement. Sampling should occur at least once during the wet season but more frequently during the dry season. The initial monitoring program would span over a two- year timeframe and would be reassessed at that time to determine if additional monitoring would be required. Monitoring would begin prior to construction of the swales to ensure an adequate baseline.

Swale Efficacy Determination

Everglades National Park remains concerned with the high degree of uncertainty associated with potential benefits of the proposed spreader swales. For example, there is little technical information provided in support of the assumed 10 to 12 percent flow increase used in the modeling of alternatives evaluated in the LRR (USACE 2008). Thus, Everglades National Park is unable to identify discrete thresholds for acceptability of the spreader swales at this time. For this reason, the park prefers to proceed cautiously with implementation of the pilot spreader swales by examining additional information that would allow for identification of these thresholds as well as provide for potential improvement to the final design of the pilot features. Everglades National Park proposes a thorough examination of the following prior to the identification of discrete swale success criteria:

- detailed topographic information immediately downstream of the outlets for proposed swale construction;
- evaluation of existing vegetative communities within the area of proposed swale construction;
- evaluation of the hydrologic and water quality data associated with the more recent sediment removal project immediately downstream of the S- 12 D structure. These data should provide useful information on the feasibility of swales to improve flow as this experiment included larger structural features (S- 12D), removal of sediment and vegetation downstream of the structure coupled with the ability to improve lateral flow from the structure into the Old Tamiami Canal
- development and implementation of a hydrologic modeling plan; and,
- development and implementation of an ecologic and hydrological monitoring plan. The baseline information from the monitoring plan should provide useful information for the modeling as well as assist in final design of the swales.

Depending on the ultimate level of design performance identified, other factors would need to be evaluated to determine swale efficacy and would include:

- adverse environmental effects beyond the spreader swale footprint;
- adverse impacts to threatened and endangered species; and

- cost/benefit analyses of the spreader swales.

For example, if the spreader swales do provide improvements in hydrologic conveyance near the desired level of performance, but create wide- ranging, adverse effects to downstream vegetation and the periphyton community, the pilot swales would not be considered a feasible restoration alternative.

Further, implementation of spreader swales at the full 19 sets of culverts at the Tamiami Trail is outside the limited scope of the pilot spreader swale EA and would need to take into account other factors, such as projected environmental benefits as compared to other feasible restoration alternatives.

Site Rehabilitation Plan

In the event monitoring efforts show that the spreader swales are ineffective at meeting the minimum improvement to hydrological conveyance (to be determined) for the project to be considered a success, Everglades National Park would implement site rehabilitation efforts. The expectation of the NPS would be to return the affected areas to a marsh habitat found throughout much of the areas encompassed by Northeast Shark River Slough; it would be highly improbable that the upland species currently occupying the proposed swale locations would be reproduced through site restoration.

Initial baseline conditions would be established through data collection and photography of the site prior to any construction activities. An exotic vegetation management plan would be developed and implemented to help control exotic vegetation and exotic snails within the affected area. Monthly monitoring and maintenance would be implemented and would initially occur over a two- year period. An assessment at the end of the two- year period would be conducted to determine if additional monthly monitoring and maintenance measures would be needed.

Cost

The estimated cost of Alternative B includes the cost of design, construction, maintenance and monitoring of the pilot spreader swales, as described above. The cost of construction will vary depending on the spreader swale configuration that is chosen.

The costs are presented as estimates (in 2008 dollars) and are not appropriate for budgeting purposes. The estimates presented have been developed using USACE, NPS, and industry standards to the extent available. Specific costs will be determined following further design of the pilot spreader swales and refinement of monitoring plans. A detailed presentation of the basis for the cost estimate is presented in Appendix B.

Total initial cost of Alternative B: $5,322,345 to $7,084,105; in the event that the pilots are not effective, the cost of compensatory wetland rehabilitation would be $322,000.

Alternative C: Non- Structural Alternative: Hydrologic Modeling

For this non- structural alternative, existing or variations of existing hydrologic models would be used to simulate potential hydrologic effects of the pilot spreader swales. The modeling would take into account local conditions at each culvert site. Various models,

such as physical models and/or numerical simulations would be considered and ultimately implemented for this approach.

The proper choice of a model and proper boundary conditions and model parameters would allow for modeling of flow to estimate the effects of building a spreader swale downstream of a culvert. Detailed field data would be required to provide adequate data to calibrate the model to provide confidence in the results. These data would include an accurate measurement of the surface water gradient downstream of the culvert. Various models, such as MODHMS, MODNET, and ISGW can be used, if a groundwater component is required. Alternatively, using one of the central culverts, away from the bounding levees, would allow the use of surface water only models, such as RMA2 or SWIFT2D.

The following criteria may be used for selecting the most appropriate model(s) for the Tamiami Trail spreader swale evaluation:

- Availability of the model: The model used for the evaluation should be off- the- shelf. That is, it should not be necessary to develop new model code for this application. There are various sources of information on available models. These include model user manuals, model evaluation reports from consultants, model evaluation reports from other government contacts, and reports from other studies. The following models may have applicability for the Tamiami Trail spreader swale evaluation:
    - adICPR
    - HEC- HMS/HEC-RAS/UNET
    - HSPF/FEQ
    - InHM
    - ISGW
    - MIKE SHE/MIKE 11
    - MODFLOW
    - MODBRANCH
    - MODHMS
    - MODNET
    - RMA- 2/RMA- 10
    - SWMM/XP- SWMM
    - WASH123D
- Overall capabilities of the model: The model should be able to simulate the major hydrologic and hydraulic processes in the study area, including but not limited to considerations for overland flow, canal flows, groundwater flows, and water control structure operations.
- Input data needs, availability of data, and ability to utilize available data to the maximum extent practical: Data collection can be expensive and take several years to capture natural variability. Several agencies maintain hydrologic data for the study area. These data should be surveyed as part of the model selection.
- Provide accurate and reliable information: Some models are more applicable to South Florida hydrology and can more exactly and consistently simulate local conditions. Other restoration projects in the study area should be reviewed to determine the models used most successfully.
- Ability of the model to simulate processes relevant to the issues: The evaluation will include canal flow, culvert flow, and overland flow from the potential spreader swales, and will need to discriminate the hydrologic and hydraulic effects of various spreader swales configurations with respect to ecological function.

- Success of the model in similar applications: As discussed for the applicability of models in the study area, the models should also have demonstrated applicability for the evaluation of spreader swale type hydraulics.
- Acceptability of the model by stakeholders and technical experts: Stakeholders in South Florida are particularly knowledgeable of various models and their applications. It is important to consider the success of other models in similarly sensitive study areas in the region.
- Speed of application of the model; ability to have results available within the delivery dates identified in the established project schedule: Model run- times should b e reasonable to allow comprehensive analyses in a reasonable amount of time. The speed of the model is directly related to the computer equipment available, so that must be part of the consideration.
- Enable both flood event and period of record simulations: Most models utilize flood event simulations. It is also desirable to use period of record simulations to demonstrate calibration with known data.

In conjunction with the proposed monitoring plans, an analogous modeling plan will also be developed in advance of conducting the modeling. This plan will outline the criteria above and provide a rationale for the selection of the most appropriate model for this application.

Cost

The estimated cost of Alternative C includes the cost of hydrologic modeling and support, as described above.

The costs are presented as estimates (in 2008 dollars) and are not appropriate for budgeting purposes. The estimates presented have been developed using USACE, NPS, and industry standards to the extent available. Specific costs will be determined following final model evaluation and selection. A detailed presentation of the basis for the cost estimate is presented in Appendix B.

Total cost of Alternative C: $51,781.

Alternative D: Preferred Alternative: Nonstructural Component: Hydrologic Modeling and Potential Structural Component (Adaptive Management Approach)

This alternative would take an adaptive management approach to evaluate the potential hydrologic effects of the pilot spreader swales project. This alternative contains a non-structural hydrologic modeling step (as described for Alternative C) and potentially, a subsequent structural component (as described for Alternative B) to build the pilot spreader swales within the park.

Initially, hydrologic modeling would be used to evaluate the potential effects of spreader swales. If results of the modeling were conclusive and showed no hydrologic benefits, then the pilot spreader swales would not be constructed. Initially, a 10 percent flow improvement threshold will be used as the success criteria as this is equivalent to the minimum LRR modeling assumption. However, final threshold success criteria will be established following

an examination of the model output. Modeling would also provide information on the most effective configuration (size, depth, dimensions) to incorporate into the final swale design.

The pilot spreader swales would be constructed only if the results of hydrologic modeling would be a positive indication of the performance of pilot spreader swales (i.e., increase the certainty that flow improvements would result from their implementation). The pilot spreader swales would then be constructed and monitored to quantify the hydrologic benefits as described for Alternative B.

Cost

The estimated cost of Alternative D includes the cost of hydrologic modeling and support, and the cost of design, construction, maintenance and monitoring of the pilot spreader swales, as described above. The cost of construction will vary depending on the spreader swale configuration that is chosen.

The costs are presented as estimates (in 2008 dollars) and are not appropriate for budgeting purposes. The estimates presented have been developed using USACE, NPS, and industry standards to the extent available. Specific costs will be determined following final model evaluation and selection, and following further design of the pilot spreader swales and refinement of monitor plans. A detailed presentation of the basis for the cost estimate is presented in Appendix B.

Total initial cost of Alternative D: $5,374,126 to $7,135,886; in the event that the pilots are not effective, the cost of compensatory wetland rehabilitation would be $322,000.

ALTERNATIVES CONSIDERED AND DISMISSED

Other sites to test swale efficacy (e.g., L- 31E canal and C- 111 spreader canal) – A literature search could locate no projects that provide a similar functionality to structural alternatives described above. Swales have been used to distribute water for marshes that are crossed by a road. Examples include U.S. 27 between WCA- 2 and WCA- 3B, I- 75 in WCA- 3B, and the old Tamiami Canal downstream of the S- 12 structures. These features actually consist of long canal segments that run the entire length of the road upstream of the bridges under the roadway. Only one study, conducted by Everglades National Park, evaluated the flows in the old Tamiami Trail and was found to contribute to the distribution of flow from the S- 12 structures for some lateral distance depending on the flow through the structure (Wagner 1982). However, most of the lateral flow was found to be attributed to the L- 67ext canal getaway. There have been no studies documenting the impacts of lesser features such as the swales being considered for evaluation in this pilot project.

Locations outside Everglades National Park were also considered as potential locations for conducting a pilot project. It was not possible to find a site similar enough to the project area to be able to evaluate the results in a manner that could be readily transferred to the Tamiami Trail outlets. For example, the L31E canal was considered because culverts are going to be added in the adjacent levee; however, the culverts will empty into a tidally influenced mangrove forest, conditions that are very different from the Tamiami Trail outlet project area.

Alternate Pilot Spreader Swale Design Options – During early planning phases for the pilot spreader swale project, other swale configurations were considered. Options included constructing the pilot spreader swales parallel to flow (perpendicular to Tamiami Trail) or including multiple spreader swales at each culvert using a radial design. Both of these options would have disturbed previously undisturbed areas, extended beyond the existing vegetation haloes, and had potential effects on proposed wilderness and cultural resource values in the vicinity of the project area. Given the uncertainty regarding the potential hydrologic benefits from swales construction, and the level of impacts that would be generated by these alternate design options, they were dismissed from further consideration.

ENVIRONMENTALLY PREFERRED ALTERNATIVE

The NPS is required to identify the "environmentally preferred alternative" in its NEPA documents for public review and comment. The NPS, in accordance with the Department of the Interior Policies contained in the Departmental Manual (516 DM 4.10) and the Council on Environmental Quality's Forty Questions, defines the environmentally preferred alternative (or alternatives) as the alternative that best promotes the national environmental policy as expressed in Section 101 of NEPA, which considers the following criteria:

1. fulfilling the responsibilities of each generation as trustee of the environment for succeeding generations;
2. assuring for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings;
3. attaining the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences;
4. preserving important historic, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity, and variety of individual choice;
5. achieving a balance between population and resource use which would permit high standards of living and a wide sharing of life's amenities; and
6. enhancing the quality of renewable resources and approach the maximum attainable recycling of depletable resources."

The Council on Environmental Quality's Forty Questions (Q6a), further clarifies the identification of the environmentally preferred alternative, stating "ordinarily, this means the alternative that causes the least damage to the biological and physical environment; it also means the alternative which best protects, preserves and enhances historic, cultural and natural resources."

Under Alternative C, the potential hydrologic impacts of spreader swales would be investigated using enhanced hydrologic modeling, without construction of the pilot swales themselves. This alternative would provide information for decision- makers without adverse impacts to park resources, and C would be more effective in meeting these six criteria than Alternatives A, B and D. Alternative A would provide no new data to inform the decision- making process regarding installation of spreader swales, thus making it less able to meet the criteria that Alternative C. The degree of uncertainty regarding the ability of spreader swales to provide measurable ecological benefits, coupled with the introduction of

new disturbance associated with spreader swale construction would make Alternatives B and D less able to meet the criteria.

Because spreader swale construction would remove native vegetation, disturb wildlife, and potentially expand the habitat of exotic aquatic fauna and plant species in the park, Alternatives B and D would not meet Criteria 1 and 3. Alternative A would not contribute to ongoing Everglades restoration efforts, and thus would not support efforts to improve future resource conditions in the park. Under Alternative C, information on spreader swale performance would be provided, no construction would take place, and the environment would be better protected without the risk of unintended consequences. Thus, the "no construction" option of Alternative C best meets Criteria 1 and 3.

Although the potential to affect cultural artifacts during construction of the spreader swales would be low, better protection of these important resources would be achieved if no ground disturbance were to take place. Thus, Alternatives A and C better meet Criterion 4 in protecting cultural resources.

Installation of the spreader swales would require use of non- renewable energy, movement of dredged materials to a land fill or other disposal site, and installation (and subsequent removal) of fill materials to provide site access. Because construction activities such as these would not take place under Alternatives A and C, they would better meet Criterion 6.

Based on the above evaluation, it has been determined that Alternative C would be considered the environmentally preferred alternative.

COMPARISON OF THE ALTERNATIVES

Table 3 shows the ability of the four alternatives to meet the project objectives. This provides a way to quickly compare and contrast the degree to which each alternative accomplishes the purpose or fulfills the need identified in the "Purpose and Need" section above.

SUMMARY OF IMPACTS

Table 4 briefly summarizes the effects of each of the alternatives on the impact topics that were retained for analysis of the spreader swales pilot project. The impacts summarized in this table include both direct and cumulative impacts. More detailed information on the effects of the alternatives is provided in the "Affected Environment and Environmental Consequences" section.

PREFERRED ALTERNATIVE

Based on the summary information, Alternative D is recommended as the Preferred Alternative. This decision is based on a combination of factors. First, there remains a wide difference of professional opinion and, therefore, substantial uncertainty in the ability of pilot spreader swales to improve water deliveries to Everglades National Park. Second, when the uncertainty of the potential hydrologic benefits is coupled with the known adverse impacts to the wetlands affected by their construction, cautious and iterative approach is warranted. Development of a fine scale hydrologic model for purposes of improving

confidence in the decision to build the pilot spreader swales would provide a much firmer basis for proceeding with their construction. Additionally, the modeling could provide insights into the function of the swales that would allow for design improvements that could optimize benefits and reduce adverse impacts.

Figure 6 presents a preliminary implementation schedule for the Preferred Alternative. This includes the schedule for:

- Pilot site identification
- Baseline monitoring
- Hydrologic modeling
- Planning and construction
- Post- project monitoring
- Evaluation reporting

TABLE 3. OBJECTIVES AND THE ABILITY OF THE ALTERNATIVES TO MEET THEM

Objective	Alternative A, the No Action Alternative	Alternative B, Structural Alternative	Alternative C, Non-Structural Alternative: Hydrologic Modeling	Alternative D, Preferred Alternative, Hydrologic Modeling and Potential Structural Component
Provide information to the NPS and USACE regarding the potential for spreader swales to enhance flows.	Under Alternative A, the spreader swale project would not be pursued. As such, information would not be collected to assess potential hydrological benefits in Northeast Shark River Slough. This objective would not be met.	Under Alternative B, implementation of pilot spreader swales would provide empirical data and information as outputs from the monitoring program regarding the potential for spreader swales to enhance flows in Northeast Shark River Slough. The structural pilot project would be limited to the range of hydrologic conditions available during the monitoring program. This objective would be fully met.	Under Alternative C, hydrologic modeling would provide estimated data and information regarding the potential for spreader swales to enhance flows in Northeast Shark River Slough. The model output would be used in lieu of the empirical data generated by constructed pilot spreader swales. A model would allow the testing of a range of hydrologic conditions that may not be available during an actual structural pilot project, such as extreme low and high flow events. This objective would be largely met; it could potentially fully meet the objective.	Under Alternative D, results from hydrologic modeling would dictate whether the park proceeds with implementation of pilot spreader swales. If modeling could not fully provide necessary information, then pilot spreader swales would be constructed. Alternative D would provide information regarding the potential for spreader swales to enhance flows in Northeast Shark River Slough. This objective would be largely met if the project ends after modeling; but, would be fully met if modeling leads to the structural element as well.

TABLE 3. OBJECTIVES AND THE ABILITY OF THE ALTERNATIVES TO MEET THEM (CONTINUED)

Objective	Alternative A, the No Action Alternative	Alternative B, Preferred / Structural Alternative	Alternative C, Non-Structural Alternative: Hydrologic Modeling	Alternative D, Hydrologic Modeling and Potential Structural Component
Establish criteria for determining compliance with restoration goals of the Mod Waters Project, including thresholds for water quality, quantity, and distribution of flows in Northeast Shark River Slough.	Under Alternative A, the spreader swale project would not be pursued. As such, a determination of compliance criteria would not be necessary. This objective would not be applicable.	Under Alternative B, preliminary criteria would be identified for determining compliance with restoration goals of the Mod Waters Project, including thresholds for water quality, quantity, and distribution of flows in Northeast Shark River Slough. These criteria will be included in the final approved monitoring plan and based on the prevailing scientific opinion. This objective would be fully met.	Under Alternative C, preliminary criteria would be identified for determining compliance with restoration goals of the Mod Waters Project, including thresholds for water quality, quantity, and distribution of flows in Northeast Shark River Slough. These criteria would be included in the final approved monitoring plan and based on the prevailing scientific opinion. This objective would be fully met.	Under Alternative D, preliminary criteria would be identified for determining compliance with restoration goals of the Mod Waters Project, including thresholds for water quality, quantity, and distribution of flows in Northeast Shark River Slough. These criteria would be included in the final approved monitoring plan and based on the prevailing scientific opinion. This objective would be fully met.

TABLE 3. OBJECTIVES AND THE ABILITY OF THE ALTERNATIVES TO MEET THEM (CONTINUED)

Objective	Alternative A, the No Action Alternative	Alternative B, Preferred / Structural Alternative	Alternative C, Non-Structural Alternative: Hydrologic Modeling	Alternative D, Hydrologic Modeling and Potential Structural Component
Define what monitoring, measurements, and modeling shall be used to verify hydrologic conditions resulting from spreader swale installation.	Under Alternative A, the spreader swale project would not be pursued. As such, no verification of hydrologic conditions can or must be made. This objective would not be applicable.	Under Alternative B, a monitoring program, as described above, would be implemented that would gather performance data from the spreader swales. The data would verify hydrologic conditions resulting from spreader swale installation. The structural pilot project would be limited to the range of hydrologic conditions available during the monitoring program. This objective would be fully met.	Under Alternative C, hydrologic modeling would be used to verify hydrologic conditions. The model output would be used in lieu of the empirical data generated by constructed pilot spreader swales, and would be less accurate. However, a model would allow the testing of a range of hydrologic conditions that may not be available during an actual structural pilot project, such as extreme low and high flow events. This objective would be largely met.	Under Alternative D, results from hydrologic modeling would dictate whether the park proceeds with implementation of pilot spreader swales. Depending on the results, either modeling or monitoring and measurements, as described under Alternative B, would be used to verify hydrologic conditions resulting from spreader swale installation. This objective would be fully met.

TABLE 3. OBJECTIVES AND THE ABILITY OF THE ALTERNATIVES TO MEET THEM (CONTINUED)

Objective	Alternative A, the No Action Alternative	Alternative B, Preferred / Structural Alternative	Alternative C, Non-Structural Alternative: Hydrologic Modeling	Alternative D, Hydrologic Modeling and Potential Structural Component
Determine acceptable levels of impact to park resources should swales prove effective.	Under Alternative A, the spreader swale project would not be pursued. As such, no determination of effects can or must be made. This objective would not be applicable.	Under Alternative B, a component of the project would be to establish, through professional knowledge, acceptable levels of impact to park resources should swales prove effective. This objective would be fully met.	Under Alternative C, a component of the project would be to establish, through professional knowledge, acceptable levels of impact to park resources should swales prove effective. This objective would be fully met.	Under Alternative D, a component of the project would be to establish, through professional knowledge, acceptable levels of impact to park resources should swales prove effective. This objective would be fully met.
Determine the level of potential beneficial effects needed to justify the adverse impacts to park natural and cultural resources from project implementation.	Under Alternative A, the spreader swale project would not be pursued. As such, no determination of effects can or must be made. This objective would not be applicable.	Under Alternative B, a component of the project would be to establish, through professional knowledge, the level of potential beneficial effects needed to justify the adverse impacts to park natural and cultural resources from project implementation. This objective would be fully met.	Under Alternative C, a component of the project would be to establish, through professional knowledge, the level of potential beneficial effects needed to justify the adverse impacts to park natural and cultural resources from project implementation. This objective would be fully met.	Under Alternative D, a component of the project would be to establish, through professional knowledge, the level of potential beneficial effects needed to justify the adverse impacts to park natural and cultural resources from project implementation. This objective would be fully met.

TABLE 3. OBJECTIVES AND THE ABILITY OF THE ALTERNATIVES TO MEET THEM (CONTINUED)

Objective	Alternative A, the No Action Alternative	Alternative B, Preferred / Structural Alternative	Alternative C, Non-Structural Alternative: Hydrologic Modeling	Alternative D, Hydrologic Modeling and Potential Structural Component
Provide information required to determine if any potential resource benefits are worth the short- term and long- term ecological and monetary costs incurred by the project.	Under Alternative A, the spreader swale project would not be pursued. As such, no determination of effects can or must be made. This objective would not be applicable.	Under Alternative B, implementation of pilot spreader swales would provide information required to determine if any potential benefits are worth the short-term and long- term costs incurred by the project. The structural pilot project would be limited to the range of hydrologic conditions available during the monitoring program. This objective would be fully met.	Under Alternative C, hydrologic modeling would provide information required to determine if any potential benefits are worth the short- term and long-term costs incurred by the project. The model output would be used in lieu of the empirical data generated by constructed pilot spreader swales. A model would allow the testing of a range of hydrologic conditions that may not be available during an actual structural pilot project, such as extreme low and high flow events. This objective would be largely met.	Under Alternative D, results from hydrologic modeling would dictate whether the park proceeds with implementation of pilot spreader swales. If modeling could not fully provide necessary information, then pilot spreader swales would be constructed. Alternative D would provide information required to determine if any potential benefits are worth the short- term and long- term costs incurred by the project. This objective would be largely met if the project ends after modeling; but, would be fully met if modeling leads to the structural element as well.

TABLE 4. SUMMARY OF THE IMPACTS OF THE ALTERNATIVES

Resource Topic	Alternative A, the No Action Alternative	Alternative B, Structural Alternative	Alternative C, Non-Structural Alternative: Hydrologic Modeling	Alternative D, Preferred Alternative, Hydrologic Modeling and Potential Structural Component
Hydrology	For Alternative A, there would be no impacts to the project area because no spreader swales would be constructed. No contribution, either beneficial or adverse, would be made to the cumulative impacts of other projects and plans. Under Alternative A, there would be no impairment of or unacceptable impacts to hydrology resources and values in Everglades National Park.	For Alternative B, hydrologic impacts would be uncertain, localized, beneficial, and could range from negligible to minor. Alternative B would combine with other projects and plans to result in long-term moderate to moderate to major cumulative impacts on hydrology resources of Everglades National Park. Under Alternative B, there would be no impairment of or unacceptable impacts to park hydrology resources or values.	For Alternative C, there would be no impacts to the project area. There would also be no contribution to other Mod Waters and CERP project components which may have moderate to major, long- term, cumulative beneficial effects. Under Alternative C, there would be no impairment of or unacceptable impacts to Everglades National Park's hydrology resources or values.	Alternative D could result in one of two possible effects to hydrology – effects as described for Alternative A in the event of unfavorable modeling results or effects as described for Alternative B in the event of favorable modeling results. In either case, under Alternative D there would be no impairment of or unacceptable impacts to Everglades National Park's hydrology resources or values.

TABLE 4. SUMMARY OF THE IMPACTS OF THE ALTERNATIVES

Resource Topic	Alternative A, the No Action Alternative	Alternative B, Structural Alternative	Alternative C, Non-Structural Alternative: Hydrologic Modeling	Alternative D, Preferred Alternative, Hydrologic Modeling and Potential Structural Component
Water Quality	For Alternative A, there would be no impacts to the project area because no spreader swales would be constructed. No contribution, either beneficial or adverse, would be made to the cumulative impacts of other projects and plans. Under Alternative A, there would be no impairment of or unacceptable impacts to park water quality resources or values in Everglades National Park.	For Alternative B, water quality effects would be directly related to the short-term and long- term effects caused by construction of the swales and potential increases in conveyance. If additional flows are achieved with the spreader swales, it is anticipated there would be minor adverse water quality impacts. Water quality monitoring would also be conducted to assess water quality impacts. It is expected that the total cumulative impacts to water quality would continue to be, adverse, localized to regional, minor to moderate, and long-term. Under Alternative B, it is expected that there would be no impairment of or unacceptable impacts to water quality resources or values.	For Alternative C, there would be no impacts to the project area. There would also be no contribution to other Mod Waters and CERP project components which may have long- term, adverse cumulative effects. Under Alternative C, there would be no impairment of or unacceptable impacts to Everglades National Park's water quality resources or values.	Alternative D could result in one of two possible effects to water quality – effects as described for Alternative A in the event of unfavorable modeling results or effects as described for Alternative B in the event of favorable modeling results. In either case, under Alternative D there would be no impairment of or unacceptable impacts to Everglades National Park's water quality.

TABLE 4. SUMMARY OF THE IMPACTS OF THE ALTERNATIVES

Resource Topic	Alternative A, the No Action Alternative	Alternative B, Structural Alternative	Alternative C, Non-Structural Alternative: Hydrologic Modeling	Alternative D, Preferred Alternative, Hydrologic Modeling and Potential Structural Component
Soils	For Alternative A, there would be no impacts to the project area because no spreader swales would be constructed. No contribution, either beneficial or adverse, would be made to the cumulative impacts of other projects and plans. Under Alternative A, there would be no impairment of or unacceptable impacts to soil resources or values in Everglades National Park.	For Alternative B, construction activities and potential removal of soil and peat layers during construction would result in short- and long- term, moderate, localized adverse effects on soils. Alternative B would not contribute to the cumulative, localized to regional, long- term, moderate benefits to soils anticipated from Mod Waters and the CERP project. Under Alternative B, there would be no impairment of or unacceptable impacts to park soil resources or values.	For Alternative C, there would be no impacts to the project area. There also would be no contribution to other Mod Waters and CERP project components which may have local, moderate, long- term, and beneficial cumulative effects. Under Alternative C, there would be no impairment of or unacceptable impacts to Everglades National Park's soil resources or values.	Alternative D could result in one of two possible effects to soils – effects as described for Alternative A in the event of unfavorable modeling results or effects as described for Alternative B in the event of favorable modeling results. In either case, Under Alternative D there would be no impairment of or unacceptable impacts to Everglades National Park's soil resources or values.

TABLE 4. SUMMARY OF THE IMPACTS OF THE ALTERNATIVES

Resource Topic	Alternative A, the No Action Alternative	Alternative B, Structural Alternative	Alternative C, Non-Structural Alternative: Hydrologic Modeling	Alternative D, Preferred Alternative, Hydrologic Modeling and Potential Structural Component
Vegetation and Wetlands	For Alternative A, there would be no impacts to the project area because no spreader swales would be constructed. No contribution, either beneficial or adverse, would be made to the cumulative impacts of other projects and plans. Under Alternative A, there would be no impairment of or unacceptable impacts to vegetation and wetland resources or values in Everglades National Park.	For Alternative B, construction activities and removal of wetland vegetation would result in adverse, local, moderate, short- and long- term effects on vegetation. The pilot spreader swales would not add or detract from benefits to wetland vegetation anticipated from other projects and plans. The cumulative effect on vegetation would be adverse, local, moderate, and long-term. There would be no impairment of or unacceptable impacts to vegetation and wetlands under Alternative B.	For Alternative C, there would be no effects to the project area. There would also be no contribution to other Mod Waters and CERP project components which may have wide ranging, long- term, and moderate cumulative benefits to wetlands vegetation. Under Alternative C, there would be no impairment of or unacceptable impacts to Everglades National Park's wetlands vegetation resources or values.	Alternative D could result in one of two possible effects to wetlands vegetation – effects as described for Alternative A in the event of unfavorable modeling results or effects as described for Alternative B in the event of favorable modeling results. In either case, under Alternative D there would be no impairment of or unacceptable impacts to Everglades National Park's wetlands vegetation resources or values.

TABLE 4. SUMMARY OF THE IMPACTS OF THE ALTERNATIVES

Resource Topic	Alternative A, the No Action Alternative	Alternative B, Structural Alternative	Alternative C, Non-Structural Alternative: Hydrologic Modeling	Alternative D, Preferred Alternative, Hydrologic Modeling and Potential Structural Component
Wildlife	For Alternative A, there would be no impacts to the project area because no spreader swales would be constructed. No contribution, either beneficial or adverse, would be made to the cumulative impacts of other projects and plans. Under Alternative A, there would be no impairment of or unacceptable impacts to wildlife resources and values in Everglades National Park.	For Alternative B, construction of the spreader swales would result in minor, short- term, long- term, localized, and adverse effects on wildlife. Alternative B would not contribute to the cumulative, localized to regional benefits to wildlife anticipated from the Mod Waters and CERP projects. Under Alternative B, there would be no impairment of or unacceptable impacts to park wildlife resources or values.	For Alternative C, there would be no impacts to the project area. There would also be no contribution to other Mod Waters and CERP project components which may have localized to regional, moderate to major, and long- term cumulative beneficial effects. Under Alternative C, there would be no impairment of or unacceptable impacts to Everglades National Park's wildlife resources or values.	Alternative D could result in one of two possible effects to wildlife – effects as described for Alternative A in the event of unfavorable modeling results or effects as described for Alternative B in the event of favorable modeling results. In either case, under Alternative D there would be no impairment of or unacceptable impacts to Everglades National Park's wildlife resources or values.

TABLE 4. SUMMARY OF THE IMPACTS OF THE ALTERNATIVES

Resource Topic	Alternative A, the No Action Alternative	Alternative B, Structural Alternative	Alternative C, Non-Structural Alternative: Hydrologic Modeling	Alternative D, Preferred Alternative, Hydrologic Modeling and Potential Structural Component
Special Status Species	For Alternative A, there would be no impacts to the project area because no spreader swales would be constructed. No contribution, either beneficial or adverse, would be made to the cumulative impacts of other projects and plans. Under Alternative A, there would be no impairment of or unacceptable impacts to special status species resource and values in Everglades National Park.	For Alternative B, effects on federally listed species in the project area would range from no effect to may affect, not likely to adversely affect. Cumulative effects from hydrology restoration and vegetation management for listed species would be beneficial, wide- ranging, long- term, and moderate. Given the up to 6.7 acres of disturbance, Alternative B would not make a measurable contribution to these cumulative effects. Under Alternative B, there would be no impairment of or unacceptable impacts to special status species.	For Alternative C, there would be no impacts to the project area. There would also be no contribution, either beneficial or adverse, to the cumulative impacts of other projects and plans. Under Alternative C, there would be no impairment of or unacceptable impacts to Everglades National Park's special- status species resources or values.	Alternative D could result in one of two possible effects to wildlife – effects as described for Alternative A in the event of unfavorable modeling results or effects as described for Alternative B in the event of favorable modeling results. In either case, under Alternative D there would be no impairment of or unacceptable impacts to Everglades National Park's special- status species resources or values.

TABLE 4. SUMMARY OF THE IMPACTS OF THE ALTERNATIVES

Resource Topic	Alternative A, the No Action Alternative	Alternative B, Structural Alternative	Alternative C, Non-Structural Alternative: Hydrologic Modeling	Alternative D, Preferred Alternative, Hydrologic Modeling and Potential Structural Component
Cultural Resources	For Alternative A, there would be no impacts to the project area because no spreader swales would be constructed. No contribution, either beneficial or adverse, would be made to the cumulative impacts of other projects and plans. Under Alternative A, there would be no impairment of or unacceptable impacts to cultural resources or values in Everglades National Park.	For Alternative B, any effects associated with implementation of pilot spreader swales would occur in areas unlikely to contain archaeological resources. Two NRHP resources are immediately adjacent to the project area but would not be altered. Minimal beneficial impact is expected to ethnographic resources. Cultural landscapes may be slightly altered; but any adverse impact would be minimal. Under Alternative B, there would be no impairment of or unacceptable impacts to cultural resources or values in Everglades National Park.	For Alternative C, there would be no impacts to the project area. There would also be no contribution to cumulative effects. Under Alternative C, there would be no impairment of or unacceptable impacts to Everglades National Park's cultural resources or values.	Alternative D could result in one of two possible effects to cultural resources – effects as described for Alternative A in the event of unfavorable modeling results or effects as described for Alternative B in the event of favorable modeling results. In either case, under Alternative D there would be no impairment of or unacceptable impacts to Everglades National Park's cultural resources or values.

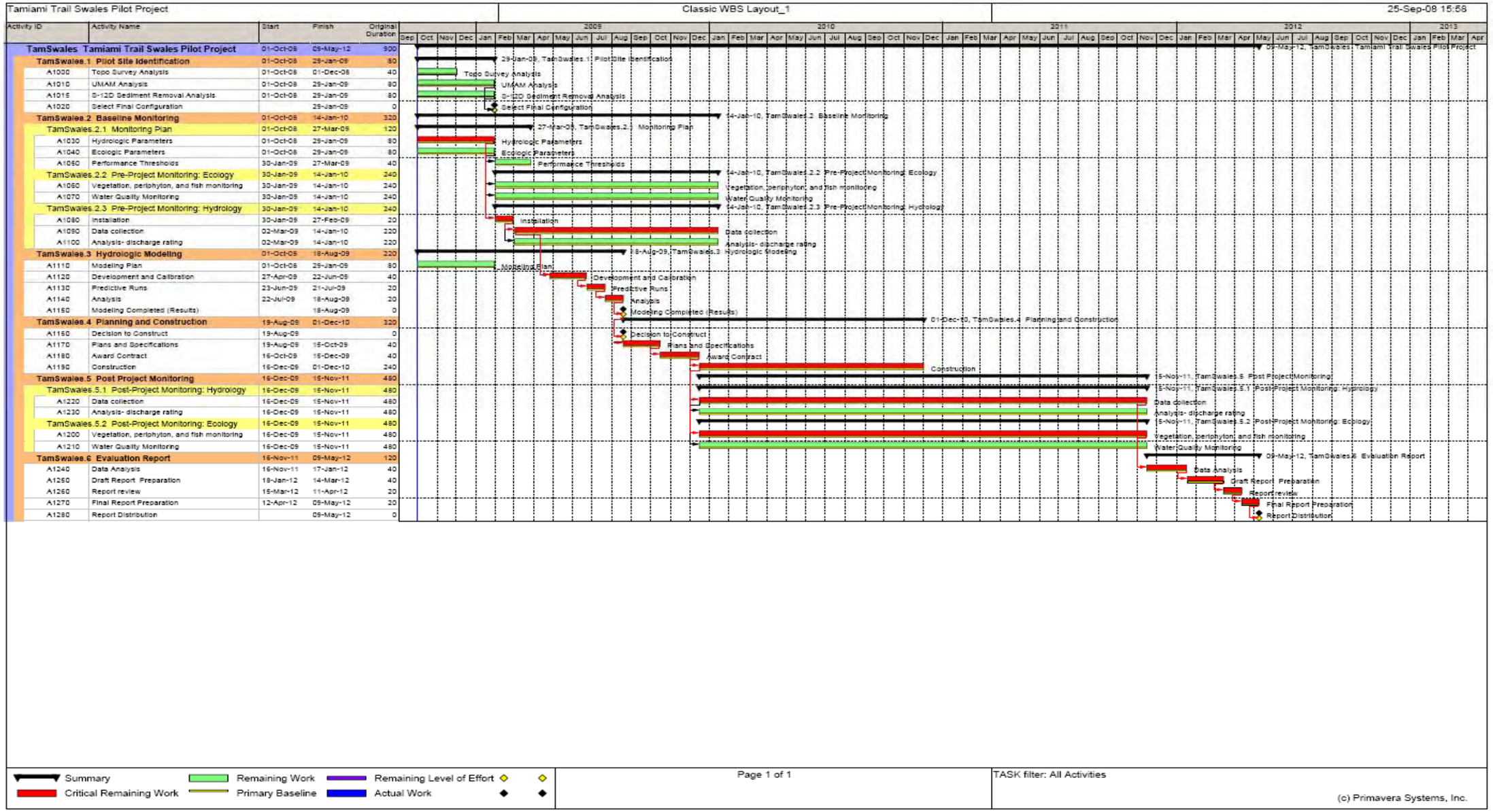
TABLE 4. SUMMARY OF THE IMPACTS OF THE ALTERNATIVES

Resource Topic	Alternative A, the No Action Alternative	Alternative B, Structural Alternative	Alternative C, Non-Structural Alternative: Hydrologic Modeling	Alternative D, Preferred Alternative, Hydrologic Modeling and Potential Structural Component
Transportation	For Alternative A, there would be no impacts to the project area because no spreader swales would be constructed. No contribution, either beneficial or adverse, would be made to the cumulative impacts of other projects and plans, specifically any delays associated with the upcoming 1- mile bridge installation just west of the project area. Under Alternative A, there would be no impairment of or unacceptable impacts to transportation resource and values in Everglades National Park.	There would be short- term, minor, adverse effects on transportation in and adjacent to the project area during construction from the presence of construction equipment and traffic control measures. Because this project would be complete before installation of the 1-mile bridge, there would be no cumulative effects on transportation. Under Alternative B, there would be no impairment of or unacceptable impacts to transportation resources and values in Everglades National Park.	For Alternative C, there would be no impacts to the project area. There would also be no contribution to other cumulative effects. Under Alternative C, there would be no impairment of or unacceptable impacts to Everglades National Park's transportation resources or values.	Alternative D could result in one of two possible effects to transportation – effects as described for Alternative A in the event of unfavorable modeling results or effects as described for Alternative B in the event of favorable modeling results. In either case, under Alternative D there would be no impairment of or unacceptable impacts to Everglades National Park's transportation resources or values.

TABLE 4. SUMMARY OF THE IMPACTS OF THE ALTERNATIVES

Resource Topic	Alternative A, the No Action Alternative	Alternative B, Structural Alternative	Alternative C, Non-Structural Alternative: Hydrologic Modeling	Alternative D, Preferred Alternative, Hydrologic Modeling and Potential Structural Component
Visitor Use and Experience	For Alternative A, there would be no impacts to the project area because no spreader swales would be constructed. No contribution, either beneficial or adverse, would be made to the cumulative impacts of other projects and plans. Under Alternative A, there would be no impairment of or unacceptable impacts to visitor use and experience resources and values in Everglades National Park.	For Alternative A, long- term effects resulting from the presence of the spreader swales would be beneficial, localized, and negligible to minor. Short- term effects would be adverse, localized, and negligible to minor. Cumulative short- term effects could be localized, adverse, and minor to moderate. Over the long-term cumulative effects would not be distinguishable from the moderate benefits of other projects and plans. Under Alternative B, there would be no impairment of or unacceptable impacts to visitor use and experience in the park.	For Alternative C, there would be no impacts to the project area. There would also be no contribution to other cumulative effects. Under Alternative C, there would be no impairment of or unacceptable impacts to Everglades National Park's visitor use and experience resources and values.	Alternative D could result in one of two possible effects to visitor use and experience – effects as described for Alternative A in the event of unfavorable modeling results or effects as described for Alternative B in the event of favorable modeling results. In either case, under Alternative D there would be no impairment of Everglades National Park's visitor use and experience resources and values.

FIGURE 6: PRELIMINARY IMPLEMENTATION SCHEDULE



CHAPTER 3: AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

This section describes the environmental consequences associated with the alternatives. It is organized by impact topic, which allows a standardized comparison between alternatives based on issues. Consistent with NEPA, the analysis also considers the context, intensity, and duration of impacts, indirect impacts, cumulative impacts, and measures to mitigate impacts. NPS policy also requires that "impairment" of resources be evaluated in all environmental documents associated with resource analysis.

METHODS

General Evaluation Method

For each impact topic, the analysis includes a brief description of the affected environment and an evaluation of the effects of implementing each alternative. The analysis is conducted on actions described in the "Alternatives" section. Specifically, this environmental assessment analyzes a) the no action alternative; b) the structural alternative - implementation of pilot spreader swales; c) the non- structural alternative – hydrologic modeling; and d) the adaptive management alternative - hydrologic modeling and potential structural component. The impact analyses were based on information provided by park staff, relevant references and technical literature citations, and subject matter experts. The impact analyses involved the following steps:

- Define issues of concern, based on internal and external scoping;
- Identify the geographic area that could be affected;
- Define the resources within that area that could be affected;
- Impose the action on the resources within the area of potential effect; and
- Identify the effects caused by the alternative, in comparison to the baseline represented by the no action alternative, to determine the relative change in resource conditions.

Characterize the effects based on the following factors:

- Whether the effect would be beneficial or adverse;
- Intensity of the effect: negligible, minor, moderate, or major. (Impact- topic- specific thresholds for each of these classifications are provided in Table 5.) Threshold values were developed based on federal and state standards, consultation with regulators, and discussions with subject matter experts;
- Duration of the effect: short- term or long- term, with specificity for each impact topic;

- Context or area affected by the proposed action: site- specific, local, parkwide, regional; and
- Whether the effect would be a direct result of the action or would occur indirectly because of a change to another resource or impact topic. An example of an indirect impact would be increased mortality of an aquatic species that would occur because an alternative would increase soil erosion, which would reduce water quality.

Method for Assessing Impacts to Cultural Resources

Potential impacts (direct, indirect, and cumulative effects) are described in terms of type (are the effects beneficial or adverse?), context (are the effects site- specific, local, or regional?), duration (are the effects short- term, long- term, or permanent?) and intensity (is the degree or severity of effects negligible, minor, moderate, or major?). Because definitions of intensity (negligible, minor, moderate, or major) vary by impact topic, intensity definitions are provided separately for each cultural resource impact topic (archaeological resources, historic properties, cultural landscapes, ethnographic resources) analyzed in this EA.

Cultural Resources and §106 of the National Historic Preservation Act Method

In this EA, impacts to cultural resources are described in terms of type, context, duration, and intensity, which is consistent with CEQ regulations that implement NEPA. These impact analyses are intended, however, to comply with the requirements of both NEPA and §106 of the National Historic Preservation Act (NHPA). In accordance with the Advisory Council on Historic Preservation's regulations implementing §106 of the NHPA (36 CFR Part 800, Protection of Historic Properties), impacts to cultural resources were also identified and evaluated by (1) determining the area of potential effects; (2) identifying cultural resources present in the area of potential effects that are either listed in or eligible to be listed in the NRHP; (3) applying the criteria of adverse effects to affected, NRHP-eligible or listed cultural resources; and (4) considering ways to avoid, minimize, or mitigate adverse effects.

CEQ regulations and the NPS's *Conservation Planning, Environmental Impact Analysis and Decision Making* (Director's Order #12) also call for a discussion of mitigation, as well as an analysis of how effective the mitigation would be in reducing the intensity of a potential impact, e.g., reducing the intensity of an impact from major to moderate or minor. Any resultant reduction in intensity of impact due to mitigation, however, is an estimate of the effectiveness of mitigation under NEPA only. It does not suggest that the level of effect as defined by §106 is similarly reduced. Cultural resources are non- renewable resources and adverse effects generally consume, diminish, or destroy the original historic materials or form, resulting in a loss in the integrity of the resource that can never be recovered. Therefore, although actions determined to have an adverse effect under §106 may be mitigated, the effect remains adverse.

TABLE 5. IMPACT THRESHOLD INTENSITIES

Impact Topic	Negligible	Minor	Moderate	Major	Duration
Hydrology	Hydrology would not be affected, or changes would be at low levels of detection. Any detected effects to hydrology would be slight and localized.	Changes in hydrology would be measurable, although the changes would be small and localized.	Changes in hydrology would be measurable and regional.	Changes in hydrology would be readily measurable, and would have observable consequences on a regional scale.	Short- term – Recovers in less than 1 year. Long- term - Takes more than 1 year to recover.
Water Quality	Water quality would not be affected, or changes would be at low levels of detection. Any detected effects to water quality would be slight and localized.	Changes in water quality would be measurable, although the changes would be small and localized.	Changes in water quality would be measurable and regional.	Changes in water quality would be readily measurable, and would have observable consequences on a regional scale.	Short- term - Recovers in less than 1 year. Long- term - Takes more than 1 year to recover.
Soils	Soils would not be affected, or the effects to soils would be at or below the lower levels of detection. Any effects to soil productivity or fertility would be slight and would return to normal project implementation activities.	The effects to soils would be detectable and the effects to soil productivity or fertility would be small, as would the area affected.	The effect on soil productivity or fertility would be readily apparent and result in a change to the soil character over a relatively wide area.	The effect on soil productivity or fertility would be readily apparent, and substantially change the character of the soils over a large area in and out of the park.	Short- term - Recovers in less than 3 years Long- term - Takes more than 3 years to recover

TABLE 5. IMPACT THRESHOLD INTENSITIES (CONTINUED)

Impact Topic	Negligible	Minor	Moderate	Major	Duration
Vegetation and Wetlands	No native vegetation would be affected, or some individual native plants could be affected as a result of the alternative, but there would be no effect on native species populations. The effects would be on a small scale, and no species of special concern would be affected. Wetlands would not be affected, or the effects to the resource would be at or below the lower levels of detection. No long- term effects to floodplains would occur and any detectable effects would be slight. A USACE 404 permit would not be required.	Effects on native plants would be measurable or perceptible, but would be localized within a small area. The viability of the plant community would not be affected and the community, if left alone, would recover. The effects to wetlands would be detectable and relatively small in terms of area and the nature of the change. A USACE 404 permit would not be required.	A change would occur at the community level and the effects would be readily measurable in terms of abundance, distribution, quantity, or quality. The effects to wetlands would be readily apparent, including an effect on the wetland vegetation community, such that an USACE 404 permit could be required.	Effects on native plant communities would be readily apparent, and would substantially change vegetation community types over a large area. The effects to wetlands would be observable on a community level and would require a USACE 404 permit.	*Vegetation* Short- term - Recovers in less than 3 years. Long- term - Takes more than 3 years to recover. *Wetlands* Short- term - Recovers in less than 1 year. Long- term - Takes more than 1 year to recover

TABLE 5. IMPACT THRESHOLD INTENSITIES (CONTINUED)

Impact Topic	Negligible	Minor	Moderate	Major	Duration
Wildlife	Wildlife habitats would not be affected or the effects would be at or below the level of detection and would be so slight that they would not be of any measurable or perceptible consequence to wildlife populations	Effects to wildlife habitats would be measurable or perceptible, but would be localized within a small area. While the mortality of individual animals might occur, the viability of wildlife populations would not be affected and the community, if left alone, would recover.	Effects to wildlife habitats would be readily detectable, long- term and localized, with consequences at the population level.	Effects to wildlife habitats would be readily apparent, and would substantially change wildlife and populations over a large area in and out of the park.	Short- term - Recovers in less than 1 year. Long- term - Takes more than 1 year to recover.
Special- status Species	There would not be any perceptible changes to special- status species or to critical habitats. ESA Section 7 would result in a find of no effect.	Changes to special- status species would be measurable or perceptible, but the functions and values associated with critical habitat would not be affected. ESA Section 7 would result in a finding of may affect, but not likely to adversely affect.	A readily apparent change would occur to special-status species or critical habitats. Functions and values associated with critical habitat would be altered. ESA Section 7 would result in a may affect, likely to adversely affect determination.	A readily apparent change would occur to special-status species and would substantially change critical habitat over a large area. ESA Section 7 would result in a determination of likely to jeopardize and adversely affect modification of critical habitat.	Short- term - Recovers in less than 1 year. Long- term - Takes more than 1 year to recover.
Cultural Resources - Archaeological Resources	The effect is at the lowest levels of detection– barely perceptible and not measurable.	The impact affects an archeological site(s) with modest data potential and no significant ties to a living community's cultural identity.	The impact affects an archeological site(s) with high data potential and no significant ties to a living community's cultural identity.	The impact affects an archeological site(s) with exceptional data potential or that has significant ties to a living community's cultural identity.	Effects on archaeological resources would be long-term because these resources are non-renewable.

TABLE 5. IMPACT THRESHOLD INTENSITIES (CONTINUED)

Impact Topic	Negligible	Minor	Moderate	Major	Duration
Cultural Resources - Historic Properties	The effect is at the lowest levels of detection– barely perceptible and not measurable.	The impact does not affect the character- defining features of a National Register of Historic Places eligible or listed structure, site, district, or cultural landscape.	The impact changes a character defining feature(s) of the eligible or listed properties, sites, districts, or cultural landscapes, but does not diminish the integrity of the resource to the extent that its National Register eligibility is jeopardized.	The impact changes a character defining feature(s) of a National Register eligible or listed structure, site, district, or cultural landscape, diminishing the integrity of the resource to the extent that it is no longer eligible to be listed in the National Register.	Effects on historic properties would be long-term because these resources are non-renewable.
Cultural Resources - Cultural Landscapes	The effect is at the lowest levels of detection– barely perceptible and not measurable.	The impact affects a pattern or feature in the cultural landscape, but does not diminish the overall integrity of the landscape.	The impact alters a character- defining feature of the cultural landscape, but does not diminish the integrity of the landscape to the extent that its National Register of Historic Places eligibility is jeopardized.	The impact alters patterns or features of the cultural landscape, seriously diminishing the overall integrity of the resource to the degree that its National Register of Historic Places eligibility is jeopardized.	Effects on cultural landscapes would be long- term because these resources are non-renewable.
Cultural Resources - Ethnographic Resources	The effect is at the lowest levels of detection– barely perceptible and not measurable.	The impact would be slight but noticeable and would neither appreciably alter resource conditions, such as traditional access or site preservation, nor the relationship between the resource and the affiliated group's body of beliefs and practices.	The impact would be apparent and would alter resource conditions. Something would interfere with traditional access, site preservation, or the relationship between the resource and the affiliated group's beliefs and practices, even though the group's beliefs and practices would survive.	The impact alters resource conditions. Something would greatly affect traditional access, site preservation, or the relationship between the resource and the affiliated group's body of beliefs and practices, to the extent that survival of a group's beliefs and/or practices would be jeopardized.	Effects on ethnographic resources would be long-term because these resources are non-renewable.

TABLE 5. IMPACT THRESHOLD INTENSITIES (CONTINUED)

Impact Topic	Negligible	Minor	Moderate	Major	Duration
Transportation	Transportation would not be affected, or the effects would be at low levels of detection and would not have an appreciable effect on travel or arrival times.	The effect would be detectable, but would not have an appreciable effect on travel or arrival times.	The effect would be readily apparent, and would result in substantial, noticeable effects on transportation on a local scale. Changes in travel and arrival times could be measured.	The effects would be readily apparent, and would result in substantial, noticeable effects on transportation on a regional scale. Effects could lead to changes in the travel and arrival times.	Short- term – Occurs only during project implementation. Long- term – Persists beyond the period of project implementation.
Visitor use and experience	Visitors would not be affected, or changes in visitor use and/or experience would be below or at the level of detection. The visitor would not likely be aware of the effects associated with the alternative.	Changes in visitor use and/or experience would be detectable, although the changes would be slight. The visitor would be aware of the effects associated with the alternative, but the effects would be slight.	Changes in visitor use and/or experience would be readily apparent. The visitor would be aware of the effects associated with the alternative and would likely be able to express an opinion about the changes.	Changes in visitor use and/or experience would be readily apparent and have important consequences. The visitor would be aware of the effects associated with the alternative and would likely express a strong opinion about the changes.	Short- term – Effects occur only during project implementation activities Long- term – Effects extend beyond project implementation activities

A §106 summary is included following the cultural resource impact analyses. The §106 summary is an assessment of the effect of the undertaking (implementation of the Preferred Alternative) on NRHP- eligible or listed cultural resources only, based on the criterion of effect and criteria of adverse effect found in the Advisory Council's regulations. The §106 criteria for characterizing the severity or intensity of impacts are the determinations of effect: *no historic properties affected*, *no adverse effect,* or *adverse effect*.

- A determination of no historic properties affected means that either there are no historic properties present or there are historic properties present but the undertaking would have no effect on them.
- A determination of no adverse effect means there is an effect, but the effect would not meet the criteria of an adverse effect, i.e., diminish the characteristics of the cultural resource that qualify it for inclusion in the NRHP. A no adverse effect finding also may include beneficial effects of an action.
- An adverse effect occurs whenever an impact alters, directly or indirectly, any characteristic of a cultural resource that qualifies it for inclusion in the NRHP, e.g., diminishing the integrity (or the extent to which a resource retains its historic appearance) of its location, design, setting, materials, workmanship, feeling, or association. Adverse effects also include reasonably foreseeable effects caused by the alternatives that would occur later in time, be farther removed in distance, or be cumulative. Because cultural resources are nonrenewable, all adverse effects on NRHP- eligible cultural resources would be long- term and have a high level of concern.

Impact threshold definitions are included with each of the following cultural resource topics (archaeological resources, historic properties, cultural landscapes, ethnographic resources) to help ensure that the intent and legal requirements of both NEPA and the NHPA are met in this EA. Note that all unevaluated cultural resources would be considered eligible for the NRHP until evaluation is completed.

Cumulative Effects Method

The CEQ (1981) regulations for implementing NEPA require an assessment of cumulative effects in the decision- making process for federal projects. Cumulative effects are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non- federal) or person undertakes such other actions" (40 CFR 1508.7). Cumulative effects are considered for both the no action and action alternatives. The cumulative impacts analysis is presented at the end of each impact topic analysis.

Cumulative effects were determined by combining the effects of the alternatives with other past, present, and reasonably foreseeable future actions in the vicinity. Therefore, it was necessary to identify other past, ongoing, or reasonably foreseeable future actions within and adjacent to the Tamiami Trail. These identified projects and plans are presented under "Relationship to Other Plans, Policies, and Actions" in the "Purpose and Need" section.

Impairment of Park Resources or Values

NPS *Management Policies* (NPS 2006) provides guidance on addressing impairment of park resources. Impairment is an impact that, "in the professional judgment of the responsible NPS manager, would harm the integrity of park resources or values, including those that would otherwise be present for the enjoyment of those resources or values. Whether an impact meets this definition depends on the particular resources that would be affected, the severity, duration, and timing of the impact, the direct and indirect effects of the impact, and the cumulative effects of the impact in question with other impacts."

Any park resource can be impaired, but an impact would be more likely to result in impairment if it affects a resource or value whose conservation is:

- Necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park,
- Key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park, or
- Identified as a goal in the park's general management plan or other relevant NPS planning documents.

An impact would be less likely to result in impairment if it is an unavoidable result, which cannot reasonably be mitigated, of an action necessary to preserve or restore the integrity of vital park resources.

Visitor use and experience, and transportation are not considered park resources for which the park was established to protect. Therefore, impairment findings are not included as part of the impact analysis for these topics.

None of the alternatives proposed in this EA would produce major adverse impacts or impairment of park resources or values.

HYDROLOGY

Affected Environment

The Northeast Shark River Slough is the predominant natural hydrologic feature in eastern Everglades National Park. The Shark River Slough historically flowed from the central Everglades south of Lake Okeechobee in a generally south and southwest direction to Florida Bay. However, this flow has been drastically altered over the last century, most notably by the construction of canals, levees, and other components of the Central and South Florida (C&SF) project.

Construction of Tamiami Trail was completed in 1928, and it was soon discovered that water flow was obstructed into the Shark River Slough and the southern Everglades. Small bridges were constructed to improve flow through the Tamiami Trail, which were replaced with culverts in the early 1950s. Also in the early 1950s, the USACE began construction of a regional flood control measure under the Flood Control Act of 1948 in which a series of canals and levees were constructed, forming Water Conservation Areas (WCA) 3A and 3B north of Tamiami Trail. The cumulative effect of the construction of the Tamiami Trail and

C&SF project components was a significant reduction of flow in the historic Shark River Slough, including the project area.

In 1989, Congress authorized the acquisition of 109,600 acres of privately owned and State lands located south of Tamiami Trail and west of metropolitan Miami (the Everglades National Park Expansion Area). The Expansion Act also directed the USACE to restore natural hydrologic conditions in the expansion area. This effort is known as the Modified Water Deliveries Project. In 1992, the USACE prepared a General Design Memorandum (GDM) for the Mod Waters project that included five major components:

1. Flood mitigation for an 8.5- square mile residential area that would flood if additional water were discharged into the Northeast Shark River Slough.
2. Conveyance and seepage control features, designed to facilitate flow from WCA- 3A and 3B to the L- 29 Canal, and to limit seepage eastward into developed areas of Miami-Dade County.
3. Modifications to eastern Tamiami Trail to increase water conveyance into Northeast Shark River Slough.
4. Raising Tigertail and Osceola Camps to levels above the expected flood levels.
5. A new operational plan for the water control structures to reflect historic flow conditions.

Since 1992, Everglades National Park acquired nearly all the additional authorized lands east of the old Everglades National Park boundary as outlined in the Expansion Act. Several components of the Mod Waters project have been constructed. Structural features were constructed that allowed for the transfer of water from Conservation Areas 3B into L- 29 and a temporary pump station was completed to control seepage from Northeast Shark River Slough into the adjacent L- 31N canal. Neither of these structures is yet operational. However, the 8.5 Square Mile Area and the Tigertail Camp Mod Waters project features have been completed to eventually provide the needed mitigation for the remaining restoration features of the project. These remaining features include structures in the L- 67A and L- 67C levees for improved conveyance and seepage, backfilling the remainder of the L-67 extension canal, raising the Osceola Camp for flood mitigation, and modifications to Tamiami Trail to increase conveyance to Everglades National Park (USACE 2005). An operational plan is currently scheduled to be developed in 2009, which will allow for all these features to be operational when construction is completed in 2013.

Presently, the L- 29 canal is the dominant source of water for Northeast Shark River Slough. Under current conditions, water flows into the L- 29 Canal primarily through structure S-333 on the western end. Water also seeps into the L- 29 Canal as groundwater seeping underneath L- 29 from Water Conservation Area 3B. Water discharges from the L- 29 Canal by flow through the 19 sets of uncontrolled culverts under Tamiami Trail and through structure S- 334 on the eastern end. Structures S- 333 and S- 334 are generally closed for much of the year. They are opened to move water from Water Conservation Area 3A to Northeast Shark River Slough and to the canal system in the urban area to the east. Structure operations are controlled by complex regulations, based on conditions upstream and downstream of the structures, as well as time of year. The maximum allowable water stage in the L- 29 canal is currently 7.5 feet, National Geodetic Vertical Datum (NGVD), to prevent damage to the Tamiami Trail roadbed.

The 1992 GDM for the Mod Waters Project specified a maximum flow target of 4,000 cubic feet per second (cfs) from the L- 29 canal to the park to meet restoration goals (USACE 1992). The 2008 Tamiami Trail LRR/EA concluded that "the existing 19 sets of culverts under Tamiami Trail cannot meet the target flow of 4,000 cfs into Everglades National Park unless stages in the L- 29 are raised very high". These higher stages result in structural damage to the Tamiami Trail roadway and embankment. Congress in 2007 directed "the Chief of Engineers to pursue immediate steps to increase flows to the Park of at least 1,400 cubic feet per second, without significantly increasing the risk of roadbed failure. Flows less than 1,400 cubic feet per second will not produce measurable benefits to the Park." In its current condition, Tamiami Trail does not have the structural capacity to pass rainy season average of 1,400 cfs without violating the Florida Department of Transportation (FDOT) maximum stage constraints of 7.5 feet NGVD.

To overcome this, the approved LRR/EA included a 1- mile long bridge in the eastern part of the project area and road improvements to allow raising the maximum stage in the L- 29 Canal to 8.5 feet. When constructed, the Mod Waters project should provide increased conveyance from WCAs 3A and 3B through Tamiami Trail to the Everglades National Park in an effort to improve historic Shark River Slough flows.

The LRR study considered spreader swales for the Tamiami Trail culverts in the initial alternatives to meet the immediate need to achieve 1,400 cfs. The LRR/EA concluded, "Modeling and evaluation of LRR alternatives suggest that spreader swale implementation would have minor hydrologic benefits that may not be ecologically significant." Further, it states, "Because technical disagreements exist regarding the ability to adequately simulate spreader swale performance, the NPS is taking the lead on a separate planning and NEPA process to consider a spreader swale pilot project and further evaluate the potential benefits of spreader swales along the Tamiami Trail."

The U.S. Geological Survey (USGS) collected approximately 1,600 flow measurements from the L- 29 canal culverts to the park from 1939 to 2008. An evaluation of flows demonstrated four distinct time periods and hydrologic condition based on construction phases of the Tamiami Trail, C&SF, and Mod Waters projects. The four time periods are grouped as followed: (1) 1939 to 1952; (2) 1953 to 1962; (3) 1963 to 1978; and (4) 1979 to 2008. Each time period indicates different flow conditions associated with prevailing management and construction events. The time period from 1939 to 1952 portrayed a decrease in flows attributed to the replacement of wooden bridges with concrete culverts. From 1953 to 1962 the water flow decreased from the previous time period because of the completion of Levee 29, which restricted water flows to rainfall and water seepage through the culverts. Data from 1963 to 1978 demonstrated the closure of the S- 333 structure, which resulted in low flows similar to the last time period. From 1979 to 2008, the flow change on the eastern and western culverts of the Tamiami Trail had the greatest fluctuations because of the removal of the lower half of Levee 67, which altered the flow gradient in the marsh and ultimately flow in the eastern culverts of the L- 29 Canal (Sonenshein and DiFrenna 2008). Please see Appendix C for additional detailed analysis of the culvert flows under the Tamiami Trail.

Environmental Consequences

Impacts of Alternative A, the No Action Alternative

Analysis

Under Alternative A, current conditions would continue and there would be no effect on the hydrologic conditions within the project area.

Cumulative Effects

Because Alternative A includes no constructed project or operational changes, it would make no contribution to the cumulative effects of other projects and plans, described below.

Ongoing and planned regional water management plans to enhance flows to the Everglades ecosystem include the Mod Waters and the Comprehensive Everglades Restoration (CERP) Project efforts. These projects include removal of barriers that impede the natural sheetflow of water through the historic Everglades ecosystem. Installation of the 1- mile bridge, raising the roadbed of the Tamiami Trail, and subsequent increases in stage in the L- 29 canal under the LRR of Mod Waters, would provide benefits to local hydrology. Over the long- term an increase in water depth and hydroperiod may be observed in the local slough environment, benefiting vegetative communities, wetlands, and associated wildlife in this portion of the Northeast Shark River Slough. These projects are also expected to improve hydrologic connectivity of the ridge and slough landscape on the north and sound sides of the Tamiami Trail.

The effect of these large- scale, regional projects would be substantial improvement of conveyance capacity from north of the park, into Everglades National Park. Localized and regional benefits from these projects would be long- term, and moderate to major.

Conclusion

For Alternative A, there would be no impacts to the project area because no pilot spreader swales would be constructed. No contribution, either beneficial or adverse, would be made to the cumulative impacts of other projects and plans.

Under Alternative A, there would be no impairment of or unacceptable impacts to hydrology resources and values in Everglades National Park.

Impacts of Alternative B

Analysis

Potential long- term effects would result from operations and maintenance of the constructed pilot spreader swales.

Modeling analysis of Tamiami Trail culvert spreader swales discussed in the LRR/EA was completed by the USACE in February 2007 (USACE 2007). The analysis used RMA2- WES, a two- dimensional, depth- averaged, finite element hydrodynamic model. The model was used to simulate the magnitude of potential flow improvements that could be achieved by construction of a spreader swale downstream of a single set of Tamiami Trail culverts. The analysis used the easternmost culvert set due to the location of stage gages in the canal and in the marsh that could be used for model calibration. The simulated spreader swale was 1,000 feet long, 30 feet wide, and 3 feet deep. The model used a range of steady state flows in the

culvert set from 2 cfs to 80 cfs. According to the analysis, this corresponds to approximately 63 cfs to 2,538 cfs through all 19 culvert sets. Different Manning's roughness values, a coefficient used in Manning's formula (used to estimate flows in open channel situations) were used in the model for the L- 29 canal, the spreader swale, and the marsh (USACE 2007). The analysis concluded that, "With the addition of the spreader canal, the calibrated set of culverts experienced up to a 36 percent increase over historical flows." Everglades National Park provided an initial review of the modeling analysis that stated, "the RMA2 simulations provided by the USACE do not represent the existing conditions accurately enough to be useful in this type of analysis. The reason for this is most likely the use of friction coefficients that create conditions that do not match field data." The Everglades National Park review further stated, "the conceptualization of the dense vegetation immediately downstream of the culverts also does not provide an accurate representation of the physical system as it currently exists."(NPS 2007).

A Tamiami Trail Spreader Swale Technical Workshop was held on February 25, 2008 to exchange technical information on the efficacy of pilot spreader swales along the Tamiami Trail, discuss policy perspectives, and provide information as part of internal scoping for the NEPA process. The workshop included presentations on the potential hydraulic function of Tamiami Trail culvert spreader swales. The USACE provided a synopsis of the 2007 modeling analysis. The South Florida Water Management District (SFWMD) provided its own analysis, concluding that the increase in flow through the Tamiami Trail culverts with spreader swales would be on the order of 5 percent. The Everglades Foundation also provided an assessment, stating that the USACE modeling assumptions do not reflect actual conditions and thereby over- estimate flow increases. Further, the Foundation stated, "Even if swales are constructed, it is unlikely they would be more efficient than the distribution system that has formed naturally; and vegetation would quickly respond in the swale, requiring constant maintenance."

The long- term hydrologic effects of the pilot spreader swales is unknown and could potentially include improvement in the quantity and distribution of flows from the L- 29 canal into the park. The magnitude of any potential long- term hydrologic effects could range from negligible to minor, but is uncertain; the determination of hydrologic and ecological impacts is the primary objective for this pilot spreader swale project. Alternative B would require substantial baseline and operational hydrologic monitoring to determine any potential increase in flow. To provide a comprehensive evaluation of the spreader swales, these efforts could take several years to complete, but a successful pilot project would provide information on the hydrologic effects of spreader swales and aid in determining if additional swales along the Tamiami Trail would be beneficial and considered in a subsequent NEPA analysis. However, as discussed above, previous analyses estimate a range of no appreciable effect to as much as a 36 percent improvement in flows. This would represent a long- term, negligible to minor benefit to hydrology.

Short- term impacts to hydrology would occur during construction of the pilot spreader swales project. Effects would include the potential for temporarily reduced flow from the project culverts during construction of the pilot spreader swales. Bulldozers would be expected to enter the marsh to excavate muck and vegetation to create the pilot spreader swales. This would cause localized obstructions and alterations of flow due to the presence of equipment and vegetation wind rows in the water course. These obstructions and alterations to flow would be short- term for the duration of construction and would be

limited by regulatory requirements and mitigation measures. Because these conditions would represent measurable alterations to historic and desired hydrologic conditions, they would be minor adverse impacts, and would be short- term and localized.

Cumulative Effects

As described for the No Action Alternative, regional water management plans implemented under the Comprehensive Everglades Restoration Plan and Modified Water Deliveries Project would have the potential to provide moderate to major, long- term, localized to regional, beneficial impacts on hydrology.

Under Alternative B, the effects on hydrologic conditions are uncertain and, therefore, difficult to predict. Estimates range from no impact to 36 percent improvement in flows. Thus, the pilot spreader swale project could provide additional benefits to those provided by the other projects and plans. However, given the scale and areal extent of the regional water management projects, construction of the pilot spreader swales would not likely make a detectable contribution to these effects. Thus, overall cumulative effects on hydrology would be as described for other projects and plans - beneficial, localized to regional, long-term, and moderate to major.

Conclusion

For Alternative B, hydrologic impacts would be uncertain, localized, beneficial, and could range from negligible to minor. Alternative B would combine with other projects and plans to result in long- term moderate to major cumulative impacts on hydrology resources of Everglades National Park.

Under Alternative B, there would be no impairment of or unacceptable impacts to park hydrology resources or values.

Impacts of Alternative C

Analysis

For this non- structural alternative, existing or new hydrologic models would be used to simulate potential hydrologic effects of the pilot spreader swales. Because this alternative would involve no physical action, the impacts would be identical to Alternative A, the No Action Alternative.

Cumulative Effects

Since Alternative C includes no constructed project or operational changes, effects would be those from other projects and plans in the area. Cumulative effects would be the same as described in Alternative A.

Conclusion

For Alternative C, there would be no impacts to the project area. There would also be no contribution to other cumulative effects of Mod Waters and CERP project components which may have moderate to major, long- term, beneficial effects.

Under Alternative C, there would be no impairment of or unacceptable impacts to Everglades National Park's hydrology resources or values.

Impacts of Alternative D, the Preferred Alternative

Analysis

For this alternative, hydrologic modeling (as described for Alternative C) would be used. Should the modeling results prove favorable but still demand additional empirical results to support a decision, a structural component (as described for Alternative B) to build the pilot spreader swales within Everglades National Park would follow. Should the modeling results be unfavorable, no action would be taken. Therefore, Alternative D could result in one of two possible impacts to hydrology - impacts as described for Alternative A in the event of unfavorable modeling results or impacts as described for Alternative B in the event of favorable modeling results.

Cumulative Effects

Cumulative effects would be as described for Alternative B if pilot spreader swales are constructed, or as described for Alternative A if only hydrologic modeling is used.

Conclusion

Alternative D could result in one of two possible effects to hydrology – effects as described for Alternative A in the event of unfavorable modeling results or effects as described for Alternative B in the event of favorable modeling results.

In either case, under Alternative D there would be no impairment of or unacceptable impacts to Everglades National Park's hydrology resources or values.

WATER QUALITY

Affected Environment

To protect the water quality in Everglades National Park, it was designated an Outstanding Florida Water (OFW) requiring special consideration. An OFW has narrative criteria that do not allow the degradation of water quality conditions relative to the optimum of a fixed point in time, which for the Everglades National Park is 1978- 1979. Since the Northeast Shark River Slough was not included in the Everglades National Park OFW designation until August 8, 1994, the base year for this portion of the park is 1993 to 1994.

The Everglades is a phosphorus- limited ecosystem in which ambient levels of phosphorus were historically below 10 parts per billion (McCormick et al. 1996). Slow water movement throughout the Everglades watershed allowed the wetland's biotic and abiotic components to absorb nutrients and maintain consistent water quality.

Current water quality within the Everglades has been affected by non- point (e.g., agricultural and urban runoff) and point (e.g., wastewater discharges) sources of contamination. Parameters of concern include:

- Metals—mercury, copper, cadmium, lead, zinc, and arsenic;
- Pesticides—DDT and derivatives, atrazine, simazine, ametryn, endosulfan compounds, ethion, bromacil, 2,4- D, aldecarb, and fenamiphos;
- Nutrients—phosphorus, nitrite/nitrate, and ammonia/non- ionized ammonia;

- Biological—fecal coliforms, pathogens, and chlorophyll- a;
- Physical parameters—pH, dissolved oxygen, specific conductance (SpC), turbidity, oil and grease, temperature, and salinity; and
- Other constituents—polycyclic aromatic hydrocarbons, dioxins and furans, sulfate, chloride, tributylin, polychlorinated biphenyls, and volatile organic compounds.

Generally, the primary parameters of concern in the Everglades include nutrients, dissolved oxygen, mercury, biochemical oxygen demand, and fecal coliforms (USACE 2005).

There have been several investigations of water quality in the northern region of the Everglades Expansion Area. The USGS National Water- Quality Assessment Program conducted a water quality survey in south Florida along Tamiami Trail from the Big Cypress Swamp to the Everglades from 1996 to 1997 (Miller et al. 1999). The major findings from the study included:

- Concentrations of total phosphorus (TP) were above Everglades background levels and exceeded the USEPA's Everglades water quality standard of 0.01 milligram per liter (mg/L). A major source of the high TP is fertilizer from agricultural runoff.
- Concentrations of dissolved organic carbon (DOC) along Tamiami Trail ranged from 4.8 to 26.9 mg L- 1. High DOC concentrations provide food for bacteria to grow, reduce light penetration in the water, and enhance transport and cycling of pesticides and trace elements such as mercury.
- Of the 21 basins surveyed nationwide, the Everglades has the second highest ratio of methylmercury to mercury in sediment. This enrichment in methylmercury enhances mercury uptake by the biota.

Sources of surface water into the L- 29 Canal are:

- rainfall directly precipitating into the canal;
- the S- 333, a gated structure at the west end on the L- 67 Canal;
- the S- 355A and S- 355B, two structures at the south side of WCA- 3B along the north side;
- the S- 356, a pump station at the east end; and the
- the S- 334, a gated structure at the east end.

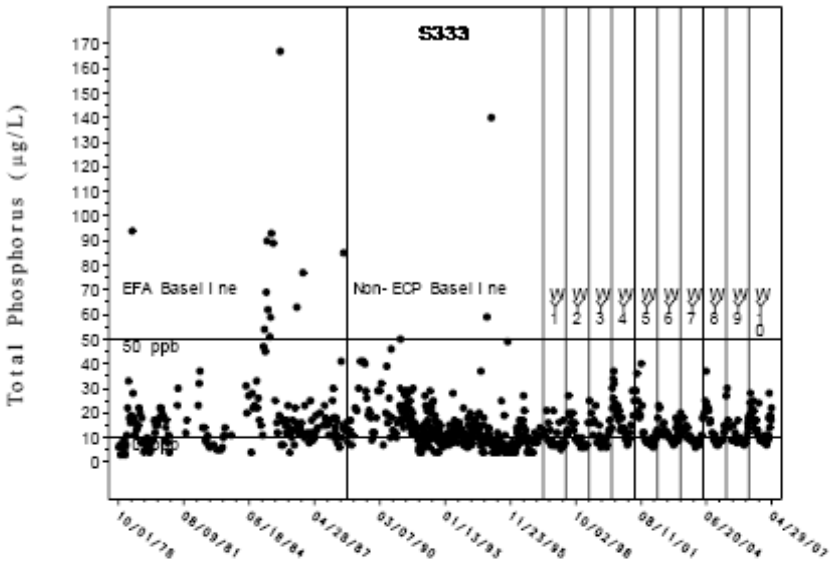
The S- 355A, S- 355B, and S- 356 are Mod Waters structures that have undergone short tests, but they have not been issued a Florida Department of Environmental Protection permit to discharge water. S- 334 is used to move water out of the L- 29 Canal. The amount of water discharged from the S- 355A, S- 355B, and S- 356 during their short tests was insignificant to assess the impact of the quality of water entering the L- 29 Canal. Other than direct rainfall and some seepage from WCA- 3B under the L- 29 levee, surface water entering the subject area mainly comes through the S- 333 structure. Water coming from the S- 333 structure mainly originates from the L- 67A canal and dominates the flow and therefore the quality of the water entering the L- 29 canal.

Time series water quality monitoring data for TP and dissolved oxygen (DO) were reported for the last 10 Water Years (WY) in the 2008 South Florida Environmental Report for the S- 333. For TP (Figure 7), seven of the 10 years had mean concentrations above 0.010 mg/L (10

parts per billion [ppb]). The numerical criterion for TP is 0.010 mg/L (10 ppb); this is the threshold for the Everglades above which TP causes an imbalance of the natural flora and fauna in the Everglades. For the DO water quality parameter (Figure 8) all 10 years had mean values below the Class III standard of 5.0 mg/L.

FIGURE 7. TIME SERIES AND BOX PLOTS FOR TOTAL PHOSPHORUS

(From Water Year 1 [May 1, 1997 through April 30, 1998] to Water Year 10 [May 1, 2006 through April 30, 2007] - Source: 2008 South Florida Environmental Report)



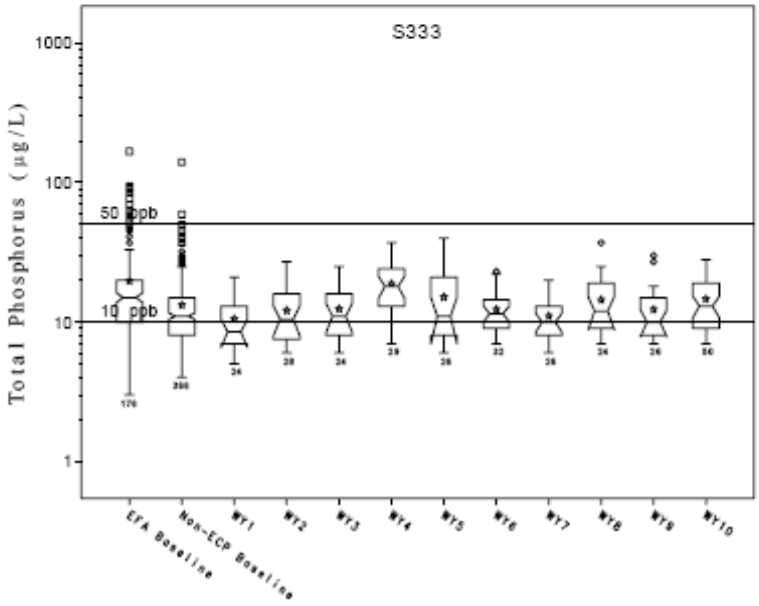
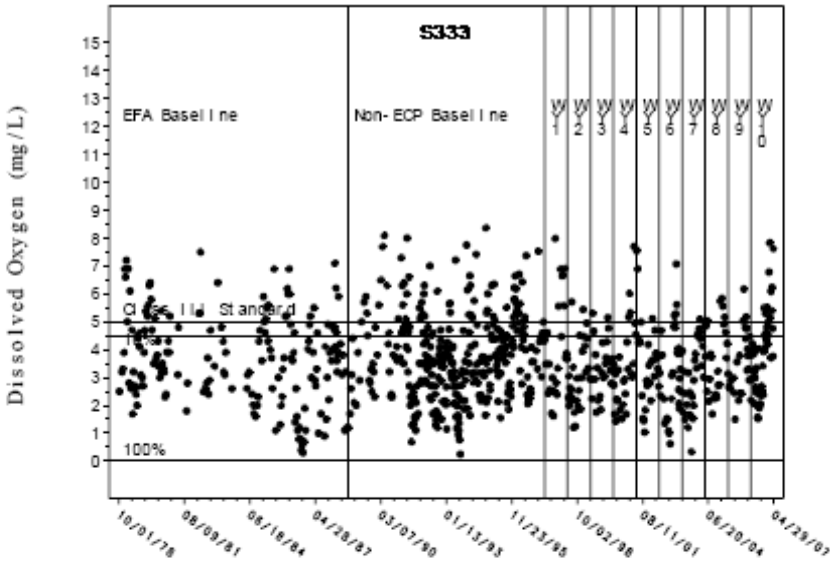
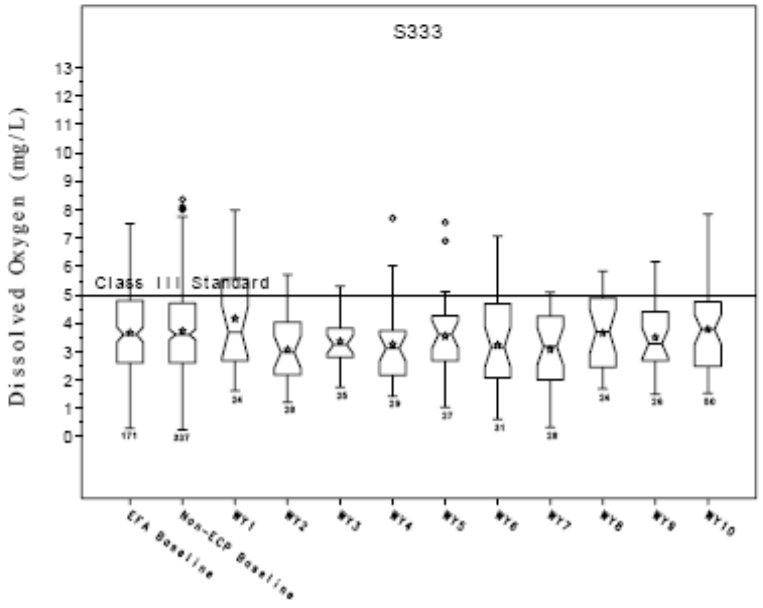


FIGURE 8. DISSOLVED OXYGEN TIME SERIES AND BOX PLOTS FOR S333 WATER QUALITY MONITORING DATA EXHIBITING EXCURSIONS FROM CLASS III NUMERIC STANDARDS

(From Water Year 1 [May 1, 1997 through April 30, 1998] to Water Year 10 [May 1, 2006 through April 30, 2007] - SFERTF 2008)





The South Florida Environmental Report in 2008 (SFWMD 2008) states that 97,181 acre feet of water flowed into the park during 2007 (structure S- 333 flows minus structure S- 334 flows) with a flow- weighted mean concentration for TP of 18 ppb for a total TP load of 2,187 kg of phosphorus entering the park through the Tamiami Trail culverts. This TP load through structure S- 333 was higher than any other structure that delivers water into Everglades National Park. The following table provides an estimate of the Tamiami Trail culvert flows and the respective TP loads.

TABLE 6. MEAN PERCENT FLOWS (USGS, UNPUBLISHED DATA)AND ESTIMATED 2007 FLOWS AND TP LOADS FOR TAMIAMI TRAIL CULVERTS

Culvert	Flow (cfs)	Percent of Flow	TP Load (kg)
41	59.12	1.41	30.8
42	65.12	1.56	33.9
43	67.3	1.60	35.0
44	60.13	1.43	31.3
45	338.38	8.07	176.5
46	76.4	1.82	39.8
47	65.42	1.56	34.1
48	87.62	2.09	45.7
49	120.59	2.88	63.0
50	288.77	6.89	150.7
51	46.55	1.11	24.3
52	0.79	0,02	0.4
53	371.12	8.85	193.5
54	165.85	3.95	86.4
55	257.02	6.13	134.1
56	236.89	5.65	123.6
57	490.52	11.70	255.9
58	547.06	13.04	285.2
59	849.4	20.25	442.9
Total	4194.05	100.00	2187.0

Comparing the photographs of the culverts from the Spreader Swale Pilot Project Environmental Assessment Internal Scoping Meeting handout packet (dated Wednesday, 14 May 2008) and the flow and TP loading totals in Table 6, it is possible that phosphorus inputs from the culverts are impacting the community structure in the downstream marsh.

Downstream TP transport through oligotrophic, free- flowing wetlands occur predominantly through the biota, notably the periphyton and the flocculent detrital components rather than through the water column itself (Gaiser et al. 2005). Thus, water quality sampling of TP will not measure the microbially bound phosphorus. The Gaiser et al. 2005 study showed that enriched water column phosphorus concentrations were not even detectable until the fifth year of the study. Soils become phosphorus enriched following the capacity of the biota to uptake phosphorus from the water column or detritus. Community structure has been shown to be altered by even minute phosphorus inputs to the system of 5 μgL^{-1} above ambient conditions; within a spikerush/periphyton community in central Shark River Slough this caused changes in the periphyton and floc after two months,

soils after three years, fish after four years, and macrophytes in the fifth year (Gaiser et al. 2005; Gaiser et al. 2007).

The TAMB stations are located at the northern border of the Park along the U.S.41, east of S- 333. Water discharged through the TAMB culverts is a mixture of canal water delivered by the S- 333 (majority) and seepage from WCA- 3B. Thus, there is a water- quality gradient along the L- 29 canal. The major findings from this study are:

- DO concentrations were low and below the state Class III water- quality criterion at the culvert sites, although it may satisfy the "site- specific" DO criterion (SFERTF 2008) at some sites within the natural marsh. DO concentrations below the criterion cause a water body to lose its ability to sustain a viable fish and wildlife population, which is one of the designated "uses" of a Class III water body. The lowest concentrations are observed on the eastern stations, for example, TAMB13(43) which has a DO concentration of 2.1 mg/L. At the mean temperature observed at this site (26.6 C) the maximum DO saturation is four times the calculated mean DO concentration.
- The mean pH varied between 7.1 and 7.2. The lower pHs are observed around stations TAMB12(44) and TAMB13(43). At station TAMB12(44), there is positive increase in the trend, although the lack of data in recent years may be masking the real trend.
- TP ranged from 0.010 to 0.013 mg/L; the highest TP occurred at TAMB13(43). The mean TP at S- 333 is 0.013 g/L. The lower values of TP may reflect contributions from marsh seepage and rainfall.
- The SpC remained around 700 S/cm. When all the TAMBs are included, there is an increasing trend west- east. The SpC increases from 573 S/cm at S- 333 to 709 at TAMB14 (42).

The data collected and analyzed from the TAMB stations provide a water quality baseline for the evaluation of potential Tamiami Trail pilot spreader swales. The data will be important whether a structural alternative or a modeling alternative is selected for the evaluation. The data will be compared to water quality conditions as measured during a structural evaluation to discriminate the actual water quality effects of the spreader swales. For a modeling evaluation, the data may be used as input to the model to simulate the possible water quality effects of spreader swales.

Environmental Consequences

Impacts of Alternative A, the No Action Alternative

Analysis

Because Alternative A includes no constructed project or operational changes in the project area, there would be no change from existing water quality conditions.

Cumulative Effects

Because Alternative A includes no constructed project or operational changes, it would make no contribution to the cumulative effects of other projects and plans, described below.

Regional water management plans in the project area include the Mod Waters project and the CERP projects. With increased flows comes the potential for increased nutrient loading (nitrogen and phosphorus). The Mod Waters and CERP projects are expected to contribute

increased contaminants, such as nitrogen and phosphorus, into the Northeast Shark River Slough, which would be mitigated using stormwater management techniques. Plants (including the biogeochemical microbial community), periphyton, and vegetation would absorb these nutrients and reduce impacts downstream. It is expected the overall impacts of the Mod Waters and the CERP projects would result in beneficial effects to water quality that are long- term, regional, and moderate to major.

Conclusion

For Alternative A, there would be no impacts to the project area because no pilot spreader swales would be constructed. No contribution, either beneficial or adverse, would be made to the cumulative impacts of other projects and plans.

Under Alternative A, there would be no impairment of or unacceptable impacts to park water quality resources or values in Everglades National Park.

Impacts of Alternative B

Analysis

Long- term effects are those that would result from operations and maintenance of the constructed pilot swale project.

It is anticipated that excavation of the soils (including all associated flocculent detritus) and the vegetation layer directly south of the culverts would make phosphorus available for plant use farther downstream in the park. The level of this impact remains unknown on long-term water quality impacts. However, based on the scale of the pilot spreader swale project, is expected this adverse impact would be local, minor, and long- term to water quality conditions from operation and maintenance of the swales.

If the pilot spreader swales provide additional flow to the park, it is expected there would be additional pollutant loading, specifically phosphorus, associated with the flow. The magnitude of additional loading would be estimated from the water quality monitoring and ecological monitoring programs. It is estimated the impacts to park water quality would be adverse, local, minor and long- term because it is estimated that some pollutants would be transported farther into the park resulting from increased water conveyance. However, because phosphorus levels are naturally low in the Everglades system, plants would readily absorb this nutrient and limit the impact on water quality downstream. Best Management Practices would be implemented to help reduce impacts from construction of the swales. Water quality monitoring would also be conducted to assess water quality impacts.

Short- term effects on water quality would occur during project implementation. Excavation of the site and other construction- related activities would cause impacts to water quality such as increased turbidity and total suspended solids. Best management practices would be implemented to help minimize impacts to water quality from construction- related activities. It is estimated these impacts to water quality would be adverse, local, minor, and short- term.

Cumulative Effects

The localized, minor adverse impacts of Alternative B would not detract measurably from the water quality benefits of Mod Waters and the CERP projects. It is expected that the total

cumulative impacts to water quality would continue to be, beneficial, regional, moderate to major, and long- term.

Conclusion

For Alternative B, water quality effects would be directly related to the short- term and long- term effects caused by construction of the swales and potential increases in conveyance. It is anticipated that construction activities could push the initial contaminants farther into the park resulting in short and long- term minor adverse impacts. If additional flows are achieved with the pilot spreader swales, it is anticipated there would be long- term, minor adverse water quality impacts. Best Management Practices would be implemented to help reduce impacts from construction of the swales. Water quality monitoring would also be conducted to assess water quality impacts.

Under Alternative B, it is expected there would be no impairment of or unacceptable impacts to water quality resources or values.

Impacts of Alternative C

Analysis

For this non- structural alternative, existing or new hydrologic models would be used to simulate potential hydrologic effects of the pilot spreader swales. Because this alternative would involve no physical action, the impacts would be identical to Alternative A, the No Action Alternative.

Cumulative Effects

Because Alternative C includes no constructed project or operational changes, it would make no contribution to the cumulative effects of the Mod Waters and the CERP projects, as described for Alternative A.

Conclusion

For Alternative C, there would be no impacts to the project area. There would also be no contribution to the cumulative effects of other Mod Waters and the CERP projects.

Under Alternative C, there would be no impairment of or unacceptable impacts to Everglades National Park's water quality resources or values.

Impacts of Alternative D, the Preferred Alternative

Analysis

For this alternative, hydrologic modeling (as described for Alternative C) would be used. Should the modeling results prove favorable but still demand additional empirical results to support a decision, a structural component (as described for Alternative B) to build the pilot spreader swales within Everglades National Park would follow. Should the modeling results be unfavorable, no action would be taken. Therefore, Alternative D could result in one of two possible impacts to water quality - impacts as described for Alternative A in the event of unfavorable modeling results or impacts as described for Alternative B in the event of favorable modeling results.

Cumulative Effects

Cumulative effects would be as described for Alternative B if pilot spreader swales are constructed, or as described for Alternative A if only hydrologic modeling is used.

Conclusion

Alternative D could result in one of two possible effects to water quality - effects as described for Alternative A in the event of unfavorable modeling results or effects as described for Alternative B in the event of favorable modeling results.

In either case, under Alternative D there would be no impairment of or unacceptable impacts to Everglades National Park's water quality.

SOILS

Affected Environment

The soils occurring within the northern region of the Everglades Expansion Area are mainly characterized as peat or marl.

Peat is formed over decades under anaerobic conditions during long periods of inundation, in which the volume of decaying plant material exceeds the ability of microbes to decompose it. Peat deposits lie beneath the surface soils of about one million acres of the central Everglades, or one- third of the park (NPS 1997). Once exposed to air, microbe populations increase and decomposition accelerates, leading to soil loss. Soil loss and soil subsidence has occurred throughout the Everglades, including the areas in the sawgrass marsh, which subsided from early draining activities (Ingebritsen et al. 2005).

Marls (muds high in calcium) are formed by precipitation of calcite from large mats of submerged blue- green algae called periphyton. These soils were formed in relatively shallow waters with a shorter period of inundation (50- 150 days each year) than peat deposits and therefore have higher rates of microbial activity and decomposition of organic matter. These are the soils that cover the extensive peat deposits of the central Everglades (NPS 1997).

Soils also play an important role in the uptake of nutrients within oligotrophic wetland systems such as the Everglades. Soils become phosphorus enriched following the capacity of the biota to uptake phosphorus from the water column or detritus (Gaiser et al. 2005). Community structure has been shown to be altered by even minute phosphorus inputs to the system of 5 $\mu g L^{-1}$ above ambient conditions; within a spikerush/periphyton community in central Shark River Slough, this caused changes in soils after three years (Gaiser et al. 2005; Gaiser et al. 2007).

Environmental Consequences

Impacts of Alternative A, the No Action Alternative

Analysis

Under Alternative A, current conditions would continue and there would be no effects to soils within the project area.

Cumulative Effects

Because Alternative A includes no constructed project or operational changes, it would make no contribution to the cumulative effects on soils of other regional water management plans, described below.

Implementation of the Mod Waters and the CERP projects would provide longer hydroperiods and increased water depths – more favorable conditions for soil formation processes such as peat accretion. The occurrence of unnatural peat fires would also be reduced. The level of this impact remains unknown on long- term cumulative impacts. While construction activities and bridge maintenance activities would create long- term adverse impacts by disturbance and removal of peat and muck, the expected benefits to soils from other projects and plans is expected to outweigh these impacts. In combination with Alternative A, effects of the Mod Waters and the CERP projects would be beneficial, long-term, moderate, and would occur over a relatively wide area.

Conclusion

For Alternative A, there would be no impacts to the project area because no pilot spreader swales would be constructed. No contribution, either beneficial or adverse, would be made to the cumulative impacts of the Mod Waters and the CERP projects

Under Alternative A, there would be no impairment of or unacceptable impacts to soil resources or values in Everglades National Park.

Impacts of Alternative B

In the event that implementation of the pilot spreader swale project proves effective at improving hydrologic conveyance, they are not expected to provide benefits to soils due to the limited scope of the project. Any potential increase in conveyance is not anticipated to increase hydroperiods or improve hydrological conditions for wetland vegetation needed to support peat accretion processes.

Under Alternative B, the estimated area of affected soil would be up to 6.7 total acres (3.35 acres for each pilot spreader swale constructed). Access routes for removal of excavated material may to need be created, and adverse, local, minor, short- term effects from general construction disturbance and compaction would also occur along these routes. Short- term construction impacts would largely be controlled by implementation of best management practices.

Under all options under Alternative B, soils would be excavated in the footprint and adjacent soils would be disturbed. It is anticipated that excavation of the soils and the vegetation layer within the spreader swale footprint would cause phosphorus assimilation processes to occur further downstream into the park. Since spreader swales have never been implemented in Northeast Shark River Slough, the level of this impact remains unknown. It is expected the impacts resulting from this soil excavation and disturbance would be adverse, local, minor, and long- term.

Cumulative Effects

As described for Alternative A, the Mod Waters and the CERP projects planned for the Tamiami Trail corridor in the northern region of the Everglades Expansion Area would

result overall in moderate, regional, long- term benefits to soils. Alternative B is not expected to contribute measurably to these projects. While Alternative B would contribute adverse effects to soils these adverse effects are not expected to measurably detract from the benefits expected from the Mod Waters and the CERP projects due to the limited scope of the pilot swale project. Overall cumulative effects on soils would be moderate, regional, long- term, and beneficial.

Conclusion

Under Alternative B, construction activities and potential removal of marl and peat layers during construction would result in long- term, minor, localized adverse effects on soils. The disturbance of peat soils would take decades to naturally re- generate; the removal of muck material to bed rock may change the soil dynamics and composition and may affect the downstream vegetation community. Alternative B would not contribute measurably to any of the soil benefits anticipated with the Mod Waters and the CERP projects, but would not detract from these benefits due to the limited scope of the pilot swale project.

Under Alternative B, there would be no impairment to park soil resources or values.

Impacts of Alternative C

Analysis

For this non- structural alternative, existing or new hydrologic models would be used to simulate potential hydrologic effects of the pilot spreader swales. Because this alternative would involve no physical action, the impacts would be identical to Alternative A, the No Action Alternative.

Cumulative Effects

Because Alternative C includes no constructed project or operational changes, effects would be those from other projects and plans in the area. Cumulative effects would be the same as described in Alternative A.

Conclusion

For Alternative C, there would be no impacts to the project area. There also would be no contribution to other Mod Waters and CERP project components which may have regional, moderate, long- term, and beneficial cumulative effects.

Under Alternative C, there would be no impairment of or unacceptable impacts to Everglades National Park's soil resources or values.

Impacts of Alternative D

Analysis

For this alternative, hydrologic modeling (as described for Alternative C) would be used. Should the modeling results prove favorable but still demand additional empirical results to support a decision, a structural component (as described for Alternative B) to build the pilot spreader swales within Everglades National Park would follow. Should the modeling results be unfavorable, no action would be taken. Therefore, Alternative D could result in one of two possible impacts to soils - impacts as described for Alternative A in the event of

unfavorable modeling results or impacts as described for Alternative B in the event of favorable modeling results.

Cumulative Effects

Cumulative effects would be as described for Alternative B if pilot spreader swales are constructed, or as described for Alternative A if only hydrologic modeling is used.

Conclusion

Alternative D could result in one of two possible effects to soils – effects as described for Alternative A in the event of unfavorable modeling results or effects as described for Alternative B in the event of favorable modeling results.

In either case, Under Alternative D there would be no impairment of or unacceptable impacts to Everglades National Park's soil resources or values.

VEGETATION AND WETLANDS

Affected Environment

Vegetation in Northeast Shark River Slough

During pre- drainage conditions, Northeast Shark River Slough was characterized by wide expanses of open water slough with elevated sawgrass ridges interspersed with tree islands (SCT 2003). The ridges and sloughs were organized in a pattern oriented parallel to the direction of flow. Historically, Everglades slough vegetation communities were characterized by floating, submerged, and some emergent species found in areas with the longest hydroperiods and deepest water that normally did not dry down.

Compartmentalization, reduced water deliveries, altered distribution, and alterations of the cyclical patterns of water deliveries have reduced downstream sheet flows and suppressed the natural processes and functions within Northeast Shark River Slough. The L- 29 Canal and Levee create a damming effect severely restricting water deliveries into the park. Stage restrictions within the L- 29 Canal due to roadbed limitations and operational limitations further contribute to reduced water deliveries, affecting plant communities and topographic structure within Northeast Shark River Slough. The paleoenvironmental seed record has shown that deep water slough plant communities such as those dominated by deep water slough species such as white water lily (*Nymphaea odorata*) within Northeast Shark River Slough have largely been replaced by vast stretches of sawgrass *(Cladium jamaicense)* following compartmentalization and other water management practices (Saunders et al.2008). (While the relevant sampling points for the Saunders et al. 2008 site were located south of the affected environment, it is reasonable to assume this would also apply to the affected environment since the Northeast Shark River Slough was historically a connected expanse of ridge and slough habitat.)

Non- native plants (also referred to as exotic species) were first introduced (both accidentally and intentionally) into the Everglades beginning in the mid- 1880s (SFWMD 2000) and continue to be introduced today. It is estimated that approximately 250,000 acres of the park are infested with exotic species (SFERTF 2008). Exotic plant infestations in Everglades National Park may be exacerbated by soil disturbance, increased nutrients and

hydrological modification. Many exotic species are flourishing in a variety of habitats and are negatively affecting the Everglades ecology.

FIGURE 9. VEGETATION HALO SOUTH OF TAMIAMI TRAIL

*Google Earth 8- 7- 08

Native Vegetation

Native plant species abundance, diversity, and community structure vary based on conditions such as topography, hydroperiod, water depth, drydown conditions, alterations in the natural fire regime, and complex intraspecific relationships. Table 7 includes representative native plants found within the northern region of the Everglades Expansion Area. Cattail, a weedy native species, is found immediately downstream of the culverts and at the downstream edge of the vegetation haloes.

Non- Native Vegetation

Non- native vegetation is found within the northern region of the Everglades Expansion Area. Non- native species such as Brazilian pepper (*Schinus terebinthifolius*), an invasive shrub species, occurs in varying densities in disturbed, drier soils adjacent to the road and in the forested wetlands where it grows on the bases of native trees. Old World climbing fern (*Lygodium microphyllum*) also occurs in low densities in the forested wetlands. Invasive aquatic species including hydrilla (*Hydrilla verticillata*), water lettuce (*Pistia stratiotes*), torpedo grass (*Panicum repens*) and Peruvian primrosewillow (*Ludwigia peruviana*) occur in the deeper water associated with the culvert openings.

TABLE 7. REPRESENTATIVE PLANTS FOUND IN THE NORTHEAST SHARK RIVER SLOUGH WITH THE POTENTIAL TO OCCUR IN THE PROJECT AREA

Common name	Scientific Name	Habitat
Pond apple tree (custard apple)	*Annona glabra*	Slough
Pickerelweed	*Pontederia cordata*	Slough
Yellow pondlily	*Nuphar lutea*	Slough
American white waterlily	*Nymphaea odorata*	Slough
Blue waterhyssop	*Bacopa caroliniana*	Slough
Leafy bladderwort	*Utricularia foliosa*	Slough
Marsh mermaidweed	*Proserpinaca palustris*	Slough, sawgrass marsh
Giant leather fern	*Acrostichum danaeifolium*	Sawgrass marsh
Southern shield fern	*Thelypteris kunthii*	Sawgrass marsh
Jamaica swampgrass (sawgrass)	*Cladium jamaicense*	Marl/wet prairie, sawgrass marsh
Southern cattail	*Typha domingensis*	Sawgrass marsh, disturbed areas
Southern beaksedge	*Phynchospora microcarpa*	Marl/wet prairie
Knotted spikebrush	*Eleocharis interstincta*	Marl/wet prairie
Maidencane	*Panicum hemitomon*	Marl/wet prairie
Carolina willow	*Salix caroliniana*	Disturbed areas, wet prairie
Gulf Coast Spikerush	*Eleocharis cellulosa*	Wet prairie, marsh
Tracy's beakrush	*Rhynchospora tracyi*	Sawgrass marsh
Maidenane	*Panicum hemitomon*	Wet prairie, marsh
Muhly Grass	*Muhlenbergia capil/aris*	Marsh
Spreading beaksedge	*Rhynchospora divergens*	Marl/ wet prairie
Bluejoint panicgrass	*Panicum tenerum*	Marl/ wet prairie
Alligator Lily	*Hymenocallis palmeri*	Sawgrass marsh
Florida little bluestem	*Schizachyrium rhizomatum*	Marl/ wet prairie
Asiatic coinwort	*Centella asiatica*	Sawgrass marsh
Egyptian paspalidium	*Paspalidium geminatum var. geminatum*	Slough
Duck potato	*Sagittaria lancifolia var. lancifolia*	Slough, sawgrass marsh, wet prairie
Beaksedge	*Rhynchospora microcarpa*	Marl/ wet prairie
Gulfdune paspalum	*Paspalum monostachyum*	Marl/ wet prairie
Southern cut grass	*Leersia hexandra*	Marsh
Pineland water- willow	*Justicia angusta*	Pineland
Wand goldenrod	*Solidago stricta*	Wet prairie
Rosy camphorweed	*Pluchea rosea*	Marl, wet prairie, sawgrass marsh

Common name	Scientific Name	Habitat
Switchgrass	*Panicum virgatum*	Pinelands
Stiff yellow flax	*Linum medium var. texanum*	Pinelands
Arrowfeather threeawn	*Aristida purpurascens*	Marl/ wet prairie
Meadow jointvetch	*Aeschynomene pratensis vtir. pratensis*	Sawgrass marsh
Water cowbane	*Oxypolis filiformis*	Wet prairie
False fennel	*Eupatorium leptophyllum*	Marl/ wet prairie
Green arrow arum	*Peltandra virginica*	Sawgrass marsh
Banana Plant	*Nymphoides aquatica*	Slough
Pineland heliotrope	*Heliotropium polyphyllum*	Pinelands
Brace's aster	*Aster bracei*	Wet prairie
Turkey tangle fogfruit	*Phyla nodiflora*	Marsh
Glade lobelia	*Lobelia glandulosa*	Slough
Primrose- willow	*Ludwigia microcarpa*	Slough

From: Lodge 2005 and Gaiser et al. 2007.

Wetlands

The majority of Everglades National Park, and all of the project area, are designated as wetlands. Wetlands are areas where water covers the soil or is present at or near the surface of the soil all year, or for varying periods of time during the year, including during the growing season (USEPA 2008). Within and adjacent to the project area are habitats such as the ridge and slough, sawgrass marsh and other freshwater marshes. The natural Everglades wetlands have been reduced in size and context over the last century; nearly 50 percent have been lost to draining for agricultural and economical development (SFERTF 2008).

The dominant habitat in the Northeast Shark River Slough is the ridge and slough wetland. The slight southerly gradient throughout the Everglades permits water to move slowly from the slough through the sawgrass prairie to the south. Water availability and duration are dominating factors that influence the features and processes of the Everglades ecosystem. The Everglades are a vulnerable wetland resource in which manipulation has had far reaching adverse impacts to its inhabitants. Although the ecosystem has been adversely affected by development and long- term water management activities, the remaining portions of the Everglades ecosystem are still defined as wetlands, both by the NPS and by the USACE.

National Wetland Inventory mapping shows the project area is located in a "freshwater emergent wetland." This designation covers the proposed project area and most of the vicinity. The 19 sets of drainage culverts beneath the Tamiami Trail continue to provide flow to the project area during much of the year (based on the stage of water in the L- 29 canal). Wetland vegetation is present downstream of all the culvert sets. In addition, some exotic vegetation is present at most of the outlets, with the majority of vegetation cover by native species. Although the flows are altered from the natural pattern, the hydrology, soils, and vegetation of the project area are indicative of a wetland environment (for more information please refer to Appendix D "Wetlands Statement of Findings").

Vegetation in the Project Area

Vegetation within the immediate project area contains a mixture of exotic and native species. The immediate project area has been impacted by human disturbances such as the Tamiami Trail roadbed and culvert construction/maintenance activities and nutrient loading from the S- 333 releases. Flows into the project area are channelized through the Tamiami Trail culverts; distinct "vegetation haloes" are downstream of most of the culverts and are evident upon visual examination of aerial photographs of the area (Figure 9).

Plant assemblages within the vegetation haloes south of the Tamiami Trail culverts vary depending on site conditions. Some of the haloes contain a distinct plume of forested wetlands dominated by pond apple (*Annona glabra*) and Carolina willow (*Salix caroliniana*) directly south of the culverts. The vegetation eventually transitions into the more uniform sawgrass community downstream within Northeast Shark River Slough. Exotic invasive species are largely restricted to the open water pools immediately downstream of the culverts. In addition, Brazilian pepper (*Schinus terebinthifolius*) occurs in varying densities in disturbed, drier soils adjacent to the road and in the forested wetlands where it grows on the bases of native trees. Old World climbing fern (*Lygodium microphyllum*) also occurs in low densities in the forested wetlands.

Impacts of Alternative A, the No Action Alternative

Analysis

Under Alternative A, current conditions would continue and there would be no effect on the wetland vegetation community within the project area.

Cumulative Effects

Because Alternative A includes no constructed project or operational changes, it would make no contribution to the cumulative effects of other regional water management projects and plans, described below.

Implementation of Mod Waters and the CERP projects would provide benefits to most local plant communities. Over the long- term, deep- water species, such as water lilies, pond apple, and willow would benefit from more natural inflow velocities, increased flows and water depth. Thus, implementation of the Mod Waters and the CERP projects would be expected to provide beneficial, wide ranging, moderate to major, long- term effects.

In addition, the park's vista clearing project, fire management plan, and park- wide exotic vegetation management plan would be implemented in and around the project area. Under the vista clearing effort, vegetation (non- native and native) along the Tamiami Trail would be controlled to provide more natural and historic views from the road into the park's interior. Use of prescribed fire and control of invasive species in the area would support native vegetation processes. In combination, these management practices would have long-term, localized, minor to moderate, beneficial effects on vegetation and wetlands in the vicinity of the project.

Overall cumulative effects on vegetation in the project area would be long- term, beneficial, and moderate to major.

Conclusion

For Alternative A, there would be no impacts to the project area because no pilot spreader swales would be constructed. No contribution, either beneficial or adverse, would be made to the cumulative impacts of other projects and plans.

Under Alternative A, there would be no impairment of or unacceptable impacts to vegetation and wetland resources or values in Everglades National Park.

Impacts of Alternative B

Analysis

The acreage of long- term wetland loss would be up to 6.7 acres. Information collected during the Tamiami Trail topographic survey would be assessed to select pilot spreader swale sites that will result in the least damage to wetlands.

Vegetation would be removed from the spreader swale footprint during construction and vegetation will also be removed during maintenance. Construction access and staging would utilize the Tamiami Trail whenever feasible and may require clearing or filling wetland areas outside of the swale footprint.

It is anticipated that excavation of the soils and the vegetation layer within the pilot spreader swale footprint would cause the phosphorus assimilation processes to occur further downstream into the park. Community structure of macrophytes has been shown to be altered by even minute phosphorus inputs to the system of 5 μgL^{-1} above ambient conditions; within a spikerush/periphyton community in central Shark River Slough this caused changes in macrophytes in the fifth year of the study (Gaiser et al. 2005, Gaiser et al. 2007). The level of this impact to vegetation remains unknown; however, increased availability of this vital plant nutrient could result in accelerated vegetation growth and productivity, but this effect would be limited. Anticipated potential adverse effects on vegetation would be long- term, localized, minor and adverse.

Disturbance caused by removal of the soil and vegetation is expected to make the area more vulnerable to exotic species spread and disruption of native plant species compositions, further contributing to these adverse effects. If the pilot spreader swales prove effective in improving hydrologic conveyance, it is expected this could result in a southward shift in phosphorus uptake likely resulting in an expansion of cattails and/or encroachment of the invasive plant species already in the project area.

However, based on the limited scope of the pilot spreader swales project, it is expected the overall impacts to vegetation resulting from construction and implementation of the pilot spreader swales would be adverse, localized, minor to moderate, and long- term.

The ability for swales to increase hydrologic conveyance remains unknown. However, based on the limited scope of the project, any potential hydrological conveyance improvements provided by swales are not expected to provide any benefits to the downstream plant communities.

If the hydrologic monitoring program were to show that pilot spreader swales were ineffective in improving hydrologic conveyance, the sites would be rehabilitated. This process is described in Chapter 2 under the description of Alternative B.

Cumulative Effects

As indicated in Alternative A, regional water management plans and projects, in concert with the park's vegetation management plans, would have localized to regional, moderate to major, long- term beneficial effects on vegetation and wetlands. Due to the limited scope of the pilot spreader swales, even if proven effective in improving hydrologic conveyance, they would not be expected to contribute to nor detract from the benefits of Mod Waters, the CERP projects. Overall cumulative beneficial effects on vegetation and wetlands would be localized and regional, long- term, and moderate to major.

Conclusion

For Alternative B, construction activities and removal of wetland vegetation would result in adverse, localized, minor to moderate, long- term effects on vegetation. No benefits to wetland vegetation would be expected from the potential range of increased flow from the two test culverts. The pilot spreader swales would not add or detract from benefits to vegetation and wetlands anticipated from other projects and plans.

There would be no impairment of or unacceptable impacts to vegetation and wetlands under Alternative B.

Impacts of Alternative C

Analysis

For this non- structural alternative, existing or new hydrologic models would be used to simulate potential hydrologic effects of the pilot spreader swales. Because this alternative would involve no physical action, the impacts would be identical to Alternative A, the No Action Alternative.

Cumulative Effects

Because Alternative C includes no constructed project or operational changes, effects would be those from other projects and plans in the area. Cumulative effects would be the same as described in Alternative A.

Conclusion

For Alternative C, there would be no effects to the project area. There would also be no contribution to other projects and plans components which may be local to regional, long-term, and minor to major cumulative benefits to wetlands vegetation.

Under Alternative C, there would be no impairment of or unacceptable impacts to Everglades National Park's wetlands vegetation resources or values.

Impacts of Alternative D

Analysis

For this alternative, hydrologic modeling (as described for Alternative C) would be used. Should the modeling results prove favorable but still demand additional empirical results to support a decision, a structural component (as described for Alternative B) to build the pilot spreader swales within Everglades National Park would follow. Should the modeling results be unfavorable, no action would be taken. Therefore, Alternative D could result in one of two possible impacts to vegetation - impacts as described for Alternative A in the event of

unfavorable modeling results or impacts as described for Alternative B in the event of favorable modeling results.

Cumulative Effects

Cumulative effects would be as described for Alternative B if pilot spreader swales are constructed, or as described for Alternative A if only hydrological modeling is used.

Conclusion

Alternative D could result in one of two possible effects to wetlands vegetation - effects as described for Alternative A in the event of unfavorable modeling results or effects as described for Alternative B in the event of favorable modeling results.

In either case, under Alternative D there would be no impairment of or unacceptable impacts to Everglades National Park's wetlands vegetation resources or values.

WILDLIFE

Affected Environment

The drainage of the Everglades from 1910 thru the 1940's significantly reduced the amount of water that moved southward into Shark River Slough (Lodge 2005). This led to significant alternations in the historic wildlife habitat of the now northern region of the Everglades Expansion Area, composed of ridge and slough habitat. For example, deep water slough plant communities within Shark River Slough have largely been replaced by vast stretches of sawgrass *(Cladium jamaicense)* following compartmentalization and other water management practices (Saunders et al. 2008).

Introduction of regional transportation corridors and water management systems fragmented wildlife habitat throughout the Everglades ecosystem. The once vast, naturally connected landscape has been cut into a mosaic of various- sized habitat patches. The Tamiami Trail, L- 29 Canal, and L- 29 Levee, adjacent to the project area, serve as an effective barrier to wildlife movement, interfering with or preventing life functions of many native wildlife species. Large parcels may be suitable for populations of several species of small- sized animals, but very few remaining habitat patches are large enough to provide spatial needs of far- ranging species such as the Florida panther (*Felis concolor coryi*) (USFWS 2006).

The construction and completion of Tamiami Trail in 1928 has had substantial effects on the function and process in the marsh prairie habitat. Historically, the area adjacent to the Tamiami Trail was ridge and slough wetland. The altered hydrology has changed the area immediately adjacent to the road to a consistently flooded habitat that now has a mixed composition of native and non- native vegetation species. Farther south of the Tamiami Trail, drier conditions now support a wooded habitat rather than marsh or wet prairie. These changes in habitat have also altered associated wildlife species diversity and composition.

Mammals

Mammals within the project area have adapted to changing wetland conditions, and in some cases may be distinguished from other North American populations by smaller size or other

adaptive characteristics. For example, white- tailed deer in the Everglades are distinctive in their small size and adaptation to marsh habitats (Kushlan 1990). The marshlands are habitat for at least 10 mammal species, including the largest and most endangered land mammal in the state, the Florida panther (*Felis concolor coryi*) (discussed in the Special- Status Species section), and the Everglades mink (*Mustela vison*), which is rare and generally found in sawgrass habitat but retreats from marshland during the dry season (Humphrey and Zinn 1982). Other mammals expected to occur in the project area include mice, rodents, transient deer and mesocarivores such as skunks, raccoons, otters, and bobcats. The West Indian manatee (discussed in the Special- Status Species section) has never been observed in the culvert ponds within the project area. For the past 20 years, one manatee has been reported within the L- 29 Canal adjacent to the Tamiami Trail. The expected chance of a manatee occurring in the project area is considered negligible.

Birds

Over 400 species of birds have been sighted in the project area, and approximately 300 bird species regularly occur in the Everglades (Lodge 2005). There are over 150 species of birds that breed or forage in the park year round, using both land and water habitats. Tree islands provide habitat for many resident and migratory birds.

Species which may be found within the freshwater marsh and marl prairies include raptors (including the Everglades snail kite, discussed in the Special- Status Species section), wading birds, song birds, corvids, ducks, and numerous other birds. There are approximately 18 species of wading birds that commonly use marshland habitat (Lodge 2005). The spoonbill (*Platalea ajaja*), white ibis (*Eudocimis albus*), and a few species of egrets and herons wade in the shallow marsh habitat foraging for invertebrates and fish. Wood storks (discussed in the Special- Status Species section) have rookeries in the Everglades but migrate to north Florida in the summer (Lodge 2005).

The wetland habitats downstream of the Tamiami Trail culverts provide tree canopy, loafing, nesting, roosting, and foraging areas for bird species. Canopy habitat components found here are edible forage, insect populations, tree cavities, and winter (dry season) cover. Songbirds such as warblers (*Dendrocia* spp.) are common; water birds such as limpkins (*Aramus guarana*), that feed on snails, wade at the water's edge; and several species of egrets and herons, forage in this environment (Ewel 1990).

Amphibians and Reptiles

A variety of amphibians and reptiles are found in the wetlands in and near the project area. The deep- water habitats of the canal outlets are home to leopard frogs (*Rana sphenocephala*), green tree frogs (*Hyla cinerea* spp.) and newts (*Notophthalamus* spp.). Snakes can be locally abundant and include the green water snakes (*Nerodia cyclopion*) and the cottonmouth (*Agkistrodon piscivorus*). Mud turtles (*Kinosternon bauri*) and red- bellied turtles (*Chrysemys nelsoni*) can also be found in these ponded areas.

The American alligator (*Alligator mississippiensis*) is a dominant native predator in the Everglades. Its role in forming "gator holes" is important in maintaining ponded areas during dry periods that support a variety of other species (Kushlan 1990). This species is addressed further in the Special Status Species section.

Fish

Native Fish

At least 28 native fish species are expected to occur in the project area (Loftus 2000). Twenty of these fish species are tolerant of warm, slow moving water in south Florida (Lodge 2005). Most Everglades marsh fish are minnow- sized, which provides an advantage in dry periods when water levels and availability are low (Kushlan 1990). Freshwater fish are an important resource in the Everglades food chain (DeAngelis et al. 2005). The diet of many animals, such as, the otter, alligator, and wading birds include the assemblage of fish species in the Everglades. Species common to the Everglades marsh habitat include the mosquitofish (*Gambusia holbrooki*), golden topminnow (*Fundulus chrysotus*), sailfin molly (*Poecilia latipinna*), and the least killifish (*Heterandria farmosa*). Small individuals of larger species, such as warmouth (*Lepomis gulosus*) and spotted sunfish (*L. punctatus)* can be found in fluctuating marshes.

In the deep- water habitats adjacent to Tamiami Trail (in the L- 29 Canal to the north and the culvert pools to the south), larger fish species can survive and dominate (Kushlan 1990). Florida gar (*Lepisosteus platyrhincus*) and bullhead catfish (*Ictalurus natalis* and *nebulosus*) are common along the highway. Sunfish (*Lepomis* spp.) may also occur, but are affected by fluctuating water levels. These species support the recreational fishery in the L- 29 Canal and culvert pools along the Tamiami Trail.

In 2006, Rehage and Trexler published native and exotic fish data collected in 5 canals in Everglades National Park - 4 in water conservation areas and 1 in the C- 111 Canal panhandle. This study revealed that impacts of water management structures on fish populations are multifaceted and include increased ability of species to migrate, increased local fish densities, and increased local predation. However, the net effects were limited to the immediate vicinity of the canals and the downstream areas affected by increased phosphorus levels. One important aspect of the Rehage and Trexler study to consider is that in 4 of the 5 canal/marsh transects, water flowed from the marsh into the canal. In the project area, downstream flow would predominantly be from the canal into the marsh.

Canals and other man- made flow control structures generally affect the abundance of aquatic species, but have little effect on community structure at distances greater than 5 meters. In their study (Rehage and Trexler 2006), the abundance of all fish groups, including large species, was correlated with increased phosphorus levels. At distances greater than 5 meters from the canal, small fish density was similar to that of interior marshes. However, large fish densities (e.g., Florida gar) were increased slightly at distances up to 1,000 meters from the L- 29 Canal. In addition, culvert holes are known to contain a disproportionately higher number of large fish compared to natural marshes. Large and small fish concentrate in the culvert holes seasonally, where the small fish may be consumed by the large fish. Thus, culvert pools have the potential to disrupt the natural fish community found in these wetlands (Howard et al. 1995).

Exotic Fish

The many canals and water conservation areas which retain water level throughout the year have allowed several exotic fish species to enter and persist in the Everglades. More than 50 introduced fish species found in the Everglades and south Florida (Trexler et al. 2000).

Several species of these exotic fish are predatory and are sought as sport fish by anglers - such as tilapia (*Tilapia* spp.) and the peacock bass (*Cichla ocellaris*). Other species commonly found in the aquarium trade, such as Oscars (a member of the cichlid family *Astronotus ocellatus*) and Mayan cichlids (*Cichlasoma uropthalmus*) are widely dispersed and can be locally abundant, especially in water management structures. Many introduced species prefer habitats that have warmer water temperatures and a longer hydroperiod. Canals within the park maintain warmer temperatures during winter months, and deeper refuge for these species. Thus, marsh habitats connected to canals tend to have more exotic fish than marshes not connected by canals. Culvert hole and canal fish communities may be dominated by non- native species (Trexler et al. 2000).

The interaction between natives and non- natives depends on local environmental conditions that can include habitat patches and water temperature. Environmental disturbances, including construction of water control measures, hurricanes, and tropical storms, can elevate water levels in the park and increase distribution of these species throughout the park (Trexler et al. 2000).

Canals are preferred habitats for introduced fish species and provide thermal refuge during the cold season and provide water refuge during the dry season when marsh surfaces can become exposed (Trexler et al. 2000). Canals contain larger concentrations of exotic fish species than wet prairies and alligator ponds distant from canals; this indicates that non-native fish species may not be able to tolerate cold temperature stress and hydrologic fluctuations more typical of a natural marsh environment (Trexler et al. 2000). Marsh habitats connected to canals tend to have more exotic fish than marshes not connected by canals (Trexler et al. 2000). Culvert pools provide few microhabitats that would be typical of a natural marsh environment (Howard et al. 1995). Exotic fish are known to concentrate in artificial culvert pools as water levels decline during the dry season and leave the culvert pools and enter the natural marsh upon reflooding conditions (Howard et al. 1995). Culvert pools are thought to alter the natural predator- prey dynamics as they harbor large, predatory fish species and do not provide an adequate environment for avian predators (Howard et al. 1995). Fish production is concentrated in artificial culvert pools during the dry season, which could be unavailable to avian predators due to the steep slopes and depths of the culvert pools (Howard et al. 1995).

No native fish extinctions or widespread fish community disruptions resulting from the introduction of exotic fish were noted. However, it should not be inferred that exotic fish species have no effect on native communities; over time, it is possible that exotic fish species could adversely impact native fish community structure. Competitive interactions between natives and non- natives have been observed, and smaller, native species are subject to predation by larger non- natives (Trexler et al. 2000).

Invertebrates

Invertebrates expected to be in the project area include leeches, worms, insects, spiders, crustaceans and mollusks. Many invertebrates, including the crawfish, riverine grass shrimp, and several species of snails, are considered keystone species because of the dietary importance to many other animals in the Everglades (Lodge 2005). Notably, the Florida apple snail (*Pomacea paludosa*), is an important freshwater mollusk because it is the primary food source of the endangered Everglade Snail Kite. Exotic aquatic invertebrates such as the island and spiketop apple snails (*Pomacea insularum* and *P. diffusa*), giant ramshorn snail

(*Marisa cornuarietis*), Asian clam (*Corbicula fluminea*), and the red- rimmed melania (*Melanoides tuberculata*) are also present in the project area.

Exotic Applesnails

The exotic island applesnail (*Pomacea insularum*) has been documented in artificial habitats such as the L- 29 Canal and in the Old Tamiami Trail Canal within the northern boundary of Everglades National Park. Egg masses are thought to disperse to downstream wetlands during high water conditions. The spiketop applesnail (*Pomacea bridgesi*) is also known to occur within the project area and has been observed between Frog City and the Gator Park (personal communication, Kline 2008). It is thought this species may be replacing the native applesnail within the Everglades, the main food source for the endangered Everglade snail kite. The Everglade snail kite beak is designed to feed on the native applesnail and cannot readily feed on the spiketop applesnail as the shape of its shell does not match the kite's beak. Research conducted thus far within and around the L- 29 canal, discharge structures, and the downstream wetland habitats indicates that exotic applesnails are found in higher abundances adjacent to artificial and disturbed habitats than within less disturbed downstream wetland habitats (Kline, personal communication, 2008).

Environmental Consequences

Impacts of Alternative A, the No Action Alternative

Analysis

Under Alternative A, current conditions would continue and there would be no effect on wildlife within the project area.

Cumulative Effects

Because Alternative A includes no constructed project or operational changes, it would make no contribution to the cumulative effects of other projects and plans, described below.

Over the long- term, the Mod Waters and the CERP projects, would have mixed effects on wildlife habitat in the vicinity of the project area. Native wildlife adapted to the ridge and slough environment would benefit from improved hydrologic conditions and increased connectivity of habitats and wildlife corridors. However, excavation of soils and vegetation resulting from installation of the 1- mile bridge would provide refuge for exotic fish species and potentially alter the behavior of alligators residing nearby. Phosphorus uptake processes would occur farther downstream, potentially altering wildlife habitats by increasing plant productivity. The adverse effects are not expected to diminish the regional, long- term, moderate to major, benefits to wildlife.

Vegetation management under the exotic plant management plan, fire management plan, and vista clearing project would improve habitat conditions, providing parkwide, long- term, minor benefits for wildlife.

In combination, effects of other projects and plans would be regional, beneficial, long- term, and moderate to major.

Conclusion

For Alternative A, there would be no impacts to the project area because no pilot spreader swales would be constructed. No contribution, either beneficial or adverse, would be made to the cumulative impacts of other projects and plans.

Under Alternative A, there would be no impairment of or unacceptable impacts to wildlife resources and values in Everglades National Park.

Impacts of Alternative B

Analysis

Over the long- term, measurable impacts to wildlife resulting from potential increased flows from pilot spreader swales would not be anticipated. Because the project is small in scale and any potential changes in flow rates are not known, detectable improvements in wildlife habitat conditions would not likely be measurable.

Over the short- term, mammals, birds, and fish would be affected by ground disturbance, vegetation removal, and the presence of construction equipment and crews. Mobile species would leave and avoid the area. Although individual rodents or small animals could be inadvertently killed during installation activities, it is not likely that community or population changes would occur. Many invertebrates in the swale installation area would be removed with the peat and muck substrate and subsequently killed.

Implementation of pilot spreader swales would result in a minor, adverse effect and a long-term loss of useable habitat by wildlife. It is anticipated that implementation of the swales would result in a loss of resting, shelter, and foraging sites for mammals. For birds, implementation of spreader swales would result in a loss of nesting, loafing, roosting, and foraging sites. It is anticipated that wading birds would not be able to forage within a spreader swale due to the steep swale edges.

For amphibians and reptiles, implementation of spreader swales would result in a net loss of resting, shelter, nesting, and foraging sites. It is anticipated that implementation of the pilot spreader swales could alter alligator behavior in the project area since alligators are known to leave natural marsh environments to inhabit deeper artificial refuges. Should this occur, it would create cascading effects within the downstream marsh since alligator holes are known to provide habitat for many species such as fish, turtles, and wading birds. Since swales have never been implemented in Northeast Shark River Slough, impacts to overall community structure and trophic interrelationships remain unknown.

The pilot spreader swales would be expected to provide a type of artificial habitat similar to canals or culvert pools since the soils and vegetation would be excavated and vegetation would not be allowed to reform. It is anticipated the deeper habitat within the spreader swales would increase suitable conditions for larger native fish, such as Florida gar, and for many exotic fish species that are not adapted to the cyclical drying of the marsh environment. Smaller native fish using the swales would be subject to increased predation. Overall, it is anticipated the deeper water habitat would serve as a refuge during the dry season, which may alter downstream marsh dynamics for species such as wading birds that use natural alligator holes and shallower ponds for foraging. While it is anticipated the pilot spreader swales would provide refuge for exotic fish and exotic apple snail, the potential spread and effects on native species remains unknown since spreader swales have never

been implemented within Northeast Shark River Slough. Impacts on native invertebrates in the construction area would be minor and adversely affected over the long- term by removal of the muck and peat substrate - their primary habitat. For invertebrates, implementation of spreader swales is expected to result in a net loss of shelter, and foraging sites.

Based on the limited scope of the swales, it is estimated that implementation of the pilot spreader swales would produce adverse, local, minor, long- term effects to wildlife.

If the hydrologic monitoring program were to show the pilot spreader swales to be ineffective in improving local flow conditions, the sites would be rehabilitated as described in Chapter 2, Alternative B, Site Rehabilitation Plan.

Cumulative Effects

Regional water management projects, in conjunction with the park management practices would improve habitat as described for Alternative A. The pilot spreader swales would not measurably contribute to nor detract from those effects. In concert, overall cumulative effects would be beneficial, regional, long- term, and moderate to major.

Conclusion

For Alternative B, construction of the pilot spreader swales would result in minor, long-term, localized, and adverse effects on wildlife. Alternative B would not contribute to nor detract from the cumulative, localized to regional benefits from other projects and plans.

Under Alternative B, there would be no impairment of or unacceptable impacts to park wildlife resources or values.

Conclusion

For Alternative B, construction of the pilot spreader swales would result in minor, short-term, long- term, localized, and adverse effects on wildlife. Alternative B would not contribute to the cumulative, localized to regional benefits to wildlife anticipated from the other projects and plans.

Under Alternative B, there would be no impairment of or unacceptable impacts to park wildlife resources or values.

Impacts of Alternative C

Analysis

For this non- structural alternative, existing or new hydrologic models would be used to simulate potential hydrologic effects of the pilot spreader swales. Because this alternative would involve no physical action, the impacts would be identical to Alternative A, the No Action Alternative.

Cumulative Effects

Since Alternative C includes no constructed project or operational changes, effects would be those from other projects and plans in the area. Cumulative effects would be the same as described in Alternative A.

Conclusion

For Alternative C, there would be no impacts to the project area. There would also be no measurable contribution to cumulative long- term, regional, moderate to major, benefits of other projects and plans.

Under Alternative C, there would be no impairment of or unacceptable impacts to Everglades National Park's wildlife resources or values.

Impacts of Alternative D, the Preferred Alternative

Analysis

For this alternative, hydrologic modeling (as described for Alternative C) would be used. Should the modeling results prove favorable but still demand additional empirical results to support a decision, a structural component (as described for Alternative B) to build the pilot spreader swales within Everglades National Park would follow. Should the modeling results be unfavorable, no action would be taken. Therefore, Alternative D could result in one of two possible impacts to wildlife - impacts as described for Alternative A in the event of unfavorable modeling results or impacts as described for Alternative B in the event of favorable modeling results.

Cumulative Effects

Cumulative effects would be as described for Alternative B if pilot spreader swales are constructed, as described for Alternative A if only hydrologic modeling is used.

Conclusion

Alternative D could result in one of two possible effects to wildlife - effects as described for Alternative A in the event of unfavorable modeling results or effects as described for Alternative B in the event of favorable modeling results.

In either case, under Alternative D there would be no impairment of or unacceptable impacts to Everglades National Park's wildlife resources or values.

SPECIAL- STATUS SPECIES

Affected Environment

Everglades National Park provides habitat for six special- status species within the northern region of the Everglades Expansion Area. Although individuals from these imperiled groups find refuge in the park, their species' status and prognosis for survival may well depend on larger external factors acting outside the park boundaries. The park endeavors to protect these species and continues to provide habitat necessary for preserving the natural abundance, diversity, ecological integrity, behavior of the unique flora and fauna.

Six federally listed animal species have the potential to occur within the affected area. These species, and their status, are outlined in the table below.

TABLE 8. FEDERALLY LISTED ENDANGERED, THREATENED, AND CANDIDATE ANIMAL SPECIES WITH THE POTENTIAL TO OCCUR IN THE PROJECT AREA

Common Name	Scientific Name	Status
MAMMALS		
West Indian Manatee	*Trichechus manatus*	Endangered
Florida panther	*Felis concolor coryi*	Endangered
BIRDS		
Wood stork	*Mycteria americana*	Endangered
Cape Sable seaside sparrow	*Ammodramus maritimus mirabilis*	Endangered
Everglades snail kite	*Rostrhamus sociabilis plumbeus*	Endangered
REPTILES		
Eastern indigo snake	*Drymarchon corais couperi*	Threatened
American alligator	*Alligator mississippiensis*	Threatened (S/A- similar in appearance to the American crocodile)

The **West Indian Manatee (***Trichechus manatus***)** was first listed as endangered in 1967. This large, herbivorous mammal lives in freshwater, brackish, and marine habitats and eats submerged, emergent, and floating vegetation. They do not utilize terrestrial habitats during any life stage. For the period of record of over 20 years, there has been one record of a manatee utilizing the L- 29 Canal adjacent to Tamiami Trail. This species has not been documented in the culvert pools south of Tamiami Trail. It is highly unlikely that a manatee would be encountered in the project area because the project would not affect the L- 29 Canal. Therefore, it is concluded that the project will not affect the West Indian manatee and, thus, is eliminated from further analysis.

Florida panthers (*Felis concolor coryi*) appear to indicate a preference toward large and remote tracts with adequate prey and cover. There are approximately 11 Florida panthers currently found within Everglades National Park. Preferred habitat is upland forests such as pine flatwoods and hardwood hammock rather than wetlands and disturbed areas. Dense saw palmetto is preferred for resting and denning. Panther breeding may occur throughout the year, with a peak during the period of winter and spring. Panthers have a gestation period of around 90 to 95 days, litter sizes of one to four kittens, and a breeding cycle of two years for females successfully raising young to dispersal, which occurs around 18 to 24 months (USFWS 1999). The panthers' preferred prey species are the white- tailed deer and feral hogs (USFWS 2006).

The project area occurs in the Florida panther primary zone that supports the sole breeding population of Florida panthers. Telemetry data indicate that Florida panthers have previously ranged adjacent to the Tamiami Trail; also panthers have been involved in vehicle collisions along the Tamiami Trail which further supports their potential presence adjacent

to the project area. It is also possible there could be other un- collared Florida panthers within or adjacent to the project area.

Wood storks (*Mycteria americana*) are birds of freshwater and brackish wetlands, primarily nesting in cypress or mangrove swamps. They feed in freshwater marshes, narrow tidal creeks, or flooded tidal pools, primarily on fish between 2 and 25 centimeters long (USFWS 1999). Particularly attractive feeding sites are depressions in marshes or swamps where fish become concentrated during periods of falling water levels. The U.S. breeding population of the wood stork declined from an estimated 20,000 pairs in the 1930s to about 10,000 pairs by 1960. Since 1978, fewer than 5,000 pairs have bred each year. The decline is believed to be due primarily to the loss of suitable feeding habitat, especially in south Florida rookeries, where repeated nesting failures have occurred despite protection of the rookeries. Feeding areas in south Florida have decreased by about 35 percent since 1900 because of human alteration of wetlands. Additionally, human- made levees, canals, and floodgates have greatly changed natural water regimes in south Florida (USFWS 1999). There are two wood stork colonies that currently occur south of Tamiami Trail.

The **Everglade snail kite** (*Rostrhamus sociabilis plumbeus*) is an endangered raptor that inhabits the freshwater marshes and marl prairies of the Florida peninsula. The Everglade snail kite feeds almost exclusively on the apple snail (*Pomacea paludosa*), so the continued existence and availability of this snail primarily decides the fate of the snail kite. The apple snail lives in freshwater wetlands with sparsely distributed emergent vegetation consisting predominantly of grass and sedge species. Managing the hydrology of these marshes is important to the survival of the snails. Previously, there have been two snail kite management areas north of the Tamiami Trail (USACE and NPS 2008).

The **Cape Sable seaside sparrow** (*Ammodramus maritimus mirabilis*) is an endangered, ecologically isolated subspecies of the seaside sparrow. Recent surveys estimate the population at approximately 3,000 individuals, all of which are restricted to the marl prairies of Big Cypress National Preserve and the Everglades National Park (USFWS 1999). The Cape Sable seaside sparrow has a specific habitat preference of dense stands of graminoid species less than 1 meter in height and naturally inundated by freshwater during part of the year. The sparrow has a generalist diet; it commonly feeds on soft- bodied insects such as grasshoppers, spiders, moths, caterpillars, beetles, dragonflies, wasps, marine worms, shrimp, grass, and sedge seeds, and tends to shift the importance of prey items in response to their availability (USFWS 1999). The Cape Sable seaside sparrow's breeding season typically extends over nearly half of the year. Nesting may begin as early as late February and may persist into early August. The amount of summer nesting, which essentially means the number of third broods attempted, may depend on the characteristics of individual rainy seasons. Nesting activity decreases abruptly when water depths in nesting habitat exceed 10- 20 cm. This species is known to occur south of the project area in the marl prairie habitats of the park.

The **Eastern indigo snake** (*Drymarchon corais couperi*) is the longest of the North American snakes, with a heavy body and shiny blue- black coloring. This, docile, non-venomous snake has declined in numbers over the last 100 years because of a loss of habitat, pesticide use, and collection for the pet trade. Individuals require large areas with a variety of habitats, and areas of 10,000 acres or more may be essential for population viability. The U.S. Fish and Wildlife Service (USFWS) has categorized the species as declining with strict enforcement of anti- collection laws needed (NatureServe 2008, USFWS 2008).

Within the park the snake can be found within the wet prairie and hardwood hammock areas. The snake uses the burrows of other animals for denning or to lay eggs. The preferred diet of these snakes is frogs, other snakes, toads, salamanders, small mammals, and birds. In summer, the eastern indigo snake ranges widely (over 125 to 250 acres) in search of prey, but in winter generally stays close to the den (within 25 acres). The USFWS (2004) conducted a year long roadkill survey along Tamiami Trail and had found many reptiles and amphibians but had no documented Indigo snakes in the survey.

The **American alligator (***Alligator mississippiensis***)** is a member of the crocodile family that can be distinguished from the American crocodile by its broader snout, dark body color, and are found in freshwater and brackish water habitats. Alligators may live to 30 years of age, or more, and can reach length of 10 to 13 feet and weigh 1,000 pounds at maturity. Alligators prey on fish, turtles, snails, and any animals that come to the water's edge. They depend on wetland habitats, and in some ways, the wetlands of the Everglades depend on them. An alligator uses its mouth and claws to uproot vegetation; then, slashing with its powerful tail, wallows out a depression. This "gator hole" is full of water in the wet season and holds water during the dry season. During extended droughts, gator holes provide vital water for fish, insects, crustaceans, snakes, turtles, birds, and other animals in addition to the alligator (USFWS 2008a).

Historically, alligators were depleted as a result of hunting and habitat loss. Since they were first protected in 1967, prior to the Endangered Species Act, the species has made a dramatic comeback. In 1987, the USFWS pronounced the species "fully recovered." However, the species remains protected as a threatened species because of its similarity in appearance to the threatened American crocodile, which occupies coastal saltwater habitats in the park (USFWS 2008a).

Environmental Consequences

Impacts of Alternative A, the No Action Alternative

Analysis

Under Alternative A, current conditions would continue and there would be no effect on threatened and endangered species within the project area.

Cumulative Effects

Because Alternative A includes no constructed project or operational changes, it would make no contribution to the cumulative effects of other regional water management projects and plans, described below.

The Mod Waters project and the CERP projects have the potential to improve habitat for the park's threatened and endangered species by taking steps toward restoring natural hydrologic processes. In addition, the park's exotic plant control and fire management would also improve the health of native plant communities and enhance habitat conditions. These efforts would produce regional, long- term, moderate benefits to the federally listed species (may affect, not likely to adversely affect).

Conclusion

For Alternative A, there would be no impacts to the project area because no pilot spreader swales would be constructed. No contribution, either beneficial or adverse, would be made to the cumulative impacts of other projects and plans.

Under Alternative A, there would be no impairment of or unacceptable impacts to special status species resource and values in Everglades National Park.

Impacts of Alternative B

Analysis

Florida Panther

Based on the limited scope of the pilot swale project, any potential improvements in hydrologic conveyance are not expected to provide any short- term or long- term benefits to the Florida Panther. During project implementation, the noise and disturbance associated with construction activities would deter panthers from using the area during installation of the pilot spreader swales.

Alternative B would not reduce suitable panther habitat appreciably. However, construction disturbance could cause panthers to avoid the project area during installation.

Potential effects could include temporary disruptions in panther foraging and feeding activities. Since this is a wide ranging species with significant spatial requirements, it is also expected the project could temporarily affect their ranging activities. These are all temporary effects that would only occur during the construction of the swales. There is no designated critical habitat for this species. Implementation of Alternative B is not expected to adversely affect Florida panther habitat. Alternative B may affect, but is not likely to adversely affect, the Florida panther.

Wood stork

Based on the limited scope of the pilot swale project, any potential improvements in hydrologic conveyance are not expected to provide any short- term or long- term benefits to wood storks.

There are two wood stork colonies south of Tamiami Trail and several colonies recorded between 1985 and 2008 directly south of Tamiami Trail within Everglades National Park. However, proximity to wood stork nesting and roosting sites was used as a criterion for eliminating potential pilot spreader swale locations during early planning efforts. All wood stork primary and secondary restriction zones would be avoided during any construction-related activities. None of the potential culverts or control culverts to be analyzed is within the restriction zones or even between the wood stork colonies. It is anticipated that wood storks would not be able to forage within the swale due to the steep edges.

Although wood storks could be exposed to construction disturbance during installation, it is unlikely their nesting, roosting, loafing, and colony formation activities would be measurably affected due to location restrictions, and distance between spreader swales and the colonies. However, it is anticipated that implementation of Alternative B could result in a loss of some feeding and foraging sites. Therefore, Alternative B may affect, but is not likely to adversely affect the wood stork.

Everglade snail kite

Based on the limited scope of the pilot swale project, any potential improvements in hydrologic conveyance is not expected to provide any short- term or long- term benefits to the Everglade snail kites.

Implementation Alternative B is not expected to occur within the Everglade snail kite management zones. Culverts that are potentially available for swale construction are outside the 500 meter limited activity buffer area of the Everglade Snail Kite (USACE and NPS 2008). Potential project effects could include disruptions in foraging and feeding activities that would occur during the approximate two month project duration. Thus, over the long-term, implementation of Alternative B may affect, but is not likely to adversely affect the Everglade snail kite. Prior to any subsequent design and construction, specific mitigation measures would be developed to further reduce the potential effects of construction and operations and maintenance activities.

The contractor will be required to follow the Service's Draft Snail Kite Management Guidelines (2006). The project is not expected to adversely affect Everglades snail kite habitat. The project may affect, but is not likely to adversely affect, the Everglades snail kite.

Cape Sable seaside sparrow

Based on the limited scope of the pilot swale project, any potential improvements in hydrologic conveyance is not expected to provide any short- term or long- term benefits or adverse effects to the Cape Sable Seaside Sparrow.

The Cape Sable seaside sparrow does not occur within the project footprint. The Cape Sable seaside sparrow occurs south of the project area, in the marl prairie west of the Shark River Slough. There is no Cape Sable seaside sparrow critical habitat located within the project area. The project is expected to have no effect on the Cape Sable seaside sparrow or its habitat.

Eastern indigo snake

The Eastern indigo snake is generally found in wet prairies and hardwood hammocks and has not been observed to occur within the project footprint. The *Standard Protection Measures for the Eastern Indigo Snake* (USFWS 2006a) would be prepared and implemented during construction activities. These measures would mitigate any potential adverse effects to this species. The *Standard Protection Measures for the Eastern Indigo Snake* are project-specific measures that would be prepared by the park and submitted to the USFWS for approval prior to site clearing and excavation. The measures would include a combination of protective measures (such as covering any openings in which snakes could be trapped) and educational materials (such as pamphlets and brochures) for construction crews to assist in the identification of the snake. In addition, appropriate methods for removing individuals from the project area, and details regarding the laws and regulations regarding the handling of, or causing harm to, this threatened species would be distributed. The project is expected to have no effect on the eastern indigo snake.

American alligator

Since alligators naturally occupy and maintain gator holes in the Northeast Shark River Slough, spreader swales may encourage alligators to establish territories in the pilot swales and move out of natural ridge and slough or marsh habitats. The result of this behavioral

change may prevent alligators from seeking and maintaining natural gator holes. The gator holes allow plants and animals to survive the dry season by finding refuge in the holes (Whitney et al. 2004). Fish are among the first organisms to colonize the marsh once the water rises in the wet season. The efficient colonization of fish in the marsh is an essential process in the Everglades food web (Kushlan 1990). Thus, over the long- term, implementation of Alternative B may affect, but is not likely to adversely affect the American alligator.

Cumulative Effects

The Mod Waters and the CERP projects, in conjunction with the park vegetation management practices, would improve habitat as described for Alternative A, providing regional, long- term, moderate benefits to threatened and endangered species (may affect, not likely to adversely affect). The presence of the pilot spreader swales would result in localized, minor, adverse effects (may affect, not likely to adversely affect) on special- status species. However, the potential affects from the pilots would not detract from the overall cumulative impacts of other projects, resulting in regional, long- term, moderate benefits (may affect, not likely to adversely affect).

Conclusion

For Alternative B, effects on federally listed species in the project area would range from no effect to may affect, not likely to adversely affect. Cumulative effects from hydrology restoration and vegetation management for listed species would be beneficial, regional, long- term, and moderate. Alternative B would not make a measurable contribution to these cumulative effects.

Under Alternative B, there would be no impairment of or unacceptable impacts to Everglades National Park's special status species resources or values.

Impacts of Alternative C

Analysis

For this non- structural alternative, existing or new hydrologic models would be used to simulate potential hydrologic effects of the pilot spreader swales. Because this alternative would involve no physical action, the impacts would be identical to Alternative A, the No Action Alternative.

Cumulative Effects

Because Alternative C includes no constructed project or operational changes, effects would be those from other projects and plans in the area. Cumulative effects would be the same as described in Alternative A.

Conclusion

For Alternative C, there would be no impacts to the project area. There would also be no contribution, either beneficial or adverse, to the cumulative impacts of other projects and plans.

Under Alternative C, there would be no impairment of or unacceptable impacts to Everglades National Park's special- status species resources or values.

Impacts of Alternative D, the Preferred Alternative

For this alternative, hydrologic modeling (as described for Alternative C) would be used. Should the modeling results prove favorable but still demand additional empirical results to support a decision, a structural component (as described for Alternative B) to build the pilot spreader swales within Everglades National Park would follow. Should the modeling results be unfavorable, no action would be taken. Therefore, Alternative D could result in one of two possible impacts to special- status species – impacts as described for Alternative A in the event of unfavorable modeling results or impacts as described for Alternative B in the event of favorable modeling results.

Cumulative Effects

Cumulative effects would be as described for Alternative B if pilot spreader swales are constructed, as described for Alternative A if only hydrologic modeling is used.

Conclusion

Alternative D could result in one of two possible effects to wildlife - effects as described for Alternative A in the event of unfavorable modeling results or effects as described for Alternative B in the event of favorable modeling results.

In either case, under Alternative D there would be no impairment of or unacceptable impacts to Everglades National Park's special- status species resources or values.

CULTURAL RESOURCES

Affected Environment

Archaeological Resources

Prehistoric Period. Although archeological evidence suggests that the earliest human presence in south Florida can be traced to the Paleo- Indian period (12,000 to 7500 B.C.), sites from this period have not been discovered in Everglades National Park (NPS 2002).

The next cultural stage – the Archaic period – lasted from 7500 to 500 B.C. The Archaic period is divided into three broad temporal divisions based mainly on stylistic changes in projectile points and the introduction of fiber- tempered pottery in the Late Archaic period. These periods are the Early Archaic (7500 to 5000 B.C.), the Middle Archaic (5000 to 3000 B.C.) and the Late Archaic (3000 to 500 B.C.). Pottery first appears in the Late Archaic around 2000 B.C. (Widmer 1988; Russo 1991; Milanich 1994). No evidence of Early Archaic period has been discovered within Everglades National Park. Radiocarbon dates from tree island sites in the East Everglades reveal occupations from the middle and late Archaic periods, with the earliest date 3600 B.C.

The Glades tradition (500 B.C. to A.D. 1700) followed the Archaic period, and demonstrated a increasingly specialized adaptation to the Everglades ecosystem. The Glades tradition is divided into three sub- periods, identified by pottery types: Glades I (500 B.C. to A.D. 500), Glades II (A.D. 750- 1200), and Glades III, (A.D. 1200- 1700), which marked the appearance of European artifacts after European contact (Widmer 1988). Most of the known archeological sites in Everglades National Park date to the Glades period typified by large shell works or shell or earthen midden sites (Griffen 1988; NPS 1998).

Historic Period. At the time of Ponce de Leon's arrival in A.D. 1513, there was a thriving population in south Florida, with at least four separate tribes numbering approximately 20,000 people: the Calusa in southwest Florida and the Tequesta, Jega, and Ais along the east coast (NPS 2002). The Calusa and the Tequesta inhabited the area that is now Everglades National Park, with the Calusa chiefdom having political dominance over a wide geographical area on the Southwest coast of Florida (NPS 1998).

Aboriginal populations declined dramatically after the arrival of Europeans. When the English gained control of Florida in 1793, only a few hundred members of these tribes remained. The last of the Calusa either united with the Seminole population or migrated to Cuba with the Spanish (Swanton 1979).

As pressure from European immigration increased, tribes from the northern states began to settle in Florida. Throughout the 18th and 19th centuries, the Creek immigrants who had settled in north Florida were continuously driven out from their settlements by European and American expansion (NPS 2002). The Seminoles, as they were referred to after the 18th century, moved farther south into remote areas of Florida. During the Seminole Wars of the early 19th century, the U.S. Government promised land west of the Mississippi River for those willing to voluntarily relocate. Many Seminoles accepted this option and now are part of the Seminole Nation of Oklahoma. Meanwhile, other bands of Seminole Indians resisted relocation to the reservations of Oklahoma and retreated into the far reaches of what is today Everglades National Park and Big Cypress National Preserve (NPS 2001). The contemporary Seminole and Miccosukees are descended from fewer than 200 survivors left at the end of the last Seminole War in 1858 (Weisman 1999). The historical Seminole in Florida are divided into three separate nations, the Seminole Nation of Oklahoma, the Seminole Tribe of Florida and the Miccosukee Tribe of Indians of Florida. The two remaining Floridian tribes were federally recognized in 1957 (Seminole Tribe of Florida) and 1962 (Miccosukee Tribe of Indians of Florida) (Weisman 1999).

Historic Resources

The Tamiami Trail is important as one of the state's major engineering projects during the early 20th century. It has an overall length of 245 miles with approximately 24 miles within Miami- Dade County. Although the roadway has experienced changes over the years, such as the paving of the original limerock road with asphalt, slight widening of the road and the addition of low metal barriers on both sides of the road, the Tamiami Trail continues to retain its historic character. Additionally, the road's historic feeling, association, design, and setting are still evident. Its engineering and construction were performed under conditions that at the time were unprecedented in highway construction. It provided the first route across the southern peninsula and offered an opportunity for the general public to observe the Everglades from automobiles. Based on its associations with the developmental, commercial, and transportation history of Florida and the Miami- Dade County, the Miami-Dade County segment, including the portion adjacent to the park, is considered to be a significant historic resource.

The Tamiami Trail represented one of the first modern construction activities in the Everglades when it was built in 1928. Over the course of the Tamiami Trail's existence, a built environment has taken shape. Several small- scale, tourism- based, commercial enterprises can be found along the highway within the project area. Architectural historians

recently assessed properties along the Tamiami Trail for NRHP eligibility. Five historic properties within the project corridor were evaluated for potential eligibility for the NRHP. Private properties include: Coopertown Airboat Rides and Restaurant, Gator Park, and the Airboat Association of Florida. Gator Park was evaluated as ineligible for NRHP listing. Culverts in the remaining two private property locations that are NRHP- eligible have been avoided for the implementation of pilot spreader swales. As such, those two historic properties are not considered in the analysis of alternatives. The Tamiami Trail and the Tamiami Canal were recommended as eligible for NRHP listing. The Florida State Historic Preservation Office (SHPO) concurs with these recommendations for listing; therefore, these two historic properties are considered in the analysis of alternatives. Osceola Camp, occupied by members of the Miccosukee Tribe of Indians has been identified as a Traditional Cultural Property by the Tribe, but has not been formally documented or evaluated for NRHP significance.

Cultural Landscapes

A cultural landscape, as defined in the NPS' *Cultural Resource Management Guidelines*, is "a geographic area, including both cultural and natural resources and the wildlife or domestic animals therein, associated with a historic event, activity, or person or exhibiting other cultural or aesthetic values." The Everglades National Park has not conducted a cultural landscape inventory. In this case, the vernacular cultural landscape found within the geographic area of this project relates to three elements - the historic event of the construction of the Tamiami Road, the views of the Everglades that subsequently were provided to motorists, and the associated activities that sprung up along the route - namely airboat and restaurant operations geared to tourists. This particular cultural landscape reveals much about both the evolving relationships between two cultures, and also between those two cultures and the natural world. The road and canal serve as a prominent reminder of modern intervention in the Everglades' previously unspoiled environment. As has been discussed, the road and canal significantly altered the area's natural resources – namely its hydrology. Nonetheless, the Miccosukee Tribe has come to rely on the Tamiami Trail as a home and as a source of income.

Ethnographic Resources

Two American Indian tribes presently reside in south Florida. The Seminole and Miccosukee are descendants of Creek Indians who immigrated to the area during the 1600s to 1800s. While some Seminoles accepted relocation by the U.S. Government in the 1830s and now comprise the Seminole Nation of Oklahoma, others stayed and now form the Seminole Tribe of Florida. The Miccosukee also resisted relocation to the reservations of Oklahoma. They retreated, along with the Seminole Tribe, into the far reaches of what is today Everglades National Park and Big Cypress National Preserve (NPS 2001).

The Seminole Tribe incorporated in 1957, and the Miccosukee incorporated in 1962. Many members of the Seminole Tribe now occupy the Big Cypress Seminole Reservation. There are members of both groups that remain unaffiliated and politically independent.

The Miccosukee Tribe of Indians of Florida live along the Tamiami Trail, and constructed and now operate a casino northeast of Everglades National Park, along with several small tourism- based operations along the Trail corridor. Osceola Camp, a homestead of tribal members, has been identified as a Traditional Cultural Property.

The project area is also within areas used by "Gladesmen" or "Froggers" that use airboats to access camps in the tree islands. Fishing along the Tamiami Canal has also been identified as an ethnographic use of the project area.

Previous Investigations

Cultural resource reports have been conducted recently within the project area. Janus Research completed a report in 2001(Janus Research 2001), and New South Associates completed a report in 2005 (USACE 2005a). These previous investigations showed no evidence of archaeological resources within approximately 30.5m (100 feet) of the Tamiami Trail. Shovel testing was conducted in areas most likely to yield artifacts, but none were discovered. The reports did result in the documentation of historic properties eligible for NRHP inclusion. As of the completion of the New South Associates report, four properties have been recommended as eligible for NRHP listing. The Florida SHPO concurred with three of the recommendations. The Tamiami Trail, Tamiami Canal, and Coopertown Airboat Rides and Restaurant have been recommended as eligible, and the SHPO concurred. The Airboat Association of Florida was deemed ineligible for listing by the Janus Research report; however, the New South Associates report disagreed. Until the Florida SHPO makes a decision on concurrence, the Airboat Association of Florida will be assumed NRHP-eligible. Osceola Camp is currently unevaluated for NRHP significance, but is also avoided in this project. Regardless, selection of pilot spreader swale locations leaves only the Tamiami Trail and Canal as known resources subject to any potential impacts.

Environmental Consequences

Impacts of Alternative A, the No Action Alternative

Archaeological Resources, Historic Properties, Cultural Landscapes and Ethnographic Resources.

Analysis

Under Alternative A, current conditions would continue and there would be no effect on cultural resources within the project area.

Cumulative Effects

Because there is no disturbance in previously undisturbed areas associated with ongoing management nor modification of existing historic properties, implementation of the no action alternative would not contribute either beneficially or adversely to cumulative impacts on cultural resources in the project area.

Conclusion

For Alternative A, there would be no impacts to the project area because no pilot spreader swales would be constructed. No contribution, either beneficial or adverse, would be made to the cumulative impacts of other projects and plans.

Under Alternative A, there would be no impairment of or unacceptable impacts to cultural resources or values in Everglades National Park.

Impacts of Alternative B

Archaeological Resources, Historic Properties, Cultural Landscapes, and Ethnographic Resources.

Analysis

Implementation of Alternative B would have no impact to archaeological resources or historic properties. An archaeological survey was conducted between the S- 333 and S- 334 structures as part of the LRR project. The survey's area of potential effect extended approximately 100 feet south of the existing Tamiami Trail. Based on this survey, any areas of potential disturbance associated with construction of spreader swales would fall within the previous survey areas and would be expected to have no adverse effect to known cultural resources.

There are two known historic resources within the project area deemed eligible for NRHP listing – the Tamiami Trail and the Tamiami Canal. The pilot spreader swales construction activities would take place south of both the roadway and the canal, and would not extend past the previously surveyed area. As such, no impact to these NRHP- eligible resources is anticipated.

Implementation of Alternative B would have a minor adverse impact on cultural landscapes. As previously stated, the cultural landscape found at the project area is tied to the Tamiami Trail - the historic event of the construction of the roadway and canal, the views of the Everglades that were subsequently provided to motorists, and the associated activities that sprung up along the route – namely airboat and restaurant operations geared to tourists. The roadway and canal would not be altered during implementation of Alternative B. Neither would the commercial, tourism- based businesses be affected by Alternative B. However, it is possible that views of the Everglades from the roadway would be altered.

Alternative B would have no adverse effect on ethnographic resources. The pilot spreader swales would not alter how the Miccosukee view the Tamiami Trail and Canal as an intrusion into ancestral lands and a disruption of ecological balance. Alternative B also would not adversely affect the Miccosukee's ability to conduct commercial activities in conjunction with the Tamiami Trail. Alternative B could be seen as a beneficial effect by fishermen, as the swales could provide additional fishing opportunities. This is discussed further in the Visitor Use section of this document. If water flow is increased inside the park by the pilot spreader swales, this could also be a beneficial effect to airboaters. Therefore, Alternative B could provide a minimal beneficial effect to ethnographic resources

Cumulative Effects

Because archaeological resources are unlikely to be found in areas associated with implementation of spreader swales; there would be no modification of existing historic properties; ethnographic resources would not be significantly altered; and, any impact to cultural landscapes would be minor at most, implementation of Alternative B would not contribute either beneficially or adversely to cumulative impacts on cultural resources in the project area.

Conclusion

Any effects associated with the implementation of pilot spreader swales would occur in areas unlikely to contain archaeological resources. Two NRHP resources present, the Tamiami

Trail and Canal, are immediately adjacent to the project area but would not be altered. Minimal beneficial impact is expected to ethnographic resources. Cultural landscapes may be slightly altered; any adverse impact, expected to be minimal. After applying the implementing regulations of the Advisory Council on Historic Preservation (36 CFR 800, revised regulations effective August 5, 2004), addressing the criteria of effect and adverse effect, the NPS finds that implementation of any of the alternatives would result in a finding of no adverse effect to historic properties.

Alternative B would not produce major adverse impacts on cultural resources. There would be no impairment of or unacceptable impacts to cultural resources or values as a result of implementation of Alternative B.

Impacts of Alternative C

Archaeological Resources, Historic Properties, Cultural Landscapes, Ethnographic Resources.

Analysis

For this non- structural alternative, existing or new hydrologic models would be used to simulate potential hydrologic effects of the pilot spreader swales. Because this alternative would involve no physical action, the impacts would be identical to Alternative A, the No Action Alternative.

Cumulative Effects

Since Alternative C includes no constructed project or operational changes, effects would be those from other projects and plans. Cumulative effects would be the same as described in Alternative A.

Conclusion

For Alternative C, there would be no impacts to the project area. There would also be no contribution to cumulative effects.

Under Alternative C, there would be no impairment of or unacceptable impacts to Everglades National Park's cultural resources or values.

Impacts of Alternative D, the Preferred Alternative

Archaeological Resources, Historic Properties, Cultural Landscapes, Ethnographic Resources

Analysis

For this alternative, hydrologic modeling (as described for Alternative C) would be used. Should the modeling results prove favorable but still demand additional empirical results to support a decision, a structural component (as described for Alternative B) to build the pilot spreader swales within Everglades National Park would follow. Should the modeling results be unfavorable, no action would be taken. Therefore, Alternative D could result in one of two possible impacts to cultural resources - impacts as described for Alternative A in the event of unfavorable modeling results or impacts as described for Alternative B in the event of favorable modeling results.

Cumulative Effects

Cumulative effects would be as described for Alternative B if pilot spreader swales are constructed, as described for Alternative A if only hydrologic modeling is used.

Conclusion

Alternative D could result in one of two possible effects to cultural resources - effects as described for Alternative A in the event of unfavorable modeling results or effects as described for Alternative B in the event of favorable modeling results.

In either case, under Alternative D there would be no impairment of or unacceptable impacts to Everglades National Park's cultural resources or values.

SECTION 106 SUMMARY

The area of potential effect (APE) includes the Tamiami Trail and the area extending approximately 100 feet south of the roadway, which was previously surveyed for cultural resources in association with the Modified Waters project. This EA has described existing cultural resource conditions in the project area (including NHRP properties), and evaluated the potential environmental effects of four alternatives: Alternative A, the no action alternative; Alternative B, the structural alternative; Alternative C, the hydrologic modeling alternative; and Alternative D, the hydrologic modeling and potential structural component alternative. Alternative B involves implementation of pilot spreader swales, and Alternative D involves the potential of spreader swale implementation. Definitions of intensity levels for cultural resources were developed (Table 5) to provide a basis for evaluating effects of proposed actions on cultural resources.

Archeological resources

Given that potential pilot spreader swales would be oriented parallel to the Tamiami Trail, the APE has either been previously disturbed and/or is in an area not likely to include undisturbed archeological deposits. New South Associates completed a cultural resource study extending approximately 100 feet south of the Tamiami Trail in 2005 and did not find evidence of archaeological resources (USACE 2005a). Thus, there is little to no potential for *in situ* archeological resources.

Historic structures, buildings, and objects

According to New South Associates' Cultural Resource Survey, there are four NRHP-eligible historic properties within the project area - the Tamiami Trail, Tamiami Canal, Airboat Association of Florida, and Coopertown Airboat Rides and Restaurant. Osceola Camp is also potentially NRHP eligible, but has not been evaluated. Culverts near these properties were eliminated from consideration for pilot spreader swale implementation. None of the remaining six options are located at or near Airboat Association of Florida, Coopertown Airboat Rides and Restaurant, or Osceola Camp. Therefore, implementation would not result in an effect to these three historic properties. All six remaining culvert options, however, are found along the Tamiami Trail and Canal. Nonetheless, an assessment of potential impacts to these cultural resources suggest that implementation of any of the four alternatives will not result in an adverse effect to historic properties.

Cultural Landscapes.

A cultural landscape exists along the Tamiami Trail. Implementation of the pilot spreader swales project could have a minor impact on cultural landscapes as viewsheds may potentially be altered; but, any effect is not anticipated to be adverse.

Ethnographic Resources

Ethnographic resources associated with the Tamiami Trail would not be adversely affected by implementation of a pilot spreader swale project.

The Advisory Council on Historic Preservation, the Florida SHPO, and concerned groups were contacted at the beginning of this EA process (see Consultation and Coordination and letters in Appendix A). This EA, which will be used as a vehicle to accomplish Section 106 compliance for this proposed project, will also be sent to these entities for their review and comment.

After applying the implementing regulations of the Advisory Council on Historic Preservation (36 CFR 800, revised regulations effective August 5, 2004), addressing the criteria of effect and adverse effect, the NPS finds that implementation of any of the alternatives would result in a finding of *no adverse effect* to historic properties.

In the unlikely event that cultural resources are discovered during project implementation, work would be halted in the vicinity of the resource, and procedures outlined in 36 CFR 800 would be followed.

TRANSPORTATION

Affected Environment

The original Tamiami Trail, which linked Tampa with Miami, was completed in 1928, primarily by digging the canal by steam shovel and placing the spoil ahead to create the roadbed. In the mid- 1940s, about 38 bridges were added at various locations on the Tamiami Trail, 19 of which are within the project area. In the early 1950s, the bridges were removed and replaced with the culverts currently in place. In 1968, the shoulders were widened and the pavement was overlaid. In 1970, a guardrail was added on the north side. Between the 1980s and 1990s, another guardrail was added on the south side of the road. Finally, in 1993, the shoulders were widened, and the mainline pavement was resurfaced (USACE 2008).

Tamiami Trail traffic counts recorded approximately 5,900 vehicles per day in 2007(FDOT 2007), and are projected to reach 9,200 vehicles per day in 2020 according to the FDOT (Bingham et al. 2002). This average is quite low (USACE 2008), and represents a range of three to seven cars per minute, on average for the year 2000.

The road is currently in need of maintenance. The asphalt surface of the road has surface environmental stress cracks and subsurface fatigue cracks. On the Pavement Condition Rating, by which road surfaces are rated on a scale of 1 to 10, the Tamiami Trail would receive an FDOT rating of 6. Whenever a road is rated at 6 or below, repair actions are typically required. Because of pavement deterioration in terms of cracking, rutting, and ride, FDOT determined that the portion of the Tamiami Trail within the project area is in need of rehabilitation.

The FDOT requires culverts to be designed for a projected maintenance- free time or a Design Service Life (DSL) appropriate for the culvert function and highway type. Recently, the Florida Department of Transportation Culvert Service Life Estimator Program was used with soil parameters to determine DSLs for four locations. Results indicate that the existing reinforced concrete pipe culverts under U.S. 41, which have been in operation for approximately 50 years, should continue to provide service for an additional 50 years (USACE 2008).

Environmental Consequences

Impacts of Alternative A, the No Action Alternative

Analysis

Under Alternative A, current conditions would continue and there would be no effect on the transportation conditions within the project area.

Cumulative Effects

The USACE is planning to install a 1- mile bridge on the Tamiami Trail. This project would affect transportation and travel along the Tamiami Trail during construction. Traffic would be delayed when sections of the road would be reduced to one lane of travel and traffic control measures would be implemented, resulting in localized, short- term, minor to moderate, adverse effects. Since Alternative A includes no constructed project or operational changes, it would make no contribution to the cumulative effects of other projects and plans.

Conclusion

For Alternative A, there would be no impacts to the project area because no pilot spreader swales would be constructed. No contribution, either beneficial or adverse, would be made to the cumulative impacts of other projects and plans, specifically any delays associated with the upcoming 1- mile bridge installation just west of the project area.

Under Alternative A, there would be no impairment of or unacceptable impacts to transportation resource and values in Everglades National Park.

Impacts of Alternative B

Analysis

Under Alternative B, the pilot spreader swales would be constructed adjacent to Tamiami Trail. Construction equipment would be present on and adjacent to the highway during installation. Excavation equipment and dump trucks would operate during daylight hours, with traffic control measures implemented. Lane restrictions could be in place for up to eight months. Travel speeds outside the immediate project area could also be reduced by construction traffic. This would result in delays and occasional stopped traffic. Thus, installation of the pilot spreader swales would result in localized, minor, short- term, adverse effects on transportation along this segment of the Tamiami Trail.

Cumulative Effects

The timeframe for installation of the pilot spreader swales would be prior to construction of the 1- mile bridge. Thus, there is little potential for the two projects to combine and produce cumulative effects on transportation.

Conclusion

There would be short- term, minor, adverse effects on transportation in and adjacent to the project area during construction from the presence of construction equipment and traffic control measures. Because this project would be complete before installation of the 1- mile bridge, there would be no cumulative effects on transportation.

Under Alternative B, there would be no impairment of or unacceptable impacts to transportation resources and values in Everglades National Park.

Impacts of Alternative C

Analysis

For this non- structural alternative, existing or new hydrologic models would be used to simulate potential hydrologic effects of the pilot spreader swales. Because this alternative would involve no physical action, the impacts would be identical to Alternative A, the No Action Alternative.

Cumulative Effects

Because Alternative C includes no constructed project or operational changes, effects would be those from other projects and plans in the area. Cumulative effects would be the same as described in Alternative A.

Conclusion

For Alternative C, there would be no impacts to the project area. There would also be no contribution to other cumulative effects.

Under Alternative C, there would be no impairment of or unacceptable impacts to Everglades National Park's transportation resources or values.

Impacts of Alternative D, the Preferred Alternative

Analysis

For this alternative, hydrologic modeling (as described for Alternative C) would be used. Should the modeling results prove favorable but still demand additional empirical results to support a decision, a structural component (as described for Alternative B) to build the pilot spreader swales within Everglades National Park would follow. Should the modeling results be unfavorable, no action would be taken. Therefore, Alternative D could result in one of two possible impacts to transportation - impacts as described for Alternative A in the event of unfavorable modeling results or impacts as described for Alternative B in the event of favorable modeling results.

Cumulative Effects

Cumulative effects would be as described for Alternative B if pilot spreader swales are constructed, as described for Alternative A if only hydrologic modeling is used.

Conclusion

Alternative D could result in one of two possible effects to transportation – effects as described for Alternative A in the event of unfavorable modeling results or effects as described for Alternative B in the event of favorable modeling results.

In either case, under Alternative D there would be no impairment of or unacceptable impacts to Everglades National Park's transportation resources or values.

VISITOR USE AND EXPERIENCE

Affected Environment

Visitation to Everglades National Park has remained relatively constant at near 1 million visitors per year since 1988. Recreational opportunities include biking, boating, fishing, hiking, camping, and wildlife viewing. Visitation to the Everglades is highly seasonal. The busy season runs from December to April, and the park receives half of its annual visitation during these five months. This coincides with the dry season when falling water levels result in abundant wildlife viewing opportunities, migrating and wintering birds congregate in the park, humidity levels and temperatures drop, and there are fewer mosquitoes. Visitation is lowest during the summer, with the least visits in June, July, August, and September. This coincides with the wet season characterized by dispersed wildlife, humidity, high temperatures, and abundant mosquitoes.

Visitor Use in the Project Area

Fishing is common in the L- 29 Canal (outside the park), and occurs along both the north and south banks. On the south side of the canal, fishermen frequent the 10.7 miles via the north shoulder of the highway. On the south side of the highway, the only places for bank fishing are at culvert discharge locations. Florida Fish and Wildlife Commission personnel conducted angler counts along the Tamiami Trail from December 1998 to May 1999. The mean number of anglers per mile for weekdays and weekend days, respectively, was 0.95 and 2.28. Ninety- four percent were bank anglers (personal communication, Florida Fish and Wildlife Conservation Commission, September 28, 2000). These numbers translate into an estimated 10 fishermen per weekday and 23 per weekend day, totaling approximately 5,000 man- days of fishing per year within the 10.7- mile project area. Almost all the bank fishermen were fishing on either side of the highway right- of- way, with only a few on the north bank of the L- 29 Canal.

It should be noted that at least some of the fishing is subsistence, not recreational. There is reportedly recreational fishing for oscars (*Astronotus ocellatus*), an exotic aquarium fish native to South America that has become established in South Florida and which reportedly "puts up a good fight." Recreational anglers have been observed fishing for bass by boat in the canal during the short period of time when dry conditions drive the bass out of the marshes (USACE 2008).

The Everglades National Park Expansion Area has few facilities and currently receives limited visitor use, with the exception of commercial airboat operators and the members of the Airboat Association of Florida. Four commercial airboat operators are currently operating south of the Tamiami Trail. Three operators, Coopertown Airboat Rides and

Restaurant, Everglades Safari Park, and Gator Park, operate from facilities located on the south side of Tamiami Trail. These operators receive between 200,000 and 300,000 visitors each year. The other operator, Airboat USA, launches from a public airboat ramp immediately east of Coopertown Airboat Rides. The commercial airboat operators offer guided tours into the East Everglades that provide the "river of grass" experience for visitors.

There are four air boat ramps that launch on the south side of Tamiami Trail. Three public ramps include a ramp immediately east of Coopertown Airboat Rides (culvert 53), an undeveloped area east of the L- 67 Extension, a launch site on SW 237th Avenue about one mile north of the Chekika entrance, and a private access ramp offered at the Airboat Association of Florida (culvert 47) property west of Gator Park (culvert 49). The Expansion Act allows those noncommercial airboat operators who were using the expansion area as of January 1, 1989 to continue to operate airboats inside the Everglades Expansion Area.

Although commercial and privately owned airboat use occurs in the project area corridor, the culverts associated with or adjacent to commercial airboat operations were eliminated from consideration as sites for the pilot spreader swales. These operations would not be affected by installation of pilot spreader swales.

Visitor Use Adjacent to the Project Area

Chekika is a small, developed area in a former state park in the East Everglades, 6 miles west of Krome Avenue. Historically, local residents used the site for picnicking, swimming, and camping. It is now a seasonal day use area within the park, and future development and use will be defined by the current General Management Plan effort.

Approximately 6 miles west of the project area is the Shark Valley area - one of the major destinations in the park. It offers a 15- mile round- trip tram road (not open to private motorized vehicles) that extends into the marsh, offering one of the best opportunities for viewing the Everglades environment and the resources of the Shark River Slough. A two-hour narrated tram ride provides an overview of the freshwater Everglades and bicycles are available to rent. Shark Valley is a favorite destination for local and out- of- town bicyclists. An observation tower is located at the end of the tour road. The Shark Valley area offers excellent opportunities for wildlife viewing.

Impacts of Alternative A, the No Action Alternative

Analysis

Under Alternative A, current conditions would continue and there would be no effect on the visitor use and experience conditions within the project area.

Cumulative Effects

Because Alternative A includes no constructed project or operational changes, it would make no contribution to the cumulative effects of other projects and plans, described below.

In the vicinity of the project area, a construction of the 1- mile bridge at the west end of the project area would interfere with fishing access and traffic in and adjacent to the construction area, producing localized, short- term, minor adverse effects. On a larger, park- wide scale, the exotic vegetation management plan, general management plan, and comprehensive Everglades restoration efforts would combine to improve the long- term,

overall visitor experience at Everglades National Park. The cumulative effect of these other projects and plans would be beneficial, long- term, and minor to moderate.

Conclusion

For Alternative A, there would be no impacts to the project area because no pilot spreader swales would be constructed. No contribution, either beneficial or adverse, would be made to the cumulative impacts of other projects and plans.

Under Alternative A, there would be no impairment of or unacceptable impacts to visitor use and experience resources and values in Everglades National Park.

Impacts of Alternative B

Analysis

Over the long- term, the presence of the pilot spreader swales would provide additional open water in the project area. This could enhance opportunities to fish for both native and exotic fish species in the project area. In addition, the spreader swales may draw alligators into view of the highway. These changes, although unnatural in the Everglades system, could enhance visitor experience of park resources, producing localized, long- term, and negligible to minor benefits to the visitor experience.

Over the short- term, construction of the pilot spreader swale project would affect fishing and visitor access in the project area. Construction activities and the presence of large equipment would likely displace fishermen to other locations along the Tamiami Trail. This would result in short- term, localized, minor to moderate, adverse effects on this group of park visitors.

The percentage of Tamiami Trail travelers who are park visitors is not known. However, those who transit this highway do enjoy the resources of the park while passing. These "visitors" may be affected by changes in traffic patterns during installation and by intrusions of construction equipment on the landscape. However, this highway corridor is highly engineered, and the L- 29 Canal, levee, and flow control structures are ever- present in the proposed project area. Given the developed nature of the Tamiami Trail corridor, effects during installation of the pilot spreader swales would be short- term, negligible to minor, and adverse.

Visitors to Chekika and Shark Valley wound not be affected by implementation of Alternative B to any greater degree than visitors using the Tamiami Trail. These areas are outside the potential area of potential effect, and use or access would not change.

In the event the pilot spreader swales were found to be ineffective in meeting the hydrology goals of the project, rehabilitation of the sites would take place. This would require a construction process including addition of fill, grading, and revegetation with native plant species. As described for swale construction, heavy equipment would be present, traffic control measures would be implemented, and travel along Tamiami Trail could be disrupted over the short- term. This would produce localized, negligible to minor adverse effects. Over the long- term, rehabilitation of the spreader swale site would reduce fishing and wildlife viewing opportunities in the project area - a localized, negligible to minor, adverse effect.

Cumulative Effects

Short- term effects of other projects and plans would be as described for Alternative A - localized, minor, and adverse from traffic interruptions during construction of the 1- mile bridge span and road improvements. Implementation of Alternative B could contribute to these effects if construction were to coincide. This would produce localized, minor to moderate adverse effects.

Long- term effects from implementation of park resource management plans would be beneficial, parkwide, and minor to moderate. The long- term, negligible to minor effects of Alternative B would not measurably detract from these benefits.

Conclusion

Long- term effects resulting from the presence of the spreader swales would be beneficial, localized, and negligible to minor. Short- term effects during constriction or site rehabilitation would be adverse, localized, and negligible to minor.

If construction were to coincide with road improvements and bridge installation, cumulative short- term effects would be localized, adverse, and minor to moderate. Over the long- term cumulative effects would not be distinguishable from the parkwide, moderate benefits of other projects and plans.

Under Alternative B, there would be no impairment of or unacceptable impacts to Everglades National Park's visitor use and experience resources and values.

Impacts of Alternative C

Analysis

For this non- structural alternative, existing or new hydrologic models would be used to simulate potential hydrologic effects of the pilot spreader swales. Because this alternative would involve no physical action, the impacts would be identical to Alternative A, the No Action Alternative.

Cumulative Effects

Since Alternative C includes no constructed project or operational changes, effects would be those from other projects and plans in the area. Cumulative effects would be the same as described in Alternative A.

Conclusion

For Alternative C, there would be no impacts to the project area. There would also be no contribution to other cumulative effects.

Under Alternative C, there would be no impairment of or unacceptable impacts to Everglades National Park's visitor use and experience resources and values.

Impacts of Alternative D, the Preferred Alternative

Analysis

For this alternative, hydrologic modeling (as described for Alternative C) would be used. Should the modeling results prove favorable but still demand additional empirical results to support a decision, a structural component (as described for Alternative B) to build the pilot

spreader swales within Everglades National Park would follow. Should the modeling results be unfavorable, no action would be taken. Therefore, Alternative D could result in one of two possible impacts to visitor use and experience – impacts as described for Alternative A in the event of unfavorable modeling results or impacts as described for Alternative B in the event of favorable modeling results.

Cumulative Effects

Cumulative effects would be as described for Alternative B if pilot spreader swales are constructed, as described for Alternative A if only hydrologic modeling is used.

Conclusion

Alternative D could result in one of two possible effects to visitor use and experience - effects as described for Alternative A in the event of unfavorable modeling results or effects as described for Alternative B in the event of favorable modeling results.

In either case, under Alternative D there would be no impairment of Everglades National Park's visitor use and experience resources and values.

CHAPTER 4: CONSULTATION AND COORDINATION

SCOPING PROCESS AND PUBLIC INVOLVEMENT

The National Park Service divides the scoping process into two parts: internal scoping and external (public) scoping. Internal scoping for this Pilot Spreader Swale Project EA involved discussions among the NPS, other federal and state agencies, and the Miccosukee Tribe of Indians of Florida regarding the purpose and need for the project, issues, objectives, management alternatives, mitigation measures, appropriate level of documentation, lead and cooperating agency roles, and other related dialogue.

Public scoping is the early involvement of the interested and affected public in the environmental analysis process. The public scoping process helps ensure that people have been given an opportunity to comment and contribute early in the decision-making process.

The public scoping process began in May 2008, with the publication of a notice of intent to prepare and environmental assessment in the *Federal Register* (Federal Register, Volume 73, Number 97).

A newsletter was also distributed by electronic and conventional mail in May 2008 to the project mailing list of government agencies, organizations, businesses, and individuals. The newsletter summarized the purpose of and need for a spreader swale pilot project, potential issues and environmental topics, preliminary alternatives and opportunities for public involvement in the NEPA process. The newsletter also gave the date/time/location for the public scoping open house and requested the public to convey concerns and issues related to the implementation of pilot spreader swales along the Tamiami Trail. Respondents were encouraged to comment electronically on the NPS Planning, Environment and Public Comment website, by letter or in person at the open house.

News releases and paid ads announcing the scoping open house were published in the Miami Herald and El Nuevo Herald on May 22, 2008.

On May 28, 2008, a public scoping open house was held at Florida International University's Graham University Center, in Miami, Florida. The first hour of the meeting was an open house in which NPS staff were available to discuss the project, answer questions and record comments. This was followed by a brief presentation of the Pilot Spreader Swale Project Environmental Assessment. Topics in the presentation included resource sensitivity, physical and financial limitations, and necessity of facilitating water flow. Comments on the presentation content were received at the park, by electronic and conventional mail, at the NPS planning website, or in person. A certified court reporter transcribed the entire public hearing in which all comments were written into a typed document.

Comments were received from 16 individuals, nine organizations, and one Native American Tribe in person and by conventional and electronic mail. These comments

helped the interdisciplinary planning team refine the issues and management alternatives to be addressed in this EA.

The NPS received a total of 18 responses for the Pilot Spreader Swales Project. Many of the documents submitted by the public contained more than one comment or suggestion regarding the Pilot Spreader Swale Project. The 18 responses contained a total of 50 comments on the management options, schedule and other concerns about the project.

All but two comments received at the park and on the website included submittals that did not respond directly to the proposed actions. These two comments were outside the scope of the proposed project area because they addressed broader concerns of modified water flow in the park. Five responses were received in opposition to installation of the spreader swales. Reasons for opposition of the pilot spreader swale project include: the use of swales as an unproven habitat restoration technique, the spreader swales would be an unnatural feature in the Everglades, the spreader swales would be an inappropriate use of time and money, and the NPS is not adhering to their restoration schedule. The 11 responses that supported construction of pilot spreader swales included several reasons for encouraging the project, primarily centered on a desire for pursuit of any alternative that has the potential to increase hydrologic flow and subsequently aid in the restoration of ecologic balance in the Everglades.

COMMENTS ON THE PILOT SPREADER SWALES ENVIRONMENTAL ASSESSMENT

The public presentation presented existing conditions and the decisions in which the pilot spreader swale project was selected among other alternative as a means of increasing water flow under Tamiami Trail. The presentation included options that would be included in the alternatives, and a range of options to be considered for inclusion in the final decision- making process.

Many public responses sought clarification regarding the selection of a Preferred Alternative; however, other responses ranged from voicing an opinion, to expressing concerns among the several levels of the decision- making process leading to the pilot spreader swales project.

The majority of comments focused on the scientific merit of the pilot spreader swale project, which included comments on exotic species and long- term impacts of spreader swales on the Everglades. Many responders suggested maintenance (removal of sediment and vegetation) south of the culverts and S- 12 structures to increase water conveyance.

About 60 percent of the written comments were generally supportive of the pilot spreader swale project as a means of increasing water flow in the Everglades. Five of the 15 written responders did not approve of the project for reasons including a “lack” of scientific merit and financial cost of constructing the spreader swales. Both written and oral comments are tabulated below to display the range of comments received for the pilot spreader swale project EA.

Existing conditions and options common to all alternatives did not receive a great deal of attention. Responses to the specific concerns, management, and options are outlined as follows:

- *Efficacy of spreader swales*. Four responses commented on the scientific merit used to determine if the swales would be a good technique to convey and distribute water into the Everglades, while an equal amount of comments supported the swales as a method of establishing sheet flow into the Everglades.
- *Maintenance of the existing infrastructure*. Two responses suggested the cleanout of existing culverts and S- 12 structures as a means of increasing water conveyance in the park. Many of these responders also mentioned removal of native and non-native vegetation as an inexpensive and effective means of increasing water flow.
- *The need to execute other restoration projects under the Mod Waters Project*. One respondent questioned the authority of the NPS to conduct the pilot project, while another respondent questioned the source of the funds that would be used to conduct the project. One responder questioned why the NPS isn't going to Congress to get approval under Mod Waters project as done in prior projects of similar magnitude.
- *Disturbance*. Four comments were directed at the lack of knowledge regarding the long- term impact to the wetlands associated with construction of spreader swales, while another four commented on the exotic vegetation that may further encroach into the park from spreader swale construction.
- *Use of the Everglades as a Recreation Resource*. Two respondents were in favor of the spreader swales providing access and recreation opportunities directly into the Everglades National Park. One of these comments suggested placement of the swales should also benefit access to the Park, both for recreation and emergency uses.

CULTURAL RESOURCES CONSULTATION

Representatives from the Florida State Historic Preservation Office are aware of the project and have been involved in consultations throughout the process. As part of the Section 106 process, the NPS also sent letters to the Florida SHPO and the Advisory Council on Historic Preservation on May 9, 2008 (Appendix A). The letters invited them to participate in the planning process and informed them that the NPS plans to use this draft EA to fulfill the requirements of Section 106 of the NHPA as well as comply with provisions of NEPA.

NATIVE AMERICAN TRIBES CONSULTATION

A letter to initiate government- to- government consultations and provide information about the project was sent to the following tribes in May 2008: Miccosukee Tribe of Florida, Seminole Nation of Oklahoma, and Seminole Tribe of Florida. Representatives of the Miccosukee Tribe of Florida participated in an interagency scoping workshop on May 15, 2008

FLORIDA STATE AGENCIES CONSULTATION

The park provided the Florida State Clearinghouse with the scoping notice for processing through the appropriate state agencies. Representatives from several State of Florida agencies have been engaged in consultations concerning the project. These include the Florida Department of Environmental Protection (FDEP), the South Florida Regional Planning Council (SFRPC), Miami- Dade County, Florida Department of Agriculture and Consumer Sciences, Florida Fish and Wildlife Conservation Commission, Florida Department of State, Florida Department of Transportation, and the South Florida Water Management District.

Three of these state agencies actively commented on the proposed project. The FDEP offered a full endorsement of moving forward with implementation of the pilot spreader swales project. Furthermore, it advocated for an expedited NEPA process, to more quickly influence modification of the existing habitat south of the Tamiami Trail.

The Florida Fish and Wildlife Conservation Commission expressed concerns regarding the protection of special- status species such as the wood stork and Everglades mink, and it seeks designs that are sensitive to any impacts on threatened or endangered species.

The FDOT commented that the proposed project may have an impact on FDOT right-of- way, and therefore, asks for continued coordination throughout the NEPA process.

The remaining agencies did not submit comments.

ENDANGERED OR THREATENED SPECIES CONSULTATION

U.S. Fish and Wildlife Service personnel participated in a field inspection for the pilot swales project in December, 2007 and in an interagency internal scoping workshop on May 15, 2008. Issues and concerns raised during the meetings by USFWS staff were incorporated into the development of this EA.

In accordance with Section 7 of the Endangered Species Act (16 United States Code 1531 *et seq.*), the NPS contacted the USFWS by letter on May 14, 2008 to initiate informal consultation and request verification of the list of threatened and endangered species that may occur within the project area (see Appendix A). To date, not response has been received.

All consultation correspondence can be found in Appendix A.

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LIST OF RECIPIENTS

The following federal, state, local, and tribal government agencies have been sent a copy of this draft EA. In addition, elected officials, libraries, individuals, businesses, organizations, media outlets, and other groups that have expressed interest in Everglades National Park in the past have been sent letters stating that this draft EA is available for review and comment.

Federal Agencies

National Park Service

U.S. Army Corps of Engineers

U.S. Geological Survey

U.S. Fish and Wildlife Service

State Agencies

Florida Department of Transportation

Florida Department of Environmental Protection

South Florida Water Management District

Florida Fish and Wildlife Conservation Commission

Local Agencies

Miami- Dade County

Tribes

Miccosukee Tribe

Seminole Tribe

Seminole Nation of Oklahoma

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APPENDIX A: CONSULTATION LETTERS

Florida Department of
Environmental Protection

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Tallahassee, Florida 32399-3000

Charlie Crist
Governor

Jeff Kottkamp
Lt. Governor

Michael W. Sole
Secretary

July 2, 2008

Mr. Brien F. Culhane, AICP
National Park Service
Everglades & Dry Tortugas National Parks
40001 State Road 9336
Homestead, FL 33034

RE: National Park Service - Scoping Notice - Proposed Spreader Swales Pilot Test Project at Tamiami Trail Modifications Site, Everglades National Park - Miami-Dade County, Florida.
SAI # FL200805194235C

Dear Mr. Culhane:

The Florida State Clearinghouse, pursuant to Presidential Executive Order 12372, Gubernatorial Executive Order 95-359, the Coastal Zone Management Act, 16 U.S.C. §§ 1451-1464, as amended, and the National Environmental Policy Act, 42 U.S.C. §§ 4321, 4331-4335, 4341-4347, as amended, has coordinated a review of the scoping notice.

The Florida Department of Environmental Protection (DEP) fully supports moving forward with a pilot project to determine if spreader swales are beneficial in providing for increased supplemental flows to Everglades National Park. Due to the length of time necessary to complete the NEPA process, DEP recommends that the anticipated NEPA timeframe be re-evaluated and that the project be moved forward in an expedited manner. DEP suggests that the NEPA evaluation include a component for looking at environmentally friendly designs for the spreader swale project, rather than going through an extensive regional habitat unit evaluation as part of a cost-benefit evaluation. Staff also recommends developing a design refinement team to help achieve optimum designs and is interested in participating in that process. Since there are currently a number of different projects being planned that will involve modifying the existing wetland habitat immediately south of the Tamiami Trail, DEP would be supportive of any plans to consolidate the spreader swale pilot with these additional projects. Please refer to the enclosed DEP memorandum for additional comments and recommendations.

The Florida Fish and Wildlife Conservation Commission (FWC) has expressed concerns regarding the protection of imperiled species such as the wood stork and Everglades mink, delayed implementation of the various Mod Waters project components, and spreader swale location and design. Construction of the spreader swales may also create

some additional deep water refuge areas for aquatic species. FWC staff requests that the National Park Service address the agency's concerns and recommendations in the enclosed letter to ensure that any unintentional adverse impacts to natural resources, particularly to state-listed wildlife species, are either averted or minimized. In addition, FWC advocates the selection of culvert test sites and spreader swale designs that will provide greater interim ecological benefits to the Northeast Shark River Slough.

The Florida Department of Transportation (FDOT) notes that, since the project may have an impact on FDOT right-of-way, coordination with FDOT District Six will be required for any activities that could impact US 41/SR 90/Tamiami Trail and its right-of-way. Furthermore, continued coordination with FDOT District Six throughout the NEPA process as well as design and construction phases is requested.

Based on the information contained in the scoping notice and the enclosed state agency comments, the state has determined that, at this stage, the proposed activities are consistent with the Florida Coastal Management Program (FCMP). The concerns identified by our reviewing agencies must be addressed, however, prior to project implementation. The state's continued concurrence with the project will be based, in part, on the adequate resolution of issues identified during this and subsequent reviews. The state's final concurrence of the project's consistency with the FCMP will be determined during the environmental permitting stage.

Thank you for the opportunity to review the proposed project. Should you have any questions regarding this letter, please contact Mr. Chris Stahl at (850) 245-2169.

Yours sincerely,

Sally B. Mann

Sally B. Mann, Director
Office of Intergovernmental Programs

SBM/cjs
Enclosures

cc: John Outland, DEP, MS 45
Stacey Feken, DEP, MS 3560
Tim Gray, DEP, Southeast District
Mary Ann Poole, FWC
Lisa Stone, FDOT

Memorandum

TO: Florida State Clearinghouse

THROUGH: Stacey Feken, Acting Environmental Manager

FROM: John Outland, Inger Hansen, Erin Steurer

DATE: June 23, 2008

SUBJECT: National Park Service Scoping Notice Proposed Spreader Swales Pilot Test Project at Tamiami Trail Modification Site, Everglades National Park, Miami-Dade County, Florida

SAI #: FL08-4235C

Background:
The National Park Service plans to prepare an Environmental Assessment (EA) of a proposed swale system located within Everglades National Park (ENP) south of Tamiami Trail to determine if such a swale system would be effective in contributing to the overall restoration goals of the Modified Water Deliveries projects by augmenting flow volumes and improving flow distribution into Northeast Shark River Slough. The pilot system will consist of two spreader swales parallel to Tamiami Trail located downstream of two existing culverts. Each spreader swale will extend laterally from the culvert outlet 500 feet on each side of each culvert and 30 feet wide.

Comments:
The Florida Department of Environmental Protection (Department) fully supports moving forward with a pilot project to determine if spreader swales are beneficial in providing for increased supplemental flows to ENP. The Department believes that, if the spreader swales are designed and appropriately sited, the environmental benefits and the opportunity to learn from this project far outweigh any direct impacts associated with the project.

Based upon discussions held at the May 15, 2008, *Spreader Swales Pilot Project Environmental Assessment Scoping Meeting* workshop, the Department's understanding is that a lengthy evaluation process has been proposed for the pilot project. The Department is concerned that the proposed NEPA process would take a considerable amount of time, preventing a timely realization of benefits and critical information. The Department recommends that the Park Service re-evaluate the anticipated timeframe associated with the proposed NEPA process and continue to evaluate options for moving the project forward in an expedited manner.

There appears to be a focus on including a regional evaluation of project benefits, which, per our understanding, was not meant to reflect the overall objective of this small scale testing project. It is not clear why previous evaluations, undertaken as part of the Tamiami Trail portion of

Modified Waters, are not proposed to be incorporated by reference since many of the environmental impacts and benefits were considered in previous Environmental Impact Statements. It should be recognized that small scale testing is needed to resolve the uncertainties associated with the previous assessments and, based upon scale of the project, may be considered "reversible" if it is determined that the environmental impacts outweigh the benefits.

It is the Department's understanding that the NEPA planning process will undertake an evaluation of potential hydrological effectiveness to distribute water along a broader front into Northeast Shark River Slough and its biological effects on Park fish and wildlife resources. The Department is interested in participating in the selection and evaluation of the possible sites for the pilot swale system.

The Department suggests that the NEPA Evaluation include a component for looking at environmental friendly designs for the spreader swale project, rather than going through an extensive regional habitat unit evaluation as part of a cost-benefit evaluation. We recommend developing a design refinement team to help achieve optimum designs and are interested in participating in this process. The Department recommends that the alternatives evaluated under NEPA look at, but are not necessarily limited to, the following issues:

- Disposal of overburden from the excavation of the swales;
- Effectiveness of the swale system to uniformly distribute water flows from the north along its length;
- Biological responses to downstream flora and fauna;
- Water quality monitoring to compare with existing culvert system;
- Flow monitoring to account for flows that may bypass the swale system;
- Compare benefits to loss of existing wetland habitat;
- Compare cost/benefit analysis to placement of additional box culverts along the same stretch of Tamiami Trail; and
- An elevation survey of the proposed culvert areas should be conducted as even small changes in elevations may be critical to the performance of the swale system.

In association with this NEPA evaluation, it is critical to recognize that there are currently a number of different projects being planned that will involve modifying the existing wetland habitat immediately south of the Tamiami Trail. Upon attending an interagency meeting with the Park Service on April 29, 2008, it is the Department's understanding that there are plans to move forward with two additional separate projects, both of which are within the same project area of what is currently being considered for the pilot testing swale project. Should it be determined that there are opportunities to consolidate the spreader swale pilot within these additional projects, the Department would be supportive of that approach.

The Department believes that added benefits can be achieved by properly designing the Pilot Spreader Swale Project. The Spreader Swale Testing Project, if implemented during the shorter

timeframe discussed above, could potentially improve flows and deliveries to the Park during the period when construction of the Tamiami Trail may temporarily reduce flows (via the three sets of culverts which could be blocked during the construction). The Department also believes that the spreader swales may be beneficial in the future when the 1-mile bridge is in place, helping to better distribute and improve deliveries of flows into all of Northeast Shark River Slough, and not only into the eastern-most portion where the proposed bridge is located.

The Department sincerely appreciates the opportunity to comment. If you have any questions, please contact Ms. Inger Hansen at (561) 681-6709.

Electronic copies to:

John Outland
Stacey Feken
Ernie Marks
Inger Hansen
Tim Gray
Annet Forkink
Erin Steurer

Florida Fish and Wildlife Conservation Commission

Commissioners
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Chair
Miami
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Managing fish and wildlife resources for their long-term well-being and the benefit of people.

620 South Meridian Street
Tallahassee, Florida
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MyFWC.com

June 17, 2008

RECEIVED
JUN 20 2008
OIP / OLGA

Ms. Lauren Milligan
Florida State Clearinghouse
Department of Environmental Protection
3900 Commonwealth Boulevard, MS 47
Tallahassee, FL 32399-3000

Re: SAI #FL200894154170C, Everglades National Park (ENP), Scoping Notice, Proposed Spreader Swales Pilot Test Project at Tamiami Trail Modifications Site, Everglades National Park, Miami-Dade County

Dear Ms. Milligan:

The Habitat Conservation Scientific Services Section of the Florida Fish and Wildlife Conservation Commission (FWC) has coordinated agency review of the scoping notice for the referenced project, and has the following concerns that we would like to see addressed during the development of an Environmental Assessment.

Project Description

Initially the Army Corps of Engineers (COE) had recommended the construction of spreader swales as part of the Draft Limited Reevaluation Report on the Tamiami Trail modifications of the Modified Water Deliveries to Everglades National Park project (Mod Waters), but this component was omitted from the tentatively selected plan. The purpose of the proposed pilot project is to determine if installation of spreader swales would be effective in contributing to the overall restoration goals of the Mod Waters project by augmenting flow volumes and improving flow distribution into Northeast Shark River Slough (NESRS). Although we understand that there is some disagreement as to how large the increase in culvert conveyance capacity may be, we are encouraged by recent modeling analyses conducted by the COE that predict an increase in conveyance capacity of approximately 10 to 12 percent at an L-29 canal stage of 8.0 feet. The proposed action would construct two spreader swales parallel to the Tamiami Trail located downstream of two existing sets of culverts. Each spreader swale is proposed to extend laterally from the culvert outlet parallel to the Tamiami Trail 500 feet on each side of each culvert and 30 feet wide. All peat and vegetation within the footprint of the spreader swale would be removed down to bedrock. Flows would be monitored from the improved and existing adjacent culverts to assess swale performance. This will help determine if additional swales should be constructed at additional culverts in the future.

Concerns and Recommendations

Based on the newsletter distributed by ENP describing the proposed spreader swales pilot project and staff participation at the interagency scoping meeting, we have the following areas of concern that we asked ENP to address in the preparation of an Environmental Assessment.

Protection of imperiled species

A preliminary screening has already been conducted by the Department of the Interior (DOI) in which culverts 54, 55, 58, and 59 were removed from consideration due to their proximity to rookeries used by the federally endangered wood stork. Since rookery

vegetation at sites conducive to the formation of large wading bird colonies in the Everglades is a limited resource, we believe that such sites known to harbor colonial wading bird nests should be protected. However, only the areas downstream of culverts 55 and 59 contain woody vegetation that has supported wading bird nesting efforts, and we would only recommend excluding these culverts for the pilot test. The Tamiami West and Tamiami East wading bird rookeries located immediately south of culverts 55 and 59, respectively, are known nesting sites for 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) as well as the endangered wood stork (*Mycteria americana*) (Frederick 1995, Gawlik 1999). It is also possible that the construction of spreader swales at culverts (such as culvert 54) not at the rookeries, but within the secondary zone for wood storks, may actually help maintain flooded conditions around the colonies, thereby benefiting nesting efforts, and may lengthen hydroperiods near the colonies, thereby enhancing foraging habitat. If such a culvert is selected, construction activity should occur outside of the normal nesting season to avoid any potential disruptions to nesting efforts.

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 Everglades mink is known to utilize all types of shallow wetland habitats, but exhibits a decided preference for swamp forest habitat. Smith (1980) found Everglades mink to be most abundant around old agricultural canals, levees, and the Tamiami Trail roadway. A survey by an experienced biologist should be conducted in areas with suitable potential habitat prior to the initiation of construction activity to help determine whether any mink are present in the study area, and if any den areas may be present. Ideally, the survey should be done during the mink mating season which extends from September through November.

Concerns about further delays
We understand that ENP agreed to conduct a spreader swale pilot test in lieu of constructing swales at all possible locations under the Tamiami Trail LRR EA. There have been repeated delays in implementing various Mod Waters project components, which translates to a delay in ecological benefits to both ENP and Water Conservation Area 3A (WCA-3A) of the Everglades Wildlife Management Area. In the spirit of Incremental Adaptive Restoration, we recommend that the spreader swale pilot test be implemented quickly so as to begin achieving benefits and resolve the debated question of how effective well-designed spreader swales can be.

Spreader swale location and design considerations
In order to achieve greater interim ecological benefits, we asked that ENP consider the strategic placement of spreader swales at historic sloughs and/or aligned with the S-355 and other existing water conveyance structures in the L-29 Levee to augment hydraulic and ecological connectivity. The tentatively selected plan for the Tamiami Trail LRR now under consideration by the COE includes a one-mile bridge near the eastern end of the project area, but offers no improvements in the western portion of the project corridor where a two-mile bridge was previously recommended in the 2005 Revised General Reevaluation Report/Supplemental Environmental Impact Statement. Additional conveyance improvements would be particularly beneficial in the western portion of the

project corridor where the COE's environmental benefits analysis predicts enhanced ecological benefits from improved flows into downstream slough communities of ENP, while at the same time helping to further reduce high water impacts in WCA-3 (the Everglades and Francis S. Taylor Wildlife Management Area, located north of the roadway).

The 30-foot by 1,000-foot rectangular design and location of the spreader swales immediately south of the roadway should be examined to determine if such a configuration would best meet flow and distribution objectives, or whether a different configuration would provide better conveyance into ENP. We understand that ground elevation surveys have revealed the existence of a topographic high south of the culvert locations, so perhaps a swale orientation that penetrates through this ridge would provide greater benefits than the default design. We also note that a much longer swale feature (5,280 feet in length) will accompany the one-mile bridge to be built under the Limited Reevaluation Report/Environmental Assessment of the Tamiami Trail component of Mod Waters. We, furthermore, encourage ENP to take advantage of any natural flow paths that may exist downstream of the culvert openings.

Potential effects of deeper water refugia created by the spreader swales
The construction of spreader swales below the Tamiami Trail culverts may create some additional deeper water refugia for native fishes, alligators, turtles, and other aquatic wildlife. These swales would have depths similar to natural alligator holes, and may serve as refugia for aquatic and semi-aquatic species of wildlife during times of drought. The spreader swales may also help reduce road-related wildlife mortality as semi-aquatic species such as turtles, snakes, and alligators in the northern reaches of ENP would not need to cross the Tamiami Trail to reach a body of water. Based on recent extensive studies by Trexler (2000) and marsh sampling by Fury (1995) in the ridge and slough landscape, we would not expect these shallow swales to have any measurable effect on the occurrence of exotic fishes in marsh habitats in adjacent portions of ENP. Also, since excavation will not require penetration through the bedrock, there is no potential for thermal refugia to be created for exotic fishes.

Summary

We fully support the expedient implementation of this pilot project as an incremental step forward towards meeting the hydrological and ecological objectives of the Mod Waters project, and will continue to work closely with ENP and the COE through what we hope will be a brief planning process. We furthermore ask that ENP address our concerns and recommendations contained in this letter to ensure that any unintentional adverse impacts to the area's natural resources, particularly to state-listed wildlife species, are either averted or minimized. We also advocate the selection of culvert test sites and spreader swale designs that will provide greater interim ecological benefits to NESRS. The total magnitude of improvements in the volume and distribution of flows over thousands of acres in ENP resulting from the proposed spreader swales when implemented at all possible culvert locations should be a key consideration in the pilot project when evaluating local effects. Although we do not find this project to be inconsistent with Chapters 370 or 372, Florida Statutes, under the Florida Coastal Management Plan, we ask that ENP consider our concerns, suggestions, and recommendations contained in this letter in the formulation of alternatives and completion of an Environmental Assessment.

If you or your staff would like to coordinate further on the recommendations contained in this report, please contact me at (850) 410-5272 or email me at maryann.poole@MyFWC.com, and I will be glad to help make the necessary arrangements. If you or your staff has any specific questions regarding our comments, I encourage them to contact Tim Towles at (772) 778-6354; email tim.towles@myFWC.com.

Sincerely,

Mary Ann Poole

Mary Ann Poole, Director
Office of Policy and Stakeholder Coordination

map/dtt/cc
ENV 1-3-2
Spreader Swale ENP_1506_Scoping Notice
cc: Colonel Paul L. Grosskruger, COE, Jacksonville
Barbara Cintron, COE, Jacksonville
Greg Knecht, DEP, Tallahassee
Inger Hansen, DEP, West Palm Beach
Paul Linton, SFWMD, West Palm Beach
Paul Souza, FWS, Vero Beach
Kevin Palmer, FWS, Vero Beach
Brien Culhane, ENP, Homestead
Dan Kimball, ENP, Homestead
Chuck Collins, FWC, West Palm Beach
Dewey Worth, SFWMD, West Palm Beach

Literature Cited

Frederick, P.C. 1995. Wading Bird Nesting Success Studies in the Water Conservation Areas of the Everglades, 1992 – 1995. Final Report to South Florida Water Management District. West Palm Beach, Florida. 92 pp.

Fury, J.R., J.D. Wikert, J. Cimbaro, and F. Morello. 1995. Completion Report 1993-1995: Everglades Fisheries Investigations Project F-56. Florida Game and Fresh Water Fish Commission [now Florida Fish and Wildlife Conservation Commission], Tallahassee, Florida.

Gawlik, Dale E. 1999. South Florida Wading Bird Report. Volume 5, Issue 1, October 1999. South Florida Water Management District. West Palm Beach, Florida. 18 pp.

Smith, Andrew T. 1980. An Environmental Study of Everglades Mink (*Mustela vison*). Report T-555. South Florida Research Center, Everglades National Park, Homestead, Florida.

Trexler, J.C., W.F. Loftus, F. Jordan, J.J. Lorenz, J.H. Chick, and R.M. Kobza. 2000. Empirical assessment of fish introductions in southern Florida, U.S.A.: an Evaluation of contrasting views. *Biological Invasions* 2:265-277.

APPENDIX B: COST ESTIMATE

Estimated DRAFT Cost Estimate for the Tamiami Trail Pilot Spreader Swales EA						
Alternative:	**B**	**Configuration:**	**A**			
Cost Description	**Resource**	**Estimated Year One Cost**	**Estimated Year Two Cost**	**Estimated maximum duration (years)**	**Estimated Total Project Cost**	**Comments**
Topographic survey	Contractor	$175,705.00	$0.00	1	$175,705.00	
Pilot swale construction/maintenance project management and contractor management	Contractor/ USACE	$3,432,000.00	$0.00	1	$3,432,000.00	
Overall site monitoring management/guidance (hydrologic, ecological, and water quality)	ENP	$17,099.52	$17,099.52	2	$34,199.04	2 personnel (1 senior hydrologist, 1 senior biologist) X 2 days per month.
Hydrologic monitoring	Contractor	$140,000.00	$120,000.00	2	$260,000.00	Equipment cost is included.
Vegetation, periphyton, and fish monitoring	Contractor	$223,198.20	$157,671.24	2	$380,869.44	
Water Quality/Soils Monitoring	Contractor	$128,768.00	$128,768.00	5	$643,840.00	5 years of monitoring as estimated by FDEP.
UMAM and swale culvert site selection	ENP	$9,974.72	$0.00	1	$9,974.72	2 personnel (1 senior biologist, 1 senior hydrologist) X 14 days.
Site rehabilitation	ENP	$15,740.16	$15,740.16	2	$31,480.32	2 personnel (1 botanist, 1 senior biologist) X 2 days per month.
T & E species assessment and contractor T & E training	ENP	$11,076.80	$0.00	1	$11,076.80	2 personnel (1 wildlife biologist X 14 days, 1 senior biologist X 2 days) and 16 hours of helicopter usage.
Pilot swale maintenance[2]	USACE	$171,600.00	$171,600.00	2	$343,200.00	
Total Costs		**$4,325,162.40**	**$610,878.92**		**$5,322,345.32**	

Note: Cost estimates are presented in 2008 dollars.

Note: Estimated the rate for an ENP senior hydrologist or senior biologist is $44.53/hour and the rate for a wildlife biologist is $22.11/hour.

Note: Estimated the average rate for helicopter use is $500.00/hr.

Note: [2] Estimated annual pilot swale maintenance cost is 5 percent of initial construction costs.

Note: Total costs do not include any wetlands mitigation costs.

Note: This is meant to be an estimate and may not include every single cost item related to this project.

Note: This table represents total cost estimates and therefore, includes costs for two pilot spreader swales and two control sites.

Estimated DRAFT Cost Estimate for the Tamiami Trail Pilot Spreader Swales EA						
Alternative:	**B**	**Configuration:**	**C**			
Cost Description	**Resource**	**Estimated Year One Cost**	**Estimated Year Two Cost**	**Estimated maximum duration (years)**	**Estimated Total Project Cost**	**Comments**
Topographic survey	Contractor	$175,705.00	$0.00	1	$175,705.00	
Pilot swale construction/maintenance project management and contractor management	Contractor/ USACE	$5,033,600.00	$0.00	1	$5,033,600.00	
Overall site monitoring management/guidance (hydrologic, ecological, and water quality)	ENP	$17,099.52	$17,099.52	2	$34,199.04	2 personnel (1 senior hydrologist, 1 senior biologist) X 2 days per month.
Hydrologic monitoring	Contractor	$140,000.00	$120,000.00	2	$260,000.00	Equipment cost is included.
Vegetation, periphyton, and fish monitoring	Contractor	$223,198.20	$157,671.24	2	$380,869.44	
Water Quality/Soils Monitoring	Contractor	$128,768.00	$128,768.00	5	$643,840.00	5 years of monitoring as estimated by FDEP.
UMAM and swale culvert site selection	ENP	$9,974.72	$0.00	1	$9,974.72	2 personnel (1 senior biologist, 1 senior hydrologist) X 14 days.
Site rehabilitation	ENP	$15,740.16	$15,740.16	2	$31,480.32	2 personnel (1 botanist, 1 senior biologist) X 2 days per month.
T & E species assessment and contractor T & E training	ENP	$11,076.80	$0.00	1	$11,076.80	2 personnel (1 wildlife biologist X 14 days, 1 senior biologist X 2 days) and 16 hours of helicopter usage.
Pilot swale maintenance[2]	USACE	$251,680.00	$251,680.00	2	$503,360.00	
Total Costs		**$6,006,842.40**	**$690,958.92**		**$7,084,105.32**	

Note: Cost estimates are presented in 2008 dollars.

Note: Estimated the rate for an ENP senior hydrologist or senior biologist is $44.53/hour and the rate for a wildlife biologist is $22.11/hour.

Note: Estimated the average rate for helicopter use is $500.00/hr.

Note: [2] Estimated annual pilot swale maintenance cost is 5 percent of initial construction costs.

Note: Total costs do not include any wetlands mitigation costs.

Note: This is meant to be an estimate and may not include every single cost item related to this project.

Note: This table represents total cost estimates and therefore, includes costs for two pilot spreader swales and two control sites.

Estimated DRAFT Cost Estimate for the Tamiami Trail Pilot Spreader Swales EA						
Alternative:	**C**	**Configuration:**	**NONE**			
Cost Description	**Resource**	**Estimated Year One Cost**	**Estimated Year Two Cost**	**Estimated maximum duration (year(s))**	**Estimated Total Project Cost**	**Comments**
Hydrological modeling support	ENP	$1,781.12	$0.00	1	$1,781.12	1 senior hydrologist X 5 days.
Hydrological modeling assessment	Contractor	$50,000.00	$0.00	1	$50,000.00	
Total Costs		**$51,781.12**	**$0.00**		**$51,781.12**	

Note: Cost estimates are presented in 2008 dollars.

Note: Assumed the rate for an ENP senior hydrologist is $44.53/hour.

Note: This is meant to be an estimate and may not include every single cost item related to this project.

Estimated DRAFT Cost Estimate for the Tamiami Trail Pilot Spreader Swales EA						
Alternative:	**D**	**Configuration:**	**A**			
Cost Description	**Resource**	**Estimated Year One Cost**	**Estimated Year Two Cost**	**Estimated maximum duration (years)**	**Estimated Total Project Cost**	**Comments**
Topographic survey	Contractor	$175,705.00	$0.00	1	$175,705.00	
Pilot swale construction/maintenance project management and contractor management	Contractor/ USACE	$3,432,000.00	$0.00	1	$3,432,000.00	
Hydrological modeling support	ENP	$1,781.12	$0.00	1	$1,781.12	1 senior hydrologist X 5 days.
Hydrological modeling assessment	Contractor	$50,000.00	$0.00	1	$50,000	
Overall site monitoring management/guidance (hydrologic, ecological, and water quality)	ENP	$17,099.52	$17,099.52	2	$34,199.04	2 personnel (1 senior hydrologist, 1 senior biologist) X 2 days per month.
Hydrologic monitoring	Contractor	$140,000.00	$120,000.00	2	$260,000.00	Equipment cost is included.
Vegetation, periphyton, and fish monitoring	Contractor	$223,198.20	$157,671.24	2	$380,869.44	
Water Quality/Soils Monitoring	Contractor	$128,768.00	$128,768.00	5	$643,840.00	5 years of monitoring as estimated by FDEP.
UMAM and swale culvert site selection	ENP	$9,974.72	$0.00	1	$9,974.72	2 personnel (1 senior biologist, 1 senior hydrologist) X 14 days.
Site rehabilitation	ENP	$15,740.16	$15,740.16	2	$31,480.32	2 personnel (1 botanist, 1 senior biologist) X 2 days per month.
T & E species assessment and contractor T & E training	ENP	$11,076.80	$0.00	1	$11,076.80	2 personnel (1 wildlife biologist X 14 days, 1 senior biologist X 2 days) and 16 hours of helicopter usage.

Pilot swale maintenance[2]	USACE	$171,600.00	$171,600.00	2	$343,200.00	
Total Costs		**$4,376,943.52**	**$610,878.92**		**$5,374,126.44**	

Note: Cost estimates are presented in 2008 dollars.

Note: Assumed the rate for an ENP senior hydrologist or senior biologist is $44.53/hour and the rate for a wildlife biologist is $22.11/hour.

Note: Assumed the average rate for helicopter use is $500.00/hr.

Note: [2] Assumed annual pilot swale maintenance cost is 5 percent of initial construction costs.

Note: Total costs do not include any wetlands mitigation costs.

Note: This is meant to be an estimate and may not include every single cost item related to this project.

Note: This table represents total cost estimates and therefore, includes costs for two pilot spreader swales and two control sites.

Estimated DRAFT Cost Estimate for the Tamiami Trail Pilot Spreader Swales EA						
Alternative:	**D**	**Configuration:**	**C**			
Cost Description	**Resource**	**Estimated Year One Cost**	**Estimated Year Two Cost**	**Estimated maximum duration (year(s))**	**Estimated Total Project Cost**	**Comments**
Topographic survey	Contractor	$175,705.00	$0.00	1	$175,705.00	
Pilot swale construction/maintenance project management and contractor management	Contractor/USACE	$5,033,600.00	$0.00	1	$5,033,600.00	
Hydrological modeling support	ENP	$1,781.12	$0.00	1	$1,781.12	1 senior hydrologist X 5 days.
Hydrological modeling assessment	Contractor	$50,000.00	$0.00	1	$50,000.00	
Overall site monitoring management/guidance (hydrologic, ecological, and water quality)	ENP	$17,099.52	$17,099.52	2	$34,199.04	2 personnel (1 senior hydrologist, 1 senior biologist) X 2 days per month.
Hydrologic monitoring	Contractor	$140,000.00	$120,000.00	2	$260,000.00	Equipment cost is included.
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Water Quality/Soils Monitoring	Contractor	$128,768.00	$128,768.00	5	$643,840.00	5 years of monitoring as estimated by FDEP.
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Site rehabilitation	ENP	$15,740.16	$15,740.16	2	$31,480.32	2 personnel (1 botanist, 1 senior biologist) X 2 days per month.
T & E species assessment and contractor T & E training	ENP	$11,076.80	$0.00	1	$11,076.80	2 personnel (1 wildlife biologist X 14 days, 1 senior biologist X 2 days) and 16 hours of helicopter usage.
Pilot swale maintenance[2]	USACE	$251,680.00	$251,680.00	2	$503,360.00	
Total Costs		**$6,058,623.52**	**$690,958.92**		**$7,135,886.44**	

Note: Cost estimates are presented in 2008 dollars.

Note: Assumed the rate for an ENP senior hydrologist or senior biologist is $44.53/hour and the rate for a wildlife biologist is $22.11/hour.

Note: Assumed the average rate for helicopter use is $500.00/hr.

Note: [2] Assumed annual pilot swale maintenance cost is 5 percent of initial construction costs.

Note: Total costs do not include any wetlands mitigation costs.

Note: This is meant to be an estimate and may not include every single cost item related to this project.

Note: This table represents total cost estimates and therefore, includes costs for two pilot spreader swales and two control sites.

APPENDIX C: HYDROLOGIC CONSIDERATIONS

HYDROLOGIC CONSIDERATIONS

Hydrologic Considerations

The flow from the L29 Canal through the culverts under Tamiami Trail between Levee 30 and Levee 67 was evaluated by analysis of over 1600 discharge measurements collected by the U.S. Geological Survey (USGS) from 1939 to 2008. Tamiami Trail was completed in the late 1920's. Initially, wooden bridges were put in place at the location where the culverts are now located. The actual completion date of the bridges is unknown at this time; however, they were in place when the USGS began making measurements in 1939. The bridges were replaced by the current concrete culverts in 1952, at the same time the eastern protective levee system (including Levee 30 and Levee 31N) was completed. Levee 29 was completed in 1962, isolating the section of the Tamiami Canal between Levee 30 and Levee 67 (currently referred to as the L29 Canal) from the Water Conservation Areas to the north and west. From 1962 to 1979, the only source of water to the L29 Canal was rainfall and seepage beneath Levee 29. Structure S- 333 was completed in 1979, allowing water to be moved from Water Conservation Area 3A into the canal by gravity flow when the structure was open.

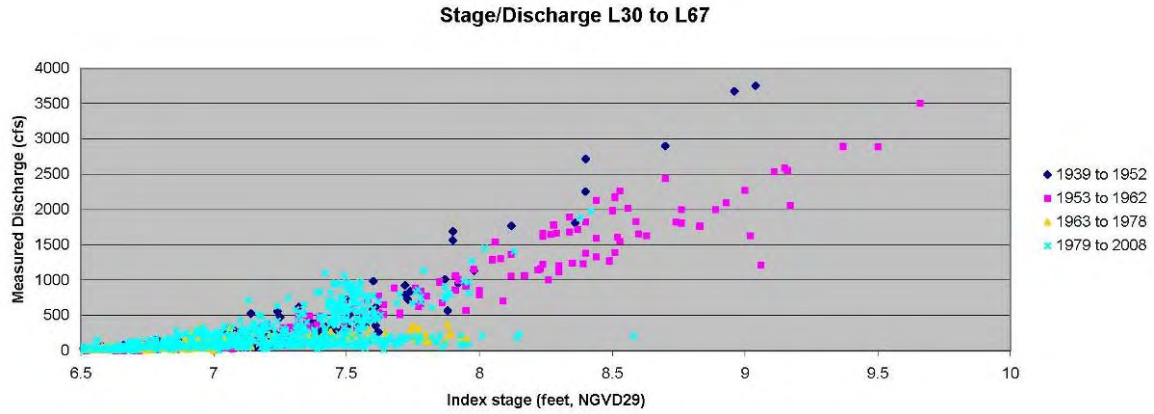
Under current conditions, water flows into the L29 Canal primarily through structure S- 333 on the western end. Water also seeps into the L29 Canal as ground water seeping underneath Levee 29 from Water Conservation Area 3B. Water discharges from the L29 Canal by flow through the 19 sets of uncontrolled culverts under Tamiami Trail and through structure S- 334 on the eastern end. Structures S- 333 and S- 334 are generally closed a good part of the year. They are opened to move water from Water Conservation Area 3A to Northeast Shark River Slough and to the canal system in the urban area to the east. Structure operations are controlled by complex regulations, based on conditions upstream and downstream of the structures, as well as time of year.

An evaluation of total flow across the section showed several changes over time. The data was broken down into 4 time periods based on the phases of road and levee construction: (1) 1939 to 1952; (2) 1953 to 1962; (3) 1963 to 1978; and (4) 1979 to 2008. The replacement of the bridges with culverts in 1952 resulted in lower discharges at stages generally above 8 feet. The completion of Levee 29 in 1962 resulted in very low flows, as there was no source of water to the canal other than seepage and rainfall. The completion of structure S- 333 resulted in 2 divergent curves. The lower curve follows the data for the period from 1963 to 1978. These measurements coincide with times when structure S- 333 was closed, thus mimicking the conditions during the previous time period. The upper curve follows the data for the time period from 1953 to 1962, essentially behaving as the system did prior to the installation of Levee 29.

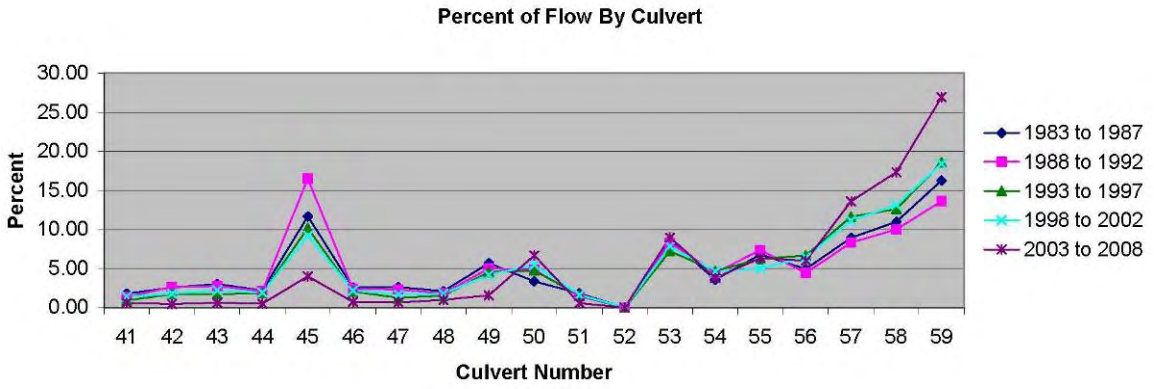
The main factor that controls flow through the culverts is the stage gradient between the L29 Canal and the marsh downstream. Currently, all culverts have a receiving pool on the downstream side; thus, there is nothing directly blocking the exit of water from the culverts. A second factor affecting discharge through the culverts is the stage in both the canal and the marsh. At lower stages, discharges tend to be lower, probably due to increased resistance to flow in the marsh with shallower water depths. A third factor is ground water seepage induced by lower water levels in the Levee 31N canal and the ground water to the east.

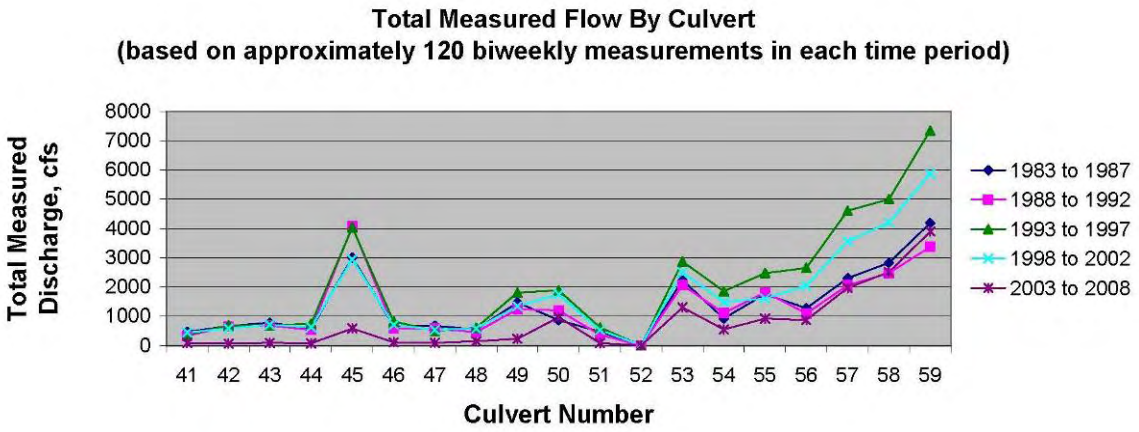
When structure S- 333 is closed, flow in most culverts is minimal, except for those culverts that flow into canals that flow several miles south into the marsh (culverts 45, 50 and 53), and

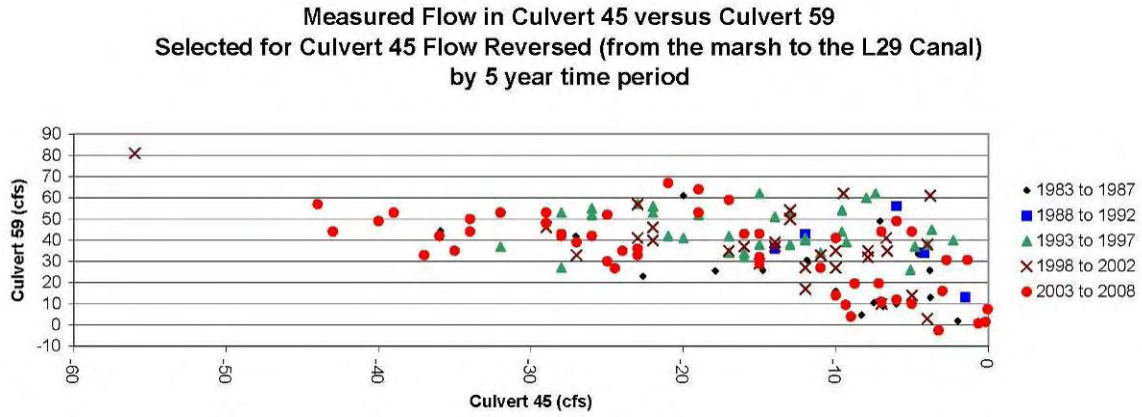
those culverts on the eastern end (culverts 57, 58, and 59) influenced by induced groundwater seepage due to the proximity of the L- 31 canal. At times when structure S- 333 is closed, negative flows (flows from the marsh into the canal) have been observed, primarily through the culverts closest to the western end of the section. The source of this reverse flow is seepage of water from the west beneath and around Levee 67 Extended.



An evaluation of culvert flow for five year periods, beginning in 1983, after structure S- 333 went into operation, showed no significant change in relative percentage of flow in the culverts in the center of the section. However, the eastern culverts increased in flow relative to the western culverts, with the most significant change in the period from 2003 to 2008. This change is due to a decrease in measured flows during this time period at the western culverts. This coincides with the removal of the lower half of Levee 67 Extended. The partial removal of this levee resulted in an increase in the backwater effect caused by water flowing around the end of the levee and to the north toward the culverts. There are more days when flows were negative in the western culverts after the lower half of the levee was removed and the negative flows were larger than in previous time periods.

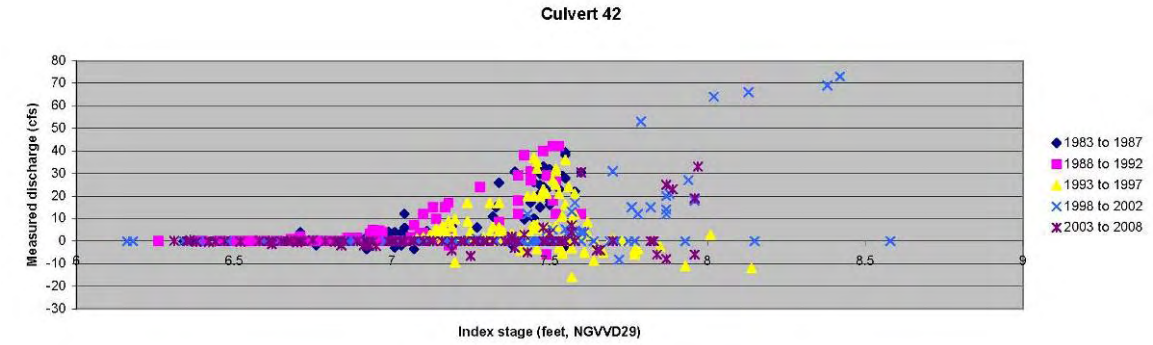


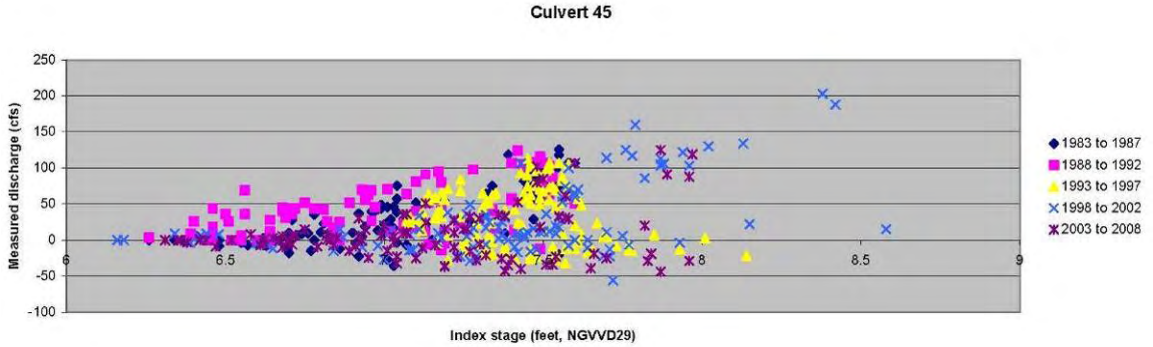


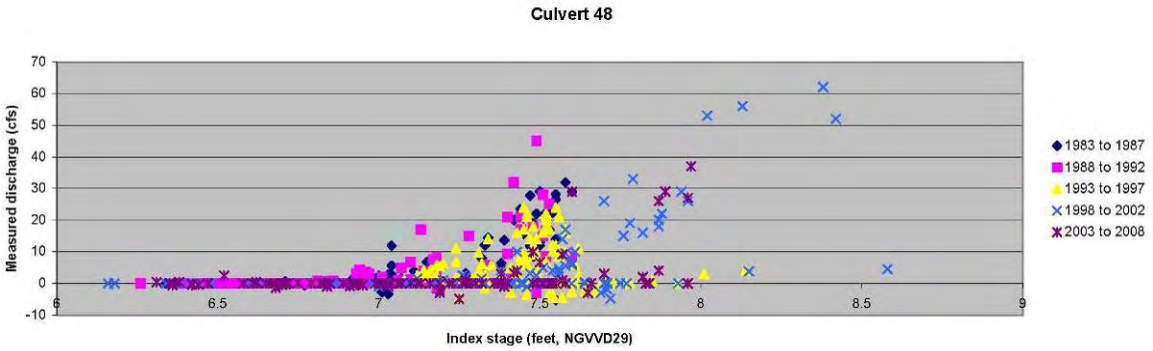


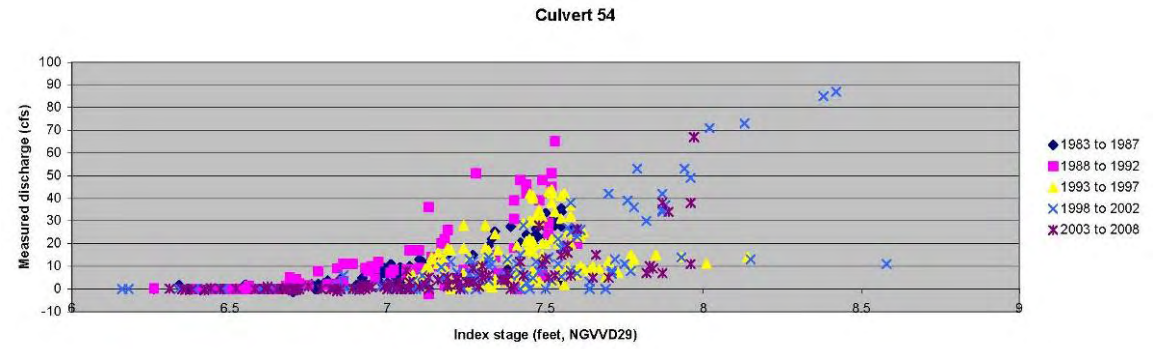
An evaluation of representative culvert flow by index stage indicates no apparent trends. Culverts 42, 45, 48, 54, and 59 are shown below. An interesting anomaly on all these graphs are two low discharge points associated with high stages during the 1998 to 2002 time period. Both of these points are associated with measurements made immediately after Hurricane Irene in October 1999. Both the marsh and the canal stages were increased by very intense rainfall, resulting in a very low gradient between the canal and the marsh and thus very low flow compared to similar high canal stages. In most other instances for high stage in the canal, the source is discharge through structure S- 333, which raises the stage in the canal relatively quickly, while having no immediate impact on the stage in the marsh.

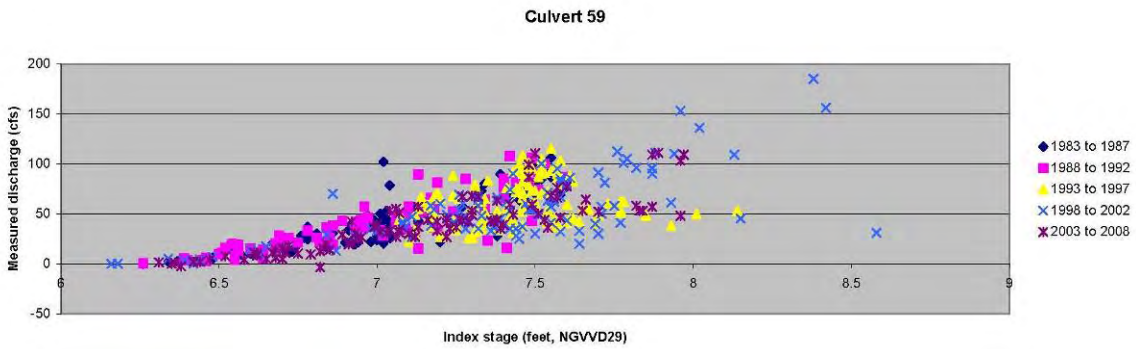
The large amount of scatter in these graphs, especially at the lower stages is due to several factors. First, these graphs do not take into account the gradient between the canal and the marsh, which, as mentioned previously, is one of the primary controlling factors in determining flow. Stage in the L29 canal is used as a proxy because downstream stage data for each culvert is not available. Second, at very low flow rates, the accuracy of the measurement is reduced.


Culvert 42
Measured discharge (cfs)
Index stage (feet, NGVVD29)
1983 to 1987
1988 to 1992
1993 to 1997
1998 to 2002
2003 to 2008


Culvert 45
Measured discharge (cfs)
Index stage (feet, NGVVD29)
1983 to 1987
1988 to 1992
1993 to 1997
1998 to 2002
2003 to 2008


Culvert 48
Measured discharge (cfs)
Index stage (feet, NGVVD29)
1983 to 1987
1988 to 1992
1993 to 1997
1998 to 2002
2003 to 2008


Culvert 54
Measured discharge (cfs)
Index stage (feet, NGVVD29)
1983 to 1987
1988 to 1992
1993 to 1997
1998 to 2002
2003 to 2008



The result of these analyses is an indication that factors controlling flow through the culverts do not appear to have changed since 1983.

Effects on Water Conservation Area 3A

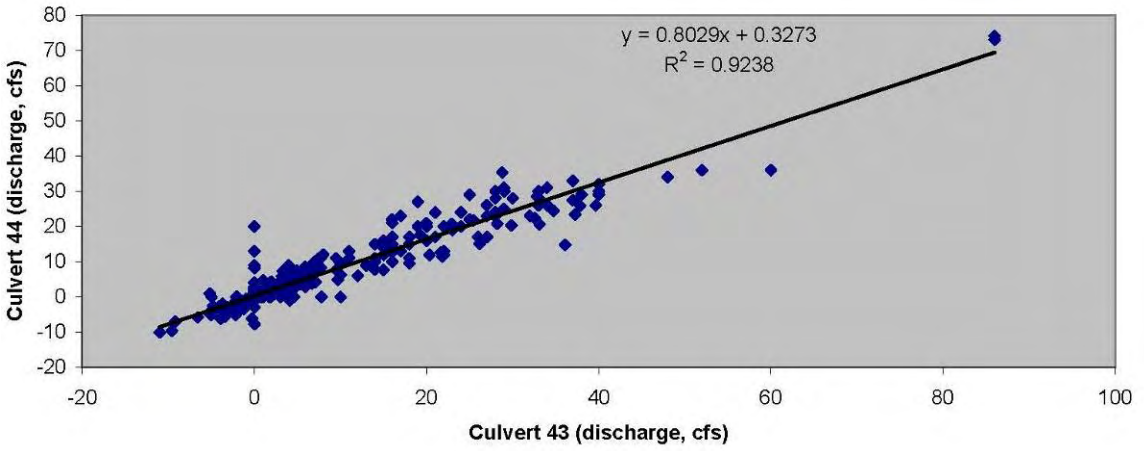
One question is the ability to lower water levels in Water Conservation Area 3A by increasing flows through the structure S- 333 and the Tamiami Trail culverts. The assumption being made is that the increase in flow through structure S- 333 would be a result of the increased flow through all culverts due to construction of swales. A ten percent increase in flow through structure S- 333 would result in a net decrease in stage in WCA 3A between .02 and .09 feet based on measured flows from 1983 to 2006.

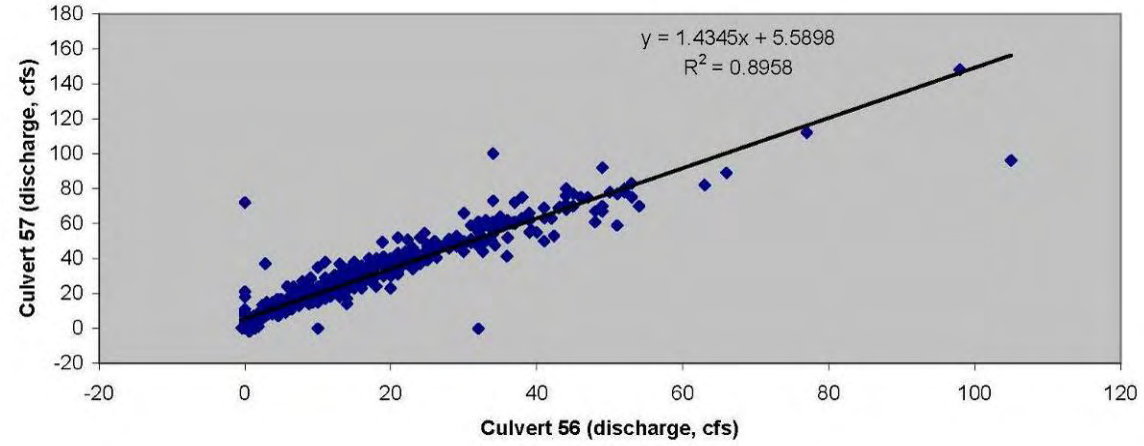
Year	Annual K acre feet	Annual Stage change in WCA3A (feet)	
		10% increase in flow	36% increase in flow
1983	139	0.03	0.10
1984	169	0.03	0.12
1985	178	0.04	0.13
1986	246	0.05	0.18
1987	174	0.03	0.12
1988	141	0.03	0.10
1989	28	0.01	0.02
1990	84	0.02	0.06
1991	216	0.04	0.15
1992	273	0.05	0.20
1993	446	0.09	0.32
1994	241	0.05	0.17
1995	187	0.04	0.13
1996	203	0.04	0.15
1997	135	0.03	0.10
1998	199	0.04	0.14
1999	160	0.03	0.11
2000	239	0.05	0.17
2001	150	0.03	0.11
2002	190	0.04	0.14
2003	168	0.03	0.12
2004	116	0.02	0.08
2005	143	0.03	0.10
2006	133	0.03	0.10

Monitoring

Proposed hydrologic monitoring for the pilot would include collecting continuous stage and flow data at the pilot swales as well as a control culvert associated with each pilot location. Continuous stage data would be collected on the upstream and downstream sides of each culvert set. A continuous flow measuring device, such as an Acoustic Doppler Current Profiler (ADCP), will be installed downstream of each culvert set. Discharge measurements will be made under various stage and flow conditions to provide the information needed to convert the ADCP measurements into continuous discharge data. Staff gages will be installed at several locations downstream of each culvert set being monitored to collect instantaneous water level readings with each discharge measurement.

An evaluation of data collected from 1983 to 2008 indicates there is a strong relationship between flows for most adjacent culverts. The exception is for culverts connected to a downstream canal. Evaluation of the success of the pilot project will be made by comparing data collected before and after collection at each pilot location and by comparing data between the pilot locations and the control locations.





Ideally, to minimize the length of time required to collect sufficient data to be able to evaluate the pilot project, the S- 333 structure would need to be operated outside the normal

range of regulations. This would include raising the stage in the L29 Canal above the 7.5 foot maximum, and maintaining flow in the canal for a sufficient amount of time under varying downstream stage conditions. However, deviations from current operational criteria are not likely to be authorized.

Modeling Deficiencies

The US Army Corps of Engineers Jacksonville District prepared a technical memorandum in February 2007 titled "Modeling the Effect of Spreader Canals on the Performance of Culverts under Tamiami Trail." The memorandum documents the use of a hydrodynamic model (RMA2- WES) to "estimate the magnitude of flow improvements achieved by the construction of a spreader canal downstream of each set of culverts". Only one culvert set was selected to be modeled, culvert set 59, which is the one farthest east. The justification for selecting this location was that it is conveniently located near stage gages and "the model boundary conditions were simple to define." The result of the model was a prediction of up to a 36 percent increase in flow through the culvert set over historical flows. However, many assumptions and boundary conditions defined for use in the model are incorrect, thus invalidating the results of the model.

Assumption 1: Groundwater seepage through the L31N levee is negligible

While this assumption is probably true, there is a significant amount of water lost to groundwater through vertical seepage in the vicinity of L31N levee. There is little confinement between the surface water and the groundwater, especially in the eastern section. When structure S- 333 is closed, many of the western culverts are not flowing or even flow in the reverse direction, however, the eastern culverts continue to flow, The gradient causing this flow is caused by lower groundwater levels east of L31N levee and canal.

Assumption 2: Water flow is parallel to the western boundary

This assumption is not valid for culvert 59, although it may be valid for culverts located away from the levees located at the ends of the section. Stage measurements and observations in the marsh indicate that water in the marsh near the L31N levee flows to the east or southeast. The area of influence from L31N varies with hydrologic conditions; however, it may be as much as one mile or more.

Assumption 3: Manning's n value assigned to the marsh was between 0.65 and 0.9

This range of values is significantly higher than values used for the TIME[1] model. The TIME model, in the marsh, used Manning's n value between 0.40 and 0.55. The justification for the higher values is the excess woody vegetation downstream of the culvert sets that appear to be restricting flow. From a distance, this does appear to be the case. However, field observations at several culvert sets, including culvert 59 indicate that although there is a significant tree canopy, there are ample channels between the trees to allow water to flow through to the undisturbed marsh areas downstream.

[1]Wang, J.D., Swain, E.D., Wolfert, M.A., Langevin, C.D., James, D.E., and Telis, P.A., 2007, Application of FTLOADDS to Simulate Flow, Salinity, and Surface- Water Stage in the Southern Everglades, Florida: U.S. Geological Survey Scientific Investigations Report 2007–5010, 112 p.

Assumption 4: Flow is divided approximately equally through all the culvert sets, with flow related to the diameter of the culverts (not all culverts are the same size)

Calibrating the model to field conditions, flow through culvert set 59 on 8/23/2001 was estimated at 44 cfs. This was assumed to be a reasonable value based on dividing the total flow on that day (1400 cfs) by the total number of culvert sets (19). The result is 73.5 cfs, and assuming the flow would be lower in culvert set 59 because it is a smaller diameter than most of the other culverts.

Field measurements made by the USGS indicate that flow is variable between the culvert sets, but the percentage of flow through each culvert set has remained relatively constant since 1983. Culvert 59 generally flows more than the other culverts, primarily due to the gradient caused by groundwater seepage. A USGS discharge measurement was made on August 16, 2001. The total flow measured was 1452 cfs and flow through culvert 59 was 136 cfs. This is three times the amount of flow estimated by the model.

Assumption 5: Culverts further downstream from structure S-333 will have a lower headwater and thus a lower flow

Although there is a gradient in the L29 Canal, there is also a gradient from west to east in the marsh. It is not the stage in the L29 Canal that controls the discharge rate, but the gradient from the L29 Canal to the marsh. In fact, field data indicate the gradient in the marsh is generally greater than the gradient in the L29 Canal, resulting in higher flows in the eastern culverts. At the western end of the section, seepage beneath L67 Extended Levee can result in higher stages in the marsh than in the L29 Canal. This seepage is the primary cause for the lower flows, and sometimes even reversed flows, in the western culverts.

Potential for Modeling

The proper choice of a model and proper boundary conditions and model parameters will allow for modeling of flow to estimate the effects of building a spreader swale downstream of a culvert. Detailed field data, which are currently not available, would be required to provide adequate data to calibrate the model to provide confidence in the results. These data would include an accurate measurement of the surface water gradient downstream of the culvert. Various models, such as MODHMS, MODNET, and ISGW can be used if a groundwater component is required. Alternatively, using one of the central culverts, away from the bounding levees, would allow the use of surface water only models, such as RMA2 or SWIFT2D.

Structural Implementation – parallel versus perpendicular to road

Two potential implementations have been proposed, building the swale parallel to the road (perpendicular to the flow direction) and perpendicular to the road (parallel to the flow direction). The advantage of building on parallel to the road is that construction would most likely be easier and the impact to the natural system would be less than the second option. However, from a hydrologic perspective, building a swale perpendicular to the road would probably have a bigger impact on increasing flows through the culvert. Culverts connected to a downstream canal have been documented to have a higher flow than adjacent culverts. However, these canals are several miles long, while the proposed swale would only be a few hundred feet long.

Off Site Issues and Similar Projects

A literature search could locate no projects that provide a similar functionality. Swales have been used to distribute water for marshes crossed by a road. Examples include US 27 between WCA2 and WCA3, I75 in WCA3, and old Tamiami Canal downstream of the S- 12 structures. These features are actually canals that run the entire length of the road between openings under the roadway and act as equalizing canals. There have been no studies documenting the impact of these canals on flow through the openings.

Locations outside of Everglades National Park were considered as potential locations for a pilot project. It was not possible to find a site that was similar enough to the project area to be able to evaluate the pilot project. For example, L31E was considered because culverts are going to be added in the levee, however, the culverts will empty into a tidally influenced mangrove forest, conditions that are very different from the project area.

APPENDIX D: WETLANDS STATEMENT OF FINDINGS

National Park Service
U.S. Department of the Interior

Everglades National Park

Florida

STATEMENT OF FINDINGS FOR EXECUTIVE ORDER 11990 (PROTECTION OF WETLANDS)

PILOT SPREADER SWALE PROJECT
EVERGLADES NATIONAL PARK

September 2008

Recommended:

_____ _____
Dan Kimball, Superintendant, Everglades National Park Date

Certified for Technical Accuracy and Servicewide Consistency:

_____ _____
Bill Jackson, Chief, Water Resources Division Date

Approved:

_____ _____
David Vela, Southeast Regional Director Date

Wetlands Statement of Findings for the

Spreader Swales Pilot Project, Everglades National Park

Introduction

The National Park Service (NPS) has prepared and made available for public review, an Environmental Assessment (EA) for a Pilot Spreader Swale Project. The purpose of the spreader swale test project is to determine if spreader swales would increase hydrologic flow into Everglades National Park and if so, determine the level of increased conveyance. These data will provide decision- makers with sufficient information to decide whether construction of additional swales on Everglades National Park land is worth the financial cost and potential environmental effects associated with construction.

The U.S. Army Corps of Engineers (USACE) proposes to construct spreader swales immediately south of two culverts found along a 10.7- mile stretch of the Tamiami Trail at the northeastern boundary of the Everglades National Park. The National Park Service (NPS) is the lead agency for preparation of this Statement of Findings and the USACE is a cooperating agency.

Executive Order 11990 – Protection of Wetlands – requires the National Park Service and other federal agencies to evaluate the likely impacts of actions on wetlands. The objectives of the Executive Order are to avoid, to the extent possible, the long- term and short- term adverse impacts associated with occupancy, modification, or destruction of wetlands, and to avoid indirect support of development and new construction in such areas, wherever there is a practicable alternative. The purpose of this Statement of Findings is to present the rationale for the location of the proposed plan in the wetlands of Everglades National Park and to document the anticipated effects on these resources.

Wetlands of Everglades National Park

Water flowing into the Everglades originates as overflow from Lake Okeechobee (Lodge 2005). Variable seasonal rainfall in the Okeechobee watershed dictates flows into the Everglades and the associated ecological functions and processes throughout the park. The gradient of the Everglades that facilitates the southward sheet flow from Lake Okeechobee is approximately 2 inches per mile (Lodge 2005). Thus, the Everglades ecosystem served as the historic floodplain for Lake Okeechobee. Water availability and duration are dominating factors that influence the features and processes of the Everglades wetland ecosystem. The wetland habitats of the Florida Everglades include the ridge and slough, cypress swamp, sawgrass prairie, and freshwater marshes, among others.

The historic Everglades ecosystem has been reduced in size and context over the last century. Nearly 50 percent of the Everglades wetlands have been lost to draining for agricultural and economical development (SFERTF 2008). Regional water management has drained and dried vast stretches of the wetland system. Transportation corridors (highway and railways) act as dams that trap flows, and canals and levees convey flows against the natural drainage patterns (away from Florida Bay to the Atlantic Ocean). The project area, which encompasses a portion of Northeast Shark River Slough, is largely devoid of the historical flows. Without benefit of natural surface water flows from the north and largely

dependent on the rainfall within this portion of the basin, the area is plagued with altered hydrology. Persistent drought and fire have also altered the ecosystem. Thus, the existing condition of the wetlands, and their associated functions, in and near the project area are severely degraded from natural conditions. Although the ecosystem has been adversely affected by development and long- term water management activities, the remaining portions of the Everglades ecosystem are still defined as wetlands, by both the NPS and by the USACE.

The dominant habitats in the project area (Northeast Shark River Slough) are emergent wetlands - the sawgrass prairie (freshwater marsh – sawgrass), the ridge and slough habitat (freshwater marsh), and forested and open water habitats (mixed wetlands – hardwoods and shrubs). These wetland may be inundated many months each year (Lodge 2005).

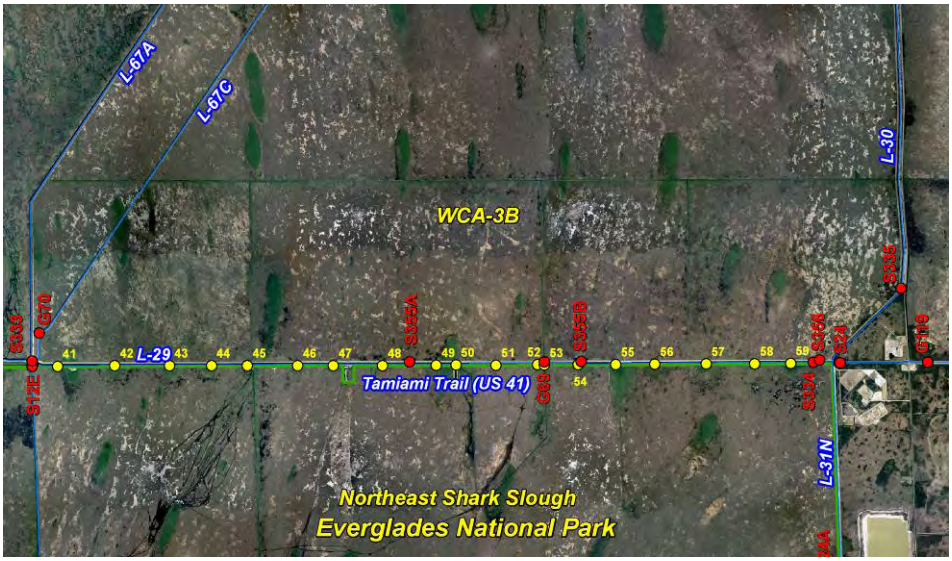
Project Description and Benefits

The proposed project (Preferred Alternative) is a small component of the larger Modified Water Deliveries Project (Mod Waters) for Everglades National Park. The purpose of Mod Waters is to restore wetland functions within the park by modifying water deliveries to the park and altering water management operation outside of the park. Mod Waters is jointly funded by the NPS and USACE and is expected to be completed in 2012.

Hydrologic analyses have shown that the Tamiami Trail roadway and the existing culverts beneath it act to impede the natural flow, quantity, timing, and distribution of water entering the Northeast Shark River Slough. The proposed project would investigate, using hydrologic modeling and potential installation of two pilot spreader swales, the ability to increase flows through the existing culverts into the park.

The USACE has recommended that construction of spreader swales downstream of existing culverts under Tamiami Trail between levees L67 and L30 to provide improved flow into Northeast Shark River Slough (see Figure 1).

FIGURE 1. VICINITY MAP OF PROPOSED PILOT SPREADER SWALE PROJECT AREA



There are 19 sets of culverts beneath this stretch of the roadway. Most of the culverts contain three equally sized pipes ranging from 42 to 60 inches in diameter, depending on location. These culverts provide flow into the park during most of the year (depending on the stage of water in the L- 29 canal).

The Preferred Alternative for the pilot project includes an adaptive management approach using:

1) An initial phase of hydrologic modeling, including site- specific, baseline flow information. Hydrologic models would simulate potential effects of the pilot spreader swales. Various models, such as physical models and/or numerical simulations, would be considered and ultimately implemented for this approach.

2) If this enhanced modeling effort were to show that spreader swales could increase flows into the Northeast Shark River Slough a second phase of installation of two pilot spreader swales downstream of suitable culverts would be implemented.

    a) The selection of culverts to serve as pilot spreader swale locations would be based on evaluation criteria that include:

        i) Avoidance of wood stork colony restriction zones (54, 55, 56, and 59);

        ii) Avoidance of private property, tribal residences, man made features, or historic/cultural properties (41, 45, 47, 48, 49, 50, 52, and 53);

        iii) Avoidance of the footprint of the LRR 1- mile bridge (56, 57, 58); and

        iv) Availability of a nearby culvert to serve as the control against which the effectiveness of the pilot spreader swale can be measured.

        v) Culverts considered feasible are 42, 43, 44, 46, and 51 (Figure 1); these could also be used as controls.

    b) If the pilot spreader swales are constructed,

        i) The swale footprint would be excavated to limestone;

        ii) Pilot spreader swales would be aligned parallel to Tamiami Trail, perpendicular to marsh flow. There are three potential configurations with total surface area between 60,000 and 62,000 square feet.

        iii) A monitoring plan would be implemented to measure hydrologic and ecologic responses resulting from the presence of the spreader swales.

3) In the event that the pilot spreader swales were ineffective in improving flows or generating ecological responses,

    a) Rehabilitation of the sites would be undertaken to return the sites to pre- disturbance conditions; and

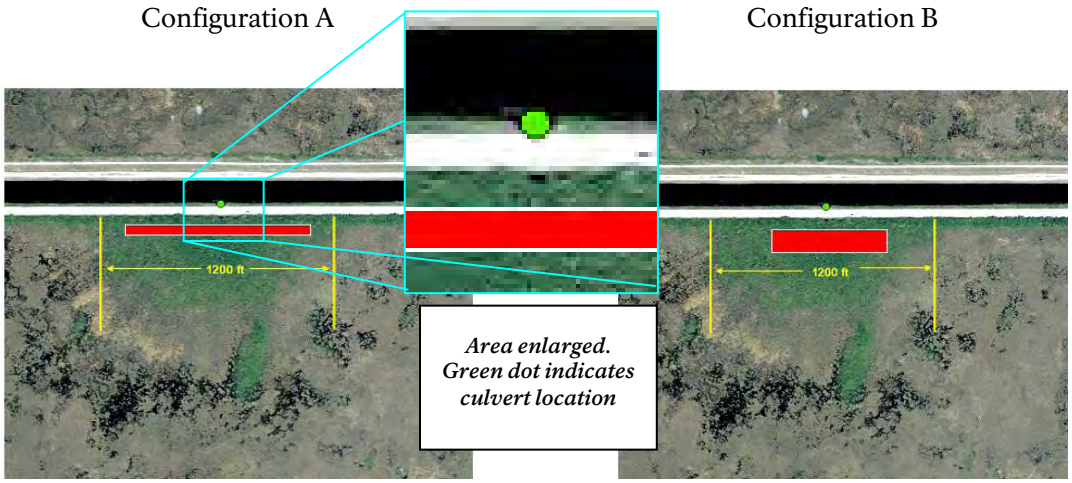
    b) To compensate for the loss of wetland acreage and function, the park would rehabilitate 6.7 acres of existing, abandoned roadbeds in the East Everglades Expansion Area (Figure 3). The wetlands in the area to be rehabilitated are generally similar to those in the project area, including palustrine emergent (freshwater marsh – sawgrass) and palustrine scrub- shrub/forested (mixed wetland scrub- shrub and mixed hardwoods). The primary functions of the wetlands in the compensation area

include surface and subsurface water storage, support of the biogeochemical processes (nutrient cycling, peat accretion, etc.), support of a characteristic plant community, and providing suitable habitat for native wildlife. All of these functions are currently degraded in the compensation area as a result of road construction and the presence of invasive plant species.

The roadbeds would be excavated to approximate original topography, road base and fill materials would be removed, and native wetland vegetation would be planted or seeded. The sites would be monitored and exotic plant species would be controlled under the Florida and South Caribbean Parks Exotic Plant Management Plan. Wetland functions that would be returned to the compensation sites include, surface and subsurface water storage, support of natural biogeochemical processes, and support of a native plant community that provides habitat for native wildlife. In addition, if the pilot spreader swales are shown to be ineffective in improving flows, the swale sites would be rehabilitated by filling the swales to approximately natural topography and planting or seeding native vegetation. If monitoring studies show that the spreader swales were not effective, the pilot swales and the East Everglades compensation sites will be restored within 24 months of this determination.

The $322,000 approximate cost of rehabilitating the compensatory wetland site would be paid by the Modified Waters Project, a joint venture of the USACE and NPS.

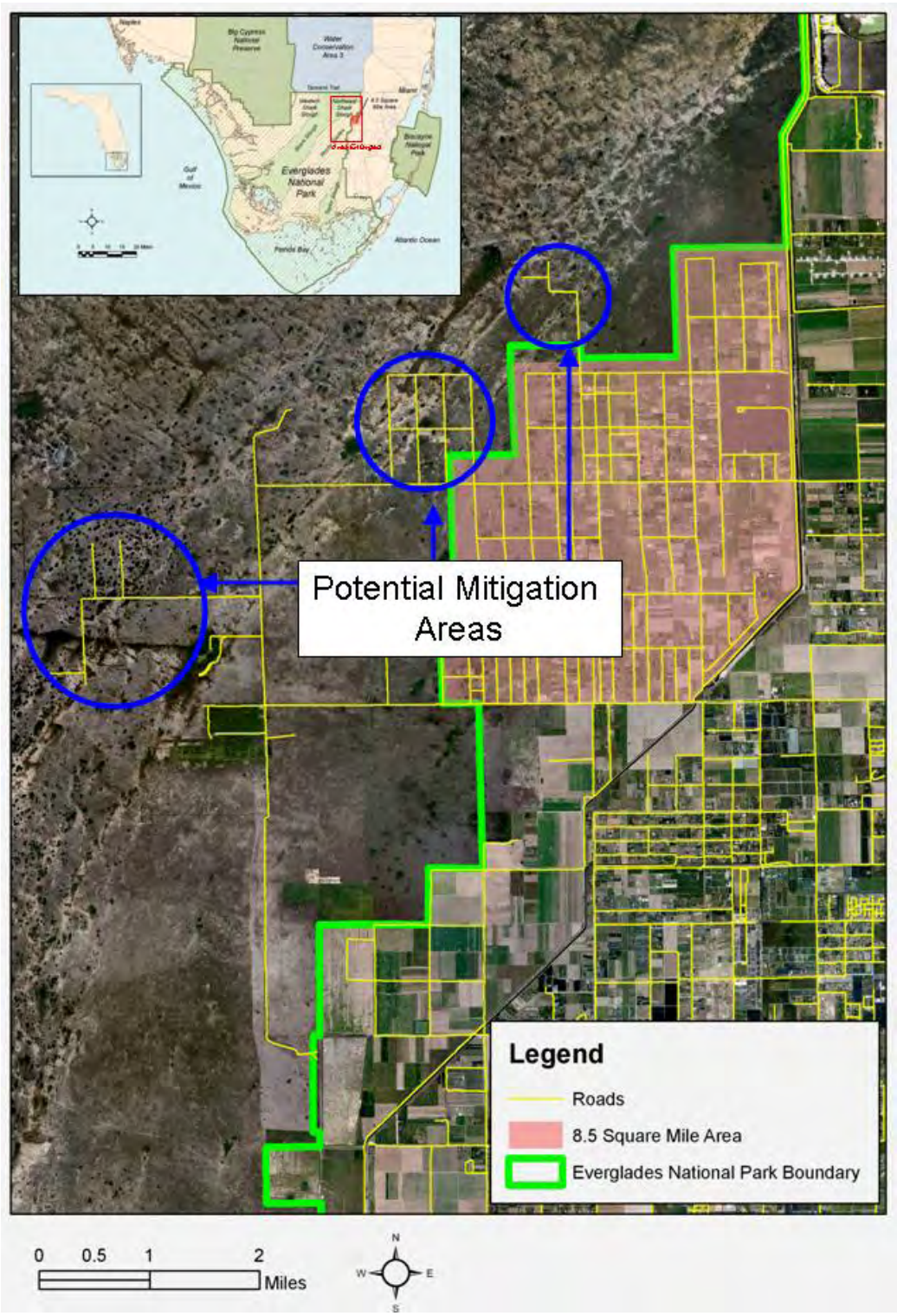
FIGURE 2. PROPOSED CONFIGURATIONS FOR PILOT SPREADER SWALES



Configuration C

Wetland vegetation is present downstream of all the culvert sets. In addition, some exotic vegetation is present at most of the outlets; however, the abundance of these non- native species varies, and the majority of vegetation cover is by native species. Although the flows are altered from the natural pattern, the hydrology, soils, and vegetation of the project area are indicative of a wetland environment. (The National Wetlands Inventory maps for the project area are included as Attachment 1.)

FIGURE 3. POTENTIAL WETLAND COMPENSATION SITES



Alternatives Considered

Three action alternatives, along with the No Action Alternatives, were fully analyzed in the Pilot spreader Swale Project EA. Three other alternatives were addressed in the EA:

1. *The No Action Alternative* was included to serve as the baseline for the NEPA analysis. The No Action alternative would not provide the opportunity to investigate the use of spreader swales to improve flows into the park, and therefore did not meet the project objectives.
2. *A structural- only alternative* would have installed two pilot spreader swales without advanced modeling or an adaptive management approach. Given the uncertainty that swales will provide benefits and the potential adverse impacts, this alternative was not selected for implementation.
3. *A modeling- only alternative* would have employed enhanced modeling techniques to inform future decision- making about installation of multiple spreader swales in the project area. This option did not provide for adaptive installation of pilot swales in the event that modeling were favorable. This alternative was not selected for implementation.

In addition to the alternatives that were fully analyzed, the NPS considered other options during early planning phases for the project. The following options were dismissed from full consideration because they did not meet the project objectives or would potentially generate unacceptable levels of natural and/or culture resource impacts.

1. *Other sites to test swale efficacy*. Spreader swales have been used to distribute water for marshes that are crossed by roads (e.g., L- 31E Canal and C- 111 spreader canal, U.S. 27 between WCA- 2 and WCA- 3B, I- 75 in WCA- 3B, and the old Tamiami Canal downstream of the S- 12 structures). There have been no studies documenting the impacts of small- scale features, such as the swales being considered for evaluation in this pilot project.
2. *Locations outside Everglades National Park* were also considered as potential locations for conducting a pilot project. It was not possible to find a site similar enough to the project area to be able to evaluate the results in a manner that could be readily transferred to the Tamiami Trail outlets.
3. *Alternate pilot spreader swale design options* were considered during early planning phases of the project. Constructing the pilot spreader swales parallel to flow (perpendicular to Tamiami Trail) or including multiple spreader swales using a radial design were considered. Both options would have disturbed pristine areas beyond the vegetation haloes (the distinct plume of bay heads, willowheads, pond apples, and other marsh vegetation directly south of the culvert sets that eventually transition into the downstream sawgrass community)and had potentially unacceptable impacts on proposed wilderness and cultural resources. Given the uncertainty that benefits will result from construction, they were dismissed from further consideration.

The Project and the Everglades National Park Northern Boundary

The Tamiami Trail (US Highway 41) defines the northern boundary of Everglades National Park. The highway runs generally east- to- west. The project area is defined as immediately south of the Tamiami Trail between levees L67 and L30 – a distance of approximately 10.7 miles. The Florida Department of Transportation (FDOT) owns the roadway and controls the adjacent, variable- width, right- of- way. In the project area, the boundary of Everglades National park runs parallel to the southern right- of- way for the highway. No boundary survey for either the right- of- way or the authorized boundary of Everglades National Park is currently available.

Wetlands and Wetland Functions in the Project Area

Most of Everglades National Park is prone to frequent and continual flooding due to low elevation, lack of extensive physical relief, and freshwater hydrologic inputs (rainfall, overland sheet flow, and direct surface water discharges). The project is thus an area that is subject to seasonal inundation. Lands impacts by the project are described below.

If the pilot spreader swales were to be constructed, the emergent wetlands that would be affected by the physical footprint include mixed wetland hardwood – mixed shrubs, freshwater marsh- sawgrass, and freshwater marsh.

- At several locations, flow from the Tamiami Trail culverts has formed ponds or open water (palustrine open water/emergent) wetlands (freshwater marsh);
- South of the ponds are palustrine forested or scrub- shrub wetland communities dominated by Carolina willow (*Salix caroliniana*) and pond apple (*Anona glabra*) (mixed wetland hardwoods – mixed shrub) also associated with flows from the culverts.
- Beyond the wetland forest vegetation is an expanse of palustrine emergent wetlands, dominated by sawgrass (*Cladium jamaicense*) and patches of cattails (*Typha latifolia*) on the northern edge of the sawgrass (freshwater marsh – sawgrass).

The primary functions of the wetlands in the project area include surface and subsurface water storage, support of the biogeochemical processes (nutrient cycling, peat accretion, etc.), support of a characteristic plant community, and providing suitable habitat for native fish and wildlife. All of these functions are currently degraded in the project area as a result of regional flood control and water management, and the presence of invasive plant and animal species. The spreader swale pilot project will determine if installation of these features would provide increased flow through the existing culvert sets and improve wetland conditions in portions of the Northeast Shark River Slough.

Palustrine emergent wetlands downstream of the culvert openings provide water storage, support for biogeochemical processes, and fish and wildlife habitat. The water storage function has been degraded by the damming effect of the Tamiami Trail and altered sheetflow distribution and timing.

Nutrients (nitrogen and phosphorus) flowing into the wetlands from the L- 29 Canal are taken up by vegetation in the park. Phosphorus, in particular, alters the natural sawgrass community by supporting growth of cattails. This species is common downstream of the culvert openings, but would not occur in a healthy sawgrass community. Thus, the sawgrass

habitat has been degraded from natural conditions, but is still home to a variety of fishes, birds, reptiles, amphibians, and invertebrates.

The palustrine forested and open water wetlands in the project area provide water storage, a forest vegetation community, support for biogeochemical processes, and fish and wildlife habitat.

The water storage function has been degraded through the damming effect of the Tamiami Trail and altered sheetflow timing and distribution. The vegetation community is degraded by invasion of Brazilian pepper (*Schinus terebinthifolius*). This invasive exotic species makes up five to 30 percent of forest cover in the area.

Forested and open water habitats are used by a variety of birds, fishes, and other wildlife. However, the habitat has been degraded by previous described disturbances and altered hydrologic processes. This habitat has also been altered by excavation and filling during Tamiami Trail construction and repairs. Aquatic habitat in the open water wetland (ponds) is degraded by the presence of numerous exotic fish species and elevated nutrient levels.

The Northeast Shark River Slough is a main water flow- way for the central and southern Everglades. Although this area has been degraded and its size reduced by development and regional water management activities, the dominant vegetation types are the palustrine emergent/open water (sawgrass and cattails) and palustrine scrub/shrub/forested (willow and pond apple) (Lodge 2005).

Special Status Species

Seven federally listed animal species have the potential to occur in the vicinity of the project area. These species, and their status, are outlined in the table below.

TABLE 1. FEDERALLY LISTED ENDANGERED, THREATENED, AND CANDIDATE ANIMAL SPECIES WITH THE POTENTIAL TO OCCUR IN THE PROJECT AREA

Common Name	Scientific Name	Status
MAMMALS		
West Indian Manatee	*Trichechus manatus*	Endangered
Florida panther	*Felis concolor coryi*	Endangered
BIRDS		
Wood stork	*Mycteria americana*	Endangered
Cape Sable seaside sparrow	*Ammodramus maritimus mirabilis*	Endangered
Everglades snail kite	*Rostrhamus sociabilis plumbeus*	Endangered
REPTILES		
Eastern indigo snake	*Drymarchon corais couperi*	Threatened
American alligator	*Alligator mississippiensis*	Threatened (S/A- similar in appearance to the American crocodile)

The proposed actions would not affect the West Indian manatee, Cape Sable seaside sparrow, or the Eastern indigo snake

- Manatee have been sighted in the L- 29 Canal on one occasion over the last 20 years. This species has not been documented in the culvert pools south of Tamiami Trail. It is highly unlikely that a manatee would be encountered in the project area because the project would not affect the L- 29 Canal. No effect on the manatee would be expected.

- The Cape Sable seaside sparrow does not occur in the project area. This species occurs several miles south and west south of the project area, in the marl prairie west of the Shark River Slough. There is no Cape Sable seaside sparrow critical habitat located within the project area. The project is expected to have no effect on the Cape Sable seaside sparrow or its habitat.

- The Eastern indigo snake is found in wet prairies and hardwood hammocks and has not been observed in the project area. The *Standard Protection Measures for the Eastern Indigo Snake* (USFWS 2006a) would be implemented during construction. These measures would mitigate any potential adverse effects to this species. The proposed action is expected to have no effect on the eastern indigo snake.

If spreader swales are implemented, construction disturbance and alternations in habitat may affect, but is not likely to adversely affect the Florida panther, wood storks, the Everglades snail kite, and the American alligator.

- The project area occurs in the Florida panther primary zone that supports the sole breeding population of Florida panthers. Telemetry data indicate that Florida panthers have ranged along the Tamiami Trail, and have been killed by vehicles on the roadway. Installation of the pilot spreader swales would not reduce suitable panther habitat appreciably. However, construction disturbance could cause panthers to avoid the project area during installation, producing temporary effects. Thus, the proposed action may affect, but is not likely to adversely affect, the Florida panther.
- There are two wood stork colonies south of Tamiami Trail within the park. However, proximity to wood stork nesting and roosting sites was a criterion for eliminating pilot spreader swale locations. Although wood storks could be exposed to construction noise during installation, it is unlikely their nesting, roosting, loafing, and colony formation activities would be measurably affected. The long- term presence of the pilot spreader swales could result in a minimal loss of feeding and foraging sites. Therefore, the proposed action may affect, but is not likely to adversely affect the wood stork.
- Construction of the pilot spreader swales would not occur within the Everglade snail kite management zones. Culverts suitable for swale construction are outside the 500 meter limited activity buffer area of the Everglade snail kite (USACE and NPS 2008). Project effects could include disruptions in foraging and feeding activities that would occur during the approximate 2- month construction period. The contractor will be required to follow the NPS *Draft Snail Kite Management Guidelines* (2006). Based on the limited scope of the pilot swale project, the proposed action is not expected to provide any short- term or long- term benefits to the Everglade snail kites. The project may affect, but is not likely to adversely affect, the Everglades snail kite.
- Alligators naturally occupy and maintain gator holes in the Northeast Shark River Slough. The presence of spreader swales may encourage alligators to inhabit the pilot swales and move out of natural ridge and slough or marsh habitats. The result of this

behavioral change may prevent several alligators from maintaining natural gator holes. Although this behavioral change would not result in adverse effects in the alligators, gator holes are vital habitat and refuge for other wetland species. Thus, over the long-term, implementation of the proposed action may affect, but is not likely to adversely affect the American alligator.

Wetland Impacts of the Preferred Alternative

Using project area wetland maps overlain by concept- level drawings of the pilot spreader swale design options, construction of two spreader swales would result in up to 6.7 acres of wetland disturbance. Wetland impacts are based on long- term presence of the swales and development of a construction access easement.

Wetland Impacts	**Acres**
Freshwater marsh – sawgrass (palustrine emergent/open water)	1.33 – 3.54
Mixed wetland hardwood – mixed shrub (palustrine scrub- shrub/forested)	0.053 – 3.16
Total Wetland Impacts	**1.38 – 6.70**

A maximum of approximately 6.7 acres of wetlands are expected to be impacted during implementation of this project. The swales themselves would be maintained as open water to facilitate maximum flow volume. Substrate would be removed, potentially to bedrock, leaving little to no growth medium for wetland vegetation. Thus, they are not anticipated to provide wetland functions, aside from water storage and distribution.

Upon completion, the test and control culverts would be monitored for increased flow rates, and routine environmental monitoring would be implemented.

- If the pilot spreader swales are effective in increasing flows through the culverts into the Northeast Shark River Slough, they would remain in place. A routine maintenance program (sediment removal when necessary and vegetation management) would be implemented. By improving hydrologic conditions, the pilot spreader swales could have beneficial wetland impacts downstream. If positive ecological response (increased water depth and hydroperiod, increased abundance of native wetland species, improved habitat for native wildlife) are recorded beyond the swales, these wetland benefits would account for compensation of wetland functions lost in the spreader swales themselves.
- If the spreader swales are determined to be ineffective in increasing flows through the culverts into the Northeast Shark River Slough, the sites would be rehabilitated. Excavated areas would be filled to approximate original topography and native wetland vegetation would be planted or seeded. However, removal of the peat and muck substrate during construction would result in long- term loss of function, regardless of the rehabilitation effort. Thus, the project would compensate for any long- term loss of wetland acreage and function by rehabilitating up to 6.7 acres of previously disturbed and degraded wetland communities with similar functions.

Justification for Use of Wetlands

There are no practicable non- wetland alternatives for the construction component of the proposed action (Preferred Alternative). The purpose of the project is to investigate the potential for benefits using spreader swales to increase and distribute flows into the wetland environments of the Northeast Shark River Slough. The areas adjacent to the roadway, and the park lands to the south, are all designated wetlands. Alternative, non- wetland locations would not provide the information needed to determine swale efficacy.

Conclusion

The National Park Service has concluded that the plan, as outlined above, and in detail in the Pilot Spreader Swale Environmental Assessment, will provide valuable information in determining if spreader swales would be an effective component of Mod Waters in bringing increased flows into Everglades National Park. Hydrologic analyses show that the existing roadbed and culverts beneath it impede natural flow, quantify, timing, and distribution. The project will evaluate the potential role of a small- scale component in improving hydrologic conditions in the Northeast Shark River Slough.

The project would adversely affect up to 6.7 acres of wetland habitat south of Tamiami Trail by removal of vegetation, excavation to bedrock, and maintenance of the swales as open water. The swales would be monitored for beneficial and adverse impacts to hydrology and natural resources. If the swales are effective, they would be retained and managed to provide continuous increased flows. Downstream wetland benefits would compensate for the loss of wetland function within the swale footprint. If the spreader swales were not effective, the sites would be filled and revegetated. Wetland acreage and function loss would be compensated by removal of existing roadbed in the Everglades Expansion Area and rehabilitation of the wetland communities.

The NPS finds that the proposed action (preferred Alternative) is consistent with the service- wide no net loss of wetland policy and is acceptable under Executive Order 11990 for the protection of wetlands.

References

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National Park Service 2008. Director's Order #77- 1 (Revised): Wetland Protection . U.S. Department of the Interior. Washington, DC. 4 pp.

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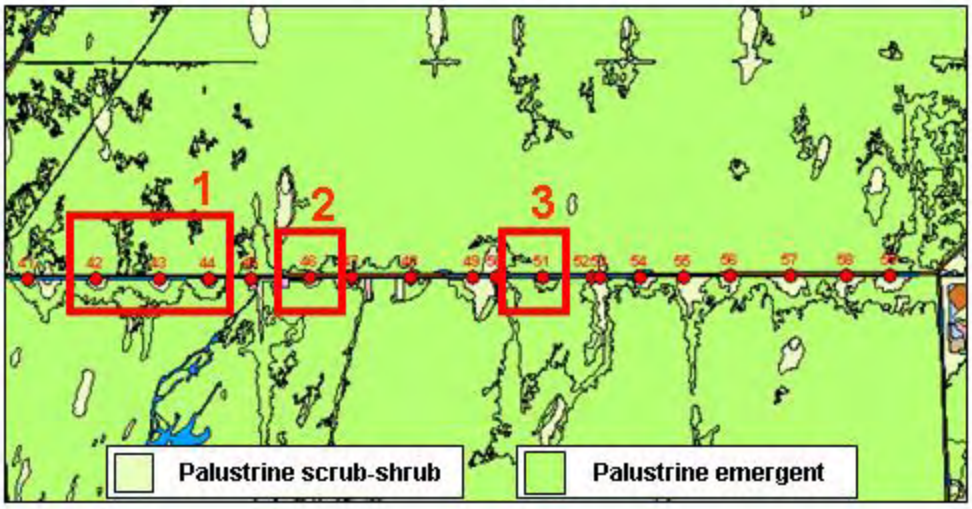
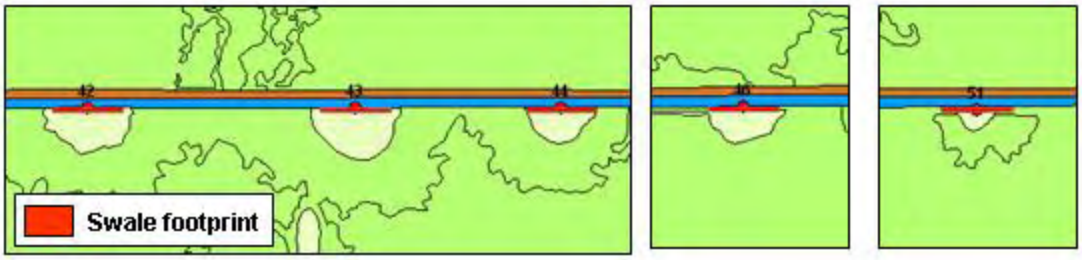
Appendix D

Attachment 1 – National Wetland Inventory Maps for the Project Area

Project Area

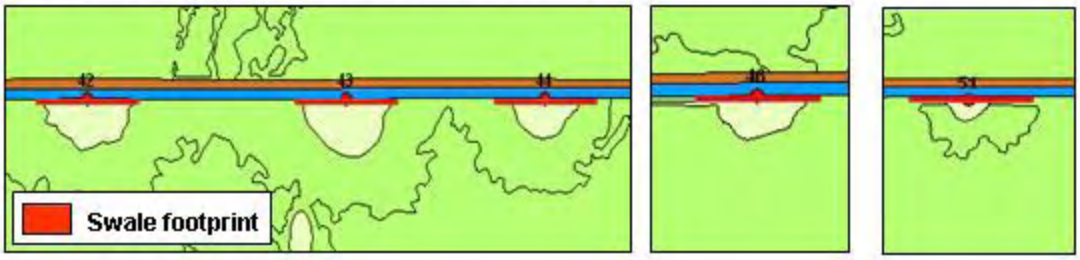


Configuration A- 1030x60 ft swale, bench, and access road



	Culvert				
Vegetation Impacted (ac)	**42**	**43**	**44**	**46**	**51**
Palustrine scrub-shrub	1.449	1.396	1.396	0.108	0.838
Palustrine emergent	0.000	0.053	0.053	1.341	0.612

Configuration B- 1555x60ft swale, bench, and access road



	Culvert				
Vegetation Impacted (ac)	**42**	**43**	**44**	**46**	**51**
Palustrine scrub-shrub	1.731	1.813	1.493	0.302	0.838
Palustrine emergent	0.424	0.342	0.662	1.852	1.317

As the nation's principal conservation agency, the Department of the Interior has the responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

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