Central and Southern Florida Project

Modified Water Deliveries to

Everglades National Park, Florida

8.5 Square Mile Area

General Reevaluation Report

DRAFT

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CONTENTS AND ORGANIZATION OF DOCUMENT SET
General Reevaluation Report and
Supplemental Environmental Impact Statement
8.5 Square Mile Area

General Reevaluation Report
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SECTION 1.0

INTRODUCTION

1.1 PROJECT DESCRIPTION

The 8.5 Square Mile Area (SMA) is an inhabited area bounded on the west by the Everglades National Park (ENP), and separated from more intensively developed urban lands to the east by the L-31N flood protection levee and borrow canal. In 1992, a flood mitigation plan was authorized for the 8.5 SMA as part of the Modified Water Deliveries (MWD) Project. This plan included the construction of a protective levee and seepage canal around the 8.5 SMA that would mitigate for higher stages associated with implementing the MWD Project. Since 1992, several of the other features of the MWD Project have been constructed; however, the full implementation of MWD cannot occur until flood mitigation is provided to the 8.5 SMA.

The fate of the 8.5 SMA has been the subject of much study and debate since the authorization of the MWD Project. Several studies have developed and evaluated new alternatives, and even re-evaluated the potential impacts of previously proposed alternatives. In July 1999, the South Florida Water Management District (SFWMD), the local sponsor for this project, requested that the United States Army Corps of Engineers

(USACE) formally develop and evaluate a full array of alternatives for providing flood mitigation to the 8.5 SMA.

The USACE has prepared this planning document to assist the Governing Board of the SFWMD in its decision to select a Locally Preferred Alternative (LPA). This planning document includes a General Reevaluation Report (GRR) and a Supplemental Environmental Impact Statement (SEIS). Together, these documents provide the Governing Board with information regarding the engineering features, expected performance, and potential impacts of each alternative.

1.2 PROJECT HISTORY

1.2.1 The Central and Southern Florida Flood Control Project. The historic Everglades was originally a broad, shallow wetland flowing imperceptibly from Lake Okeechobee to the mangrove zone at the southern tip of Florida. In an effort to control flooding and better manage water in South Florida, a complex system of canals, levees, structures, pumps, and impoundments known as the Central and Southern Florida Flood Control Project (C&SF) was constructed. Congress initially authorized this project in 1948 and provided additional authorization in subsequent years. Figure 1 depicts the features of the C&SF project.

Following construction of Water Conservation Areas (WCA) No. 3A and 3B and the southward extension of Levee 67 (L-67 ext) in the early 1960's, the natural flows to ENP at the southern terminus of the project became subject to control and dictated by an established regulation schedule. Discharges were sporadic and based on needs to retain water for urban and agricultural use during the dry season, and to maintain flood control capacity in the urban and agricultural areas during the wet season. As a result of severe impacts to ENP from droughts in the mid-1960's, Congress established a minimum water delivery schedule to protect ENP resources (PL 91-282 (June 1970)). This minimum delivery schedule remained intact for much of the 1970's.

The Flood Control Act of 1968 (PL 90-483) authorized the implementation of the Everglades National Park-South Dade Conveyance System. The act provided for modifications to the existing C&SF Project for the purposes of improving the supply and distribution of water supplies to ENP, and for meeting expanded agricultural and urban water needs in Dade County. The construction of the system, which was completed in 1983, included modifications to the original levee and borrow canal L-31 (currently comprised of L-31N and L-31W) and construction of control structure S-331.

1.2.2 Experimental Program of Water Deliveries. Following completion of the ENP-South Dade Conveyance System, the Experimental Program of Water Deliveries to Everglades National Park (*PL 98-181, Section 1302: Supplemental Appropriations Act of 1984, 30 November 1984*) authorized the modification of the Minimum Delivery Schedule (PL 91-282). This program allowed for a two-year experimental program of

water deliveries to ENP for the purposes of developing an improved regulation/delivery schedule. The law also authorized the Secretary of the Army to acquire agricultural lands and construct necessary flood protection measures for the protection of homes affected by the modification of the delivery schedule (i.e., the 8.5 SMA).

In response to PL 98-181, the USACE completed the *General Plan for Implementation of an Improved Water Delivery Schedule to Everglades National Park, Florida* in January 1985, which was approved by the Secretary of the Army on February 28, 1985. This plan recommended: (1) the preparation of a General Design Memorandum (GDM) and an Environmental Impact Statement (EIS) addressing modifications to improve water deliveries to ENP, and (2) extension of the two-year time limit specified in PL 98-181 based on a written agreement between COE, ENP, and SFWMD. The experimental water delivery program was subsequently extended to January 1, 1989 and January 1, 1992 under PL 99-190 and PL 100-676, respectively.

1.2.3 Modified Water Deliveries Project. The Everglades National Park Protection and Expansion Act of 1989 (PL 101-229 Section 104) authorized the Secretary of the Army to construct modifications to the C&SF Project to improve water deliveries to ENP. Alternatives to restore natural hydrologic conditions in the park were evaluated in a General Design Memorandum (Modified Water Deliveries to Everglades National Park, 1992) and Environmental Impact Statement. Specifically, this 1992 GDM addressed the water deliveries through the Northeast Shark River Slough (NESRS) portion of the C&SF Project. Figure 2 depicts the features of the MWD Project.

The authorized plan as presented in the GDM included a flood mitigation system for the 8.5 SMA in the East Everglades. Implementation of the MWD to ENP, as outlined in the GDM, would result in an increase in water flows through NESRS that would raise ground water levels and increase the current spatial extent and frequency of flooding in the 8.5 SMA. The flood mitigation system would prevent the 8.5 SMA from experiencing any increase in flooding as a result of the MWD Project.

The flood mitigation system authorized by the GDM consisted of a protection levee, a seepage canal, and an interior berm. These features surround the area to the north and west and tie into L-31N. Seepage water will be collected in the seepage canal, located between the exterior levee and berm, and conveyed to a pump station on the northeast corner of the project area. This seepage pump station would transfer water into the L-31N canal for conveyance north. See Section 3.4.1 for a full description of the authorized plan.

1.3 NEED FOR PREPARATION OF GENERAL REEVALUATION REPORT

Following project authorization in 1992, there have been several reevaluations of the 8.5 SMA flood mitigation component. Significant improvements to hydrologic modeling capabilities have enhanced our understanding of the restoration requirements of the Everglades ecosystem. The need to integrate the MWD project with the C-111 Project,

which has been designed and partially implemented, became evident. The SFWMD, ENP, and others suggested other potential engineering designs that would meet the needs of the 8.5 SMA community while ensuring environmental restoration of NESRS. Consequently, the SFWMD, ENP, and others have suggested the flood mitigation system, approved by the Corps in 1992, may no longer represent the best alternative for attaining full restoration of NESRS while simultaneously meeting the need for a flood mitigation system in the 8.5 SMA.

The SFWMD, as the local sponsor, has reviewed the previous analysis of the cost of construction, operation, and maintenance of the authorized flood mitigation plan, along with new information and technologies. This evaluation prompted the SFWMD Governing Board to request that the USACE evaluate additional alternatives with respect to the 8.5 SMA.

1.4 PURPOSE OF THE STUDY

The 1992 GDM sought to develop a plan for an improved water delivery system for ENP. The two main objectives of the MWD project were concerned with the park's hydrology and flood protection and/or mitigation. Hydrology is crucial to the Everglades ecosystem and thus is an integral aspect of restoration to the ENP. The hydrology has a direct effect on the plants and animals and has an influence on the overall water quality within the Everglades. Historical flooding and impacts resulting from elevated water levels from the ENP project required flood mitigation for the 8.5 SMA to be a main objective of the MWD project.

At the request of the Governing Board of the SFWMD, the USACE has agreed to develop and evaluate a full array of alternatives to the plan authorized in the 1992 GDM. This GRR/SEIS will be used by the SFWMD Governing Board as a decision document for selection of a LPA for the 8.5 SMA. In addition, the USACE and DOI may also use this GRR/SEIS as a decision document for a new federal action on this project. If this federal action is a plan other than that authorized in 1992, this document will serve as a basis for a Post Authorization Change (PAC) Report.

SECTION 2.0

AUTHORIZED PROJECT

2.1 PROJECT AUTHORITY

Everglades National Park Expansion Act, (PL101-229, Section 104, December 1989). The ENP Protection and Expansion Act, authorized the

Secretary of the Army, upon completion of a GDM, to modify the C&SF project to improve water deliveries to ENP and to take steps to restore ENP natural hydrological conditions. These modifications were specified in a GDM completed by the Corps of Engineers in 1992 entitled Modified Water Deliveries to ENP. In June 1992, the MWD GDM was approved by the Chief of the Engineering Division, Directorate of Civil Works. This approval fulfilled the requirements of Section 104 of the 1989 ENP Protection and Expansion Act, which directed the Secretary of the Army to select the plan that accomplished the goals of MWD to the maximum extent practicable.

A component of the authorized plan in the GDM included the construction of a flood mitigation system for the 8.5 SMA consisting of a levee, berm and seepage collection system surrounding the area to the north and west which ties into
L-31N. The seepage collection canal conveys seepage water to a pump station on the northeast corner and discharges to L-31N Borrow canal.

Interagency Agreement Between the Department of the Interior, National Park Service, and the Department of the Army (Interagency Agreement No. IA-5000-1-9501, June 1991). This agreement was entered into for the purpose of implementing the provisions of the Everglades National Park Protection and Expansion Act of 1989, with specific reference to modifications of the Central and Southern Florida Project to improve water deliveries to ENP. This agreement specified that the National Park Service (NPS) shall make available to the USACE such funds as are appropriated for the USACE's activities authorized under Section 104 of the 1989 Act. As such, DOI, through the NPS, is funding 100% of the initial cost of the authorized project, and the Corps. is funding 75% of the operation and maintenance cost. This agreement is the current mechanism used by the Department of the Interior to transfer funds to the U.S. Army Corps of Engineers (COE) for implementation of the project features associated with the MWD project.

Everglades National Park Protection and Expansion Act of 1989, Amendment (PL 103-219, 9 March 1994). This act amended the original act (PL 101-229) by adding an additional section pertaining to land acquisition. The amendment allows for the Secretary of the Interior to provide up to 25% of the funding for land acquisition in the Frog Pond, Rocky Glades Agricultural Area, and 8.5 Square Mile Area.

National Park Service Everglades National Park Land Acquisition and Management Grant Agreement (GA5280-5-9007). ENP executed this grant agreement with the South Florida Water Management District (SFWMD) for purposes of transferring funds from the Department of the Interior (DOI) to SFWMD to assist the state in acquiring lands in the Frog

Pond, Rocky Glades, and the 8.5 Square Mile Area which affect the restoration of the natural water flows to the Park and to Florida Bay. Transfer of funds is contingent upon a requirement that any lands acquired shall be managed in perpetuity for such restoration.

2.2 DESCRIPTION OF AREA OF POTENTIAL EFFECTS

The GDM for MWD to ENP dealt with a project area that included the ENP, East Everglades, and Water Conservation Area 3. That area is located in Broward and Dade Counties, west and southwest of the Ft. Lauderdale - Miami metropolitan area and is fully described in the GDM. The focus of this document is on the 8.5 SMA component of the Modified Water Delivers to ENP. Its name notwithstanding, the 8.5 SMA presently encompasses nearly 10 square miles of mixed use development. Also known as the East Everglades Agricultural and Residential Area, the 8.5 SMA is located in the East Everglades, approximately 20 miles southwest of Miami, approximately 10 miles north of Homestead, and 6.6 miles south of U.S. Highway 41 (Figure 3). It is bounded on the east by L-31N, on the west by ENP, on the north by SW 104th Street, and on the south by SW 168th Street (Richmond Drive).

However, for the purposes of this reevaluation, the area that has been studied (hereafter called the "area of potential effects") encompasses any area where impacts from this project may occur. Therefore, the 8.5 SMA study area is bounded roughly on the west and north by NESRS, on the south by the Taylor Slough headwaters and on the east by the urban and agricultural areas east of L-31N. Figure 3 shows the location of the 8.5 SMA and the general features of the area of potential effects.

The following sections contain a general description of resources, features, problems and needs relative to the area of potential effects. More detailed information about these and other issues is included in later sections of this report and in the SEIS.

2.2.1 Geographic/Watershed Features. Geographically, the 8.5 SMA lies within a region commonly referred to as the Rocky Glades, occupying the western slope of the Atlantic Coastal Ridge (Figure 4). The Rocky Glades forms a narrow transitional area between the Shark River Slough and Taylor Slough Headwaters physiographic zones. It also comprises a significant topographical, geological, hydrological, and ecological transition between the Atlantic Coastal Ridge proper and the Everglades trough. Topographic elevations range from 5.0 to 8.5 feet NGVD with the higher elevations (above 7.0 feet) generally in the east and southeast portions of the 8.5 SMA.

The geology of the area is characterized by the highly transmissive, water bearing, unconfined limestone Biscayne Aquifer. The aquifer extends from the Broward-Palm

Beach County boundary southward through Dade County. It is the sole source of potable water in Dade and Broward Counties and one of the most permeable aquifers in the world. The U.S. Environmental Protection Agency has designated the Biscayne Aquifer as a "sole source" aquifer under the provisions of the Safe Drinking Water Act of 1974. The aquifer is exposed at the surface in most of the area or is covered by a thin mantle of soil and/or plant material. Limestone makes up approximately eighty percent of the volume of the aquifer formation. Water levels within the rock formation annually rise to the surface in response to summer and fall precipitation (the wet season), inundating vast portions of the area.

Local rainfall is a significant source of freshwater in the area. After intense precipitation, surface water is removed either through evapotranspiration, seepage to the underlying Biscayne Aquifer, or drainage through the L-31N Canal along the eastern portion of the 8.5 SMA. Excess rainfall, particularly during the wet season, often inundates most of the 8.5 SMA, which historically contributed to the sheet flow that supplied surface water to the ENP on a regional scale. Canals, such as L-31N, tend to speed surface water drainage and preclude the natural seepage process to the underlying aquifer.

2.2.2 Natural and Cultural Resources. Prior to settlement and development, lands within this part of the eastern Everglades were a mosaic of prairies, varying in surface elevation, hydroperiod, and vegetation. Today, the 8.5 SMA is a patchwork of agricultural, residential and rural development. Rural development, including residential, commercial and recreational uses, is most concentrated in the eastern one-third of the area adjacent to the L–31 canal. Lower density residential and agricultural development with scattered vacant lots and wetlands comprise the central portion of the area. The western one-fourth of the area is dominated by a mixture of graminoid wet prairies and shrubby wet prairies with limited rural development. ENP lands located adjacent to the 8.5 SMA, are mostly natural areas existing as a mosaic of long and short hydroperiod graminoid wetlands, abundantly interspersed with willowheads, bayheads, and hardwood hammocks.

Most existing uplands in the 8.5 SMA have been converted for agricultural uses. This was accomplished by "rock plowing," a mechanical process that evened out the topographic high points and raised the surface of the intervening low points, allowing the cultivation of winter crops on the rocky soil created. Other upland areas have been developed for residential or commercial uses, employing land management practices that often discourage the growth of native plant species. Remaining undeveloped uplands generally contain dense stands of Australian Pine and/or Brazilian Pepper, sometimes intermixed with sparse areas of sawgrass.

There are four herbaceous wetland cover types in the Everglades: (1) Sloughs with deep, permanent water levels, (2) sawgrass marshes with semi-permanent water levels and long hydroperiods, (3) wet peat prairies, and (4) wet marl prairies with shorter hydroperiods. These are characterized by the average flooding depth and the duration of the flooding period, and by their predominant plant cover.

The vast majority of wetland features within the 8.5 SMA have undergone varying degrees of disturbance related to land clearing for agricultural or residential improvements and invasion by exotic species. Wetland communities exist primarily within the western portion of the 8.5 SMA, and sporadically within the central region of the area. Eastern portions of the 8.5 SMA are generally absent of recognizable wetland communities.

The native wetland communities of the 8.5 SMA range from freshwater marsh to wet prairie, dotted by tree islands. Tree islands are sometimes considered a wetland type, but generally occupy mounds on higher lands, where flooding is infrequent. This vegetation is underlain by a unique soil born of exposed limestone and marl. Less-disturbed wetlands along the western extremity of the 8.5 SMA consist of muhly grass vegetative community that dominates the landscape at higher surface elevations and sawgrass dominates in the lower, wetter elevations. These vegetative communities generally exist in a mosaic of interspersed short and long hydroperiod wetlands. Within the more developed and disturbed areas of the 8.5 SMA, exotic species invasion and land management limits natural trends in plant dominance.

A variety of species listed as threatened, endangered, or of special concern occur or potentially occur in the study area. Federally listed species that could occur in the action area or be affected by construction and operation of the proposed action include the Snail kite, Wood stork, Cape Sable seaside sparrow, Florida panther, and eastern Indigo snake. Species listed by the State of Florida as threatened, endangered, or species of special concern include various reptiles, birds, fish, mammals, and mussels. Complete descriptions of all species of concern are included in the SEIS. The on-going invasion by exotic trees, the altered hydrology of the marl prairies, reduced hydroperiod, and the lack of preferred habitat within the 8.5 SMA reduces the potential for the occurrence of these species.

There are currently no known archaeological or historical sites within the 8.5 SMA. There is a high probability that unrecorded archaeological sites are present at one or more of the ten to twelve tree islands that were historically present within the 8.5 SMA. Section 106 Consultation, under the National Historic Preservation Act, is on-going. Results of that consultant will be incorporated in the Final SEIS.

2.2.3 Socioeconomic/Political Conditions. An existing land use survey was completed in January 2000 by the Miami-Dade County Department of Environmental Resource Management (DERM). This study confirmed that, in general, the residential and agricultural areas are located on the eastern half of the 8.5 SMA and vacant land and wetlands are on the western half.

According to the DERM, the 8.5 SMA land is currently distributed as follows: 28% is agricultural, 18% is residential, 5% is government owned, less than 1% is commercial, and 49% is vacant. The overall existing residential density averages one unit per 20 acres. The agricultural land is utilized primarily for field crops. The western third of the 8.5 SMA is comprised mostly of mixed wetland hardwoods, freshwater marshes, and wet

prairies.

The future use of land is regulated by the adopted comprehensive plan for the governing local jurisdiction, as required by Florida law. The Comprehensive Development Master Plan (CDMP) for Miami-Dade County (adopted in May 1997 and amended in April 1999) establishes controls for future development in the 8.5 SMA. Consideration of one unit per 5 acres is possible only after drainage facilities become available to protect the area from a one-in-10-year flood event.

The East Everglades Overlay Zoning Ordinance, adopted by Miami-Dade County in 1981, includes incentives to limit future development within the area by offering transferable development rights. An "Open Land" classification is designated in the Land Use Element and the Land Use Plan Map for 2005 of the CDMP. This classification is intended for uses other than urban development, such as resource-based activities, recreation, and conservation. The 8.5 SMA is specifically identified in the CDMP as Open Land Subarea 4, East Everglades Residential Area.

2.2.4 Current Flooding Problems. The 8.5 SMA receives no flood protection benefits from the greater C&SF project. As a result, the area is subject to frequent flooding problems, particularly during the wet season. Much of the development in the area occurred during the 1970's, a decade of generally below normal rainfall with no major storms. In 1981, heavy rains associated with Tropical Storm Dennis (August through September) flooded the area and resulted in an extreme flooding event. This event also caused concern with the flooding of septic tanks and potential contamination of the groundwater.

Most recently (1999), Hurricane Irene impacted the 8.5 SMA with water levels similar to those experienced during Tropical Storm Dennis in 1981. Surface water levels in the area remained elevated long after the passage of the storm, resulting in property damage and loss of crops. Losses throughout Miami-Dade County due to Hurricane Irene were approximately $77,000,000 for vegetables, $2,500,000 for field crops, $150,000 for aquaculture and $126,000,000 for ornamental crops.

Periodic high groundwater stages in the 8.5 SMA have attributed to the following: deterioration in unimproved roads; damage to septic tank systems; damages to potable wells due to septic tank problems; and damages to residences due to flooding. Agricultural interests in the 8.5 SMA have experienced periodic crop losses due to root zone inundation by elevated groundwater.

2.2.5 Flood Mitigation Needs. The General Design Memorandum for the Modified Water Deliveries Project, as authorized in 1992, provided for a flood mitigation system for the 8.5 SMA. This system was designed to mitigate for any increase in flooding that might result from higher stages associated with the MWD Project. It is a requirement of the re-evaluation to analyze alternatives that provide no increase in flooding above and beyond what existed prior to the authorization of the MWD Project.

As the authorized Modified Water Deliveries Project is implemented, the net increase in water introduced to NESRS is expected to raise groundwater elevations in adjacent development areas of the East Everglades. As a result, the volume of groundwater storage available to retain rainfall runoff would be reduced and the area would be more susceptible to flood damages. The additional increase in flood depths would range from about 0.3 feet in the north part of the residential area to about 0.1 feet in the agricultural area. The planned mitigation system outlined in the 1992 GDM is designed to address these increased levels and maintain the current level of flood protection within the 8.5 SMA.

2.3 DESCRIPTION OF THE AUTHORIZED PLAN

The authorized plan for the 8.5 SMA is documented in "General Design Memorandum and Environmental Impact Statement and Appendices, Modified Water Deliveries to ENP, Part 1, Agricultural and Conservation Areas, Supplement 54, June 1992." The plan is shown on Plate 27 of the GDM and Figure 4 of this document. A description of how this plan was selected is included in Section 3.3.2.

2.3.1 Description. The plan includes a double levee surrounding the area to the north and west tied into L-31N and a seepage collection canal within the leveed area to convey seepage to a pump station at the northeast corner of the 8.5 SMA. The levee and seepage collection canal are designed to mitigate for increased flood risk as a result of projected increased water levels in NESRS and other portions of ENP. The outer levee would be constructed on the perimeter of the 8.5 SMA, terminating in the south at Richmond Drive. The seepage canal would be located approximately 500 feet east of the center of the exterior levee. From north to south, the canal narrows and becomes shallower. The canal width ranges from 45 feet in the north to only a few feet in the south. The canal depth ranges from 12 feet in the north to approximately 6.5 feet in the south. An inner berm is included to prevent sheet flow from the 8.5 SMA from entering the seepage collection canal. Pump station S-357 would be constructed at the northeastern terminus of the 8.5 SMA seepage collection canal to pump seepage water to L-31N for conveyance to ENP and NESRS via L-29.

2.3.2 Funding. According to the 1992 GDM, all first costs shall be 100% Federal responsibility and shall include the value of lands, easements, rights of way, and relocations required for construction of the project. Operation and Maintenance (O&M) and Repair, Replacement and Rehabilitation (RR&R) costs shall not be more than 75% Federally funded. Acquisition of lands for ENP expansion shall be in accordance with PL 101-229 and cost shared between the Department of the Interior and the State of Florida.

2.4 ENVIRONMENTAL CONCERNS

A public scoping coordination process was developed and implemented during the early development of this study. From April to June 1999, input

was received from various agency and stakeholder groups. Environmental issues were identified and included in a formal scoping letter distributed to the public in June 1999. Preliminary environmental concerns listed in the scoping letter include:

- Effect on natural system and ENP
- Social, economic, and environmental effects on the residential community within the 8.5 SMA
- Water management to provide continued existence and recovery of the Cape Sable Seaside Sparrow
- Effects on Native American interests
- Effects on farmlands within the 8.5 SMA and adjacent agricultural areas
- Potential contamination transport by surface and groundwater to the adjacent environment
- Secondary, cumulative impacts from providing flood protection beyond the flood mitigation plan

As a result of public comments received during the scoping process, additional environmental concerns were identified. These include:

- Need to conduct a thorough scientific and engineering evaluation of all alternatives
- Long-term effects of the alternatives on surrounding natural and physical resources
- Cumulative impacts of alternatives relative to other features in the MWD project
- Complete economic analysis of all alternatives and their impacts
- Compatibility with the Comprehensive Everglades Restoration Plan (CERP) and other related Everglades restoration projects
- Historic and cumulative loss of additional areas adjacent to the 8.5 SMA
- Water Quality impairment from areas within and adjacent to the 8.5 SMA
- Impacts to recreational amenities currently enjoyed in the area
- Land use changes required or expected from each alternative
- Effect of schedule delay for completion of the project on existing natural and cultural resources
- Geographic extent of the study

2.5 ITEMS OF LOCAL COOPERATION

A primary component of local cooperation is the Project Cooperation Agreement (PCA). A PCA is a legally binding document between the Federal government and the local sponsor, identifying the sponsor duties and obligations for the project. The South Florida Water Management District, as the local sponsor for this project, represents local interests and has certain responsibilities for cost sharing and long term project maintenance and operation.). A PCA, executed in September 1994,

defined the responsibilities of the USACE and the SFWMD for the entire MWD Project. If an alternative other than the authorized plan is selected, a PCA Amendment will be executed between the USACE and the SFWMD, defining the requirements of each party for implementing, maintaining and operating the system.

The specific requirements of local cooperation for the MWD project will comply with the following guidelines according to the GDM:

a. "Contribute a minimum of 25% of total costs needed to operate and maintain, repair, replace, and rehabilitate the project works involved to mitigate the increased risk of flooding in the residential area including the levee and canal system, the pumping stations, and the structural works and modifications in the Water Conservation Area No. 3 and adjacent canals."

b. "Hold and save the United States free from damages due to the construction or subsequent operation and maintenance of the project, except any damages due to the fault or negligence of the United States or its contractors."

c. "Prevent encroachment on the flood-carrying capacity of the project including the culvert system under the U.S. 41 road."

d. "Maintain and operate the works after completion in accordance with regulations prescribed by the Secretary of the Army, except for the water control structures and outlets in Water Conservation Area No. 3, which will be maintained and operated by the Corps of Engineers."

2.6 ROLE OF PROJECT SPONSOR DURING PROCESS

In April 1999, the Governing Board of the SFWMD requested that the USACE develop and analyze a full array of alternatives for providing flood mitigation to the 8.5 SMA. Staff at the SFWMD has worked with the USACE, along with other cooperating agencies, to develop the nine proposed alternatives, and provide the analysis as contained in this planning document. This analysis will be in the form of a planning

document consisting of a Draft GRR and Draft SEIS. During the public comment period, the Governing Board may select as its preferred alternative a plan other than the authorized plan. This alternative will be known as the LPA.

If the Governing Board selects an alternative other than the federally preferred plan, then the SFWMD, as the local sponsor, will be responsible for paying any additional initial and O&M costs above that of the federal plan. At this point in the decision process, the federally preferred plan is Alternative No. 1, the Authorized Plan.

2.7 PUBLIC COORDINATION

This reevaluation study has provided public involvement since the onset of the project and included numerous public forums for residents, cooperating agencies, and affected stakeholders to present their issues and concerns.
Table 1 summarizes public comment and interagency coordination to date.

Meetings held to specifically discuss this project included agency and stakeholder scoping meetings, technical team meetings, and formal public meetings. Critical comments were received from residents and non-residents, business owners, elected officials, special interest groups, tribal representatives and environmentalists. During formal public meetings, all input was documented on tape by a stenographer and comment cards were kept as a record. At the technical meetings, input was received from agency representatives, special interest groups, and other various stakeholders. Cooperative efforts were pursued to gain an understanding of issues and include input in the most effective manner possible.

All public meetings were announced at least two weeks in advance while technical meetings were open to all interested parties who were notified via a network of electronic mail and telephone correspondence. In an effort to gather as much information and insight as possible, several visits were made to the
8.5 SMA, hosted by residents, business owners, and government agency and tribal representatives.

SECTION 3.0
PLAN FORMULATION

3.1 INTRODUCTION/FORMULATION METHODOLOGY

The plan formulation process involved identification of problems, development of alternative plans to resolve the problems, and evaluation and comparison of the alternatives. The following was accomplished:

- Problem Identification. Input was solicited from stakeholders on water and related land resources problems and opportunities specific to the area. An assessment was made of existing conditions and expected future conditions, and concise statements were developed about specific problems and opportunities.
- Development of Alternative Plans. Nine alternatives were developed based on comments and feedback with affected stakeholders and coordinating agencies.
- Evaluation of Alternatives. Requirements and objectives were developed for the project, resulting in specific performance measures. Each alternative was evaluated to determine its performance toward meeting the project objectives and requirements.
- Comparison of Alternatives. Comparisons of the results for each alternative were made and presented.

A detailed discussion of each of these steps is continued in this GRR.

3.1.1 Previous Studies

The 8.5 SMA has been the subject of several previous studies that have set the stage for the current investigation. The most relevant of these studies are summarized/referenced in the following paragraphs. This summary provides some background of the plan formulation accomplished previously and that to be performed for this investigation.

The General Design Memorandum and Environmental Impact Statement, Modified Water Deliveries to ENP, June 1992. This document describes the evolution of alternative plans considered for improving water deliveries to ENP. It describes the relationships between hydrologic and ecologic conditions in the Everglades, historic conditions, the existing base condition (approximated by the "Base 83" condition used for this reevaluation), and the expected future condition of the Everglades without any project to improve water deliveries. The report also explains the chronological formulation of alternative plans. The process of formulating alternative plans proceeded through a series of planning iterations, or steps, during which certain conditions led to the development of a set of alternative plans. These plans were evaluated and rejected or selected for further improvement and analysis. Basic alternative plans were developed to meet the objectives of location, timing and volume of water to be delivered to ENP. In addition, several measures were required to be added to plans to mitigate for induced flood damages in certain areas. The residential portion of the East Everglades (8.5 SMA) was one of the areas where mitigation was necessary.

Two basic approaches were investigated to reduce or prevent increased flood damages in the developed 8.5 SMA. The approaches were a non-structural plan, which involved acquisition of all lands adversely impacted by the increased water depths, and various structural measures. These plans are summarized in the matrix shown in Table 16 of the 1992 GDM. Analysis of the various plans led to the selection and authorization of Plan G as the final Plan of Improvement for the 8.5 SMA. The plan is shown on Plate 15 of the 1992 GDM.

East Everglades 8.5 Square Mile Area Study Committee. On July 20, 1994, Governor Lawton Chiles issued Executive
Order 94-187, establishing the East Everglades 8.5 Square Mile Area Study Committee. The Committee was charged with analyzing the hydrology and ecology of the 8.5 SMA within western Dade County and its relationship to the protection and restoration of ENP and Florida Bay. The Committee was further directed to study the environmental and economic impacts of alternatives designed to preserve the natural values of the region while protecting the 8.5 SMA. In April 1995, the Committee issued a report to the Governor presenting the results of its evaluation and recommendations to implement a flow-way/buffer alternative for the 8.5 SMA. A complete description of the work by the Committee can be found in the Report to Governor Lawton Chiles, dated April 1995.

District Review Team. In 1996 the SFWMD formed an interagency team to evaluate and oversee the development of the alternatives proposed by the Governor's Committee and others. It consisted of representatives from ENP, SFWMD, USACE, Metro-Dade County Department of Environmental Resources Management (DERM), Florida Department of Environmental Protection (FDEP), and the United States Fish and Wildlife Service (USFWS). Working with a consultant team, this group developed and evaluated six alternatives to provide flood mitigation to the
8.5 SMA.

The analysis of these alternatives is contained in the Final Report, Alternative Land Use Analysis, Eight and One-Half Square Mile Area, August 1998, prepared by PEER Consultants ("the PEER Report").

3.1.2 Process for Developing Current Alternatives

Evaluation of these and some of the previous alternatives for the 8.5 SMA are the subject of this document. The following process was followed in developing the final list of alternatives for the
8.5 SMA:

- **Previous Studies.** The study team conducted a thorough review and evaluation of previous studies in order to gain an understanding of which features of structural and non-structural alternatives have potential to meet the goals, requirements, and objectives of the project. The technical and procedural analysis of these studies provided valuable technical insight during the process

of identifying viable alternatives.

- **Technical Coordination Meetings.** A series of technical meetings was conducted by the USACE with coordinating and cooperating agencies, and effected stakeholders associated with the project. During these meetings, technical professionals suggested new alternatives for consideration as well as discussed merits of previously studied alternatives and suggested modifications.

- **Public Coordination Workshops/Meetings.** Numerous meetings and workshops have been held with the public since the development of the PEER Report. During these meetings, comments have been received from residents, concerned citizens, environmental advocates, and local, state, federal and tribal agencies. From July to October 1999, the public was given an opportunity to comment on eight alternatives presented for this project. Comments received resulted in incorporating modifications to several of the eight alternatives and the addition of a ninth alternative for consideration.

During the conduct of modeling and design, modifications to the features of several alternatives were added to improve cost-effectiveness and performance.

3.2 PROJECT CONDITIONS

The focus of this analysis is on the 8.5 SMA. However, due to the sensitive hydrologic interconnection of all components of the Everglades, discussion of the broader system is necessary to establish a basis for evaluation of alternatives. Therefore, the base, existing, and future without project conditions, for the broader system and the 8.5 SMA are presented below. For purposes of this analysis, the conditions are defined as follows:

- Base 83 (Pre-MWD): This is the condition of the area of potential effects as it existed prior to the MWD Project. It assumes stage and flow conditions and operations as authorized in 1983.
- Base 95 (Existing): This is the condition of the area of potential effects as it exists today, as measured and observed during the conduct of this reevaluation.
- Future Without Project: This is the condition of the area of potential effects as it would be expected to exist in the future, after the authorized project was implemented. This is the base for which the "future with project" scenario will be compared.

A specific description of each of the project conditions is included in Section 4.0 of this report.

3.2.1 Base 83

There is no specific description of the Base 83 project conditions for the 8.5 SMA. However, information contained in the 1992 GDM detailed the condition of the environment and resources within the modified water deliveries study area prior to the project. It contains a snapshot of this broad area as it appeared to the MWD study team. As such, it represents the best information available for the background, conditions, and features of the MWD area for the Base 83 conditions. Therefore, the Base 83 project conditions for the 1992 MWD GDM/EIS have been used for comparative purposes to give background for Base 83 for the 8.5 SMA.

A summary of the pre-MWD project conditions was presented in the 1992 GDM, and is included below as a base for conditions as they existed prior to the MWD project.

C&SF Project. The C&SF project provides essentially all water deliveries, other than direct rainfall, to the NESRS. In total, the project's three Water Conservation Areas, WCA Nos. 1, 2 and 3, include the largest remaining portion of undeveloped Everglades in existence. WCA No. 3 is the largest and southernmost of these areas, with a total size of about 915 square miles. L-67A and L-67 C divide the WCA into two segments, 3A on the west (760 square miles) and WCA NO. 3B on the east (155 square miles).

In order of contributing magnitude, the three major sources of surface water in the study area during a normal meteorological year are:

1. In-situ rainfall
2. Regulated discharge of water from WCA No. 3A, through the S-12 structures, into ENP, and
3. Seepage from WCA No. 3B through L-29 into the Tamiami Canal and, then, through culverts into NESRS.

An average annual rainfall of about 58 inches contributes about 2.5 million acre-feet of water to the study area.

The operation of the project to deliver water to ENP is governed by the requirements of PL 91-282, which was enacted in June 1970 following droughts in the early 1960's. This law established a minimum schedule of water volume to be delivered to ENP through three delivery points: Shark River Slough and two locations east of the study area. The minimum delivery to Shark River Slough was set at 260,000 acre-feet annually, which must be distributed in accordance with a monthly schedule of minimum water releases. In times of water shortage, the law allows deliveries to be cut back to a volume representing 16.5 percent of the total volumes released from the C&SF Project.

Actual water volumes delivered from the C&SF Project through Shark River Slough to ENP are determined based on Federal regulations, the physical capabilities of the system, and management decisions of USACE, ENP, and the South Florida Water Management District. The principal governing factor in deciding the volume of water to discharge is the stage (height) of water in WCA No. 3A. Operating practice has been to provide monthly deliveries as close to delivery schedule as is possible without a deficit whenever water in WCA No. 3A is below regulation schedule. This is done to maintain sufficient storage in WCA No. 3A both to ensure that water is available for subsequent Park deliveries, and to satisfy other purposes of the project, such as storage for wildlife conservation and aquifer recharge.

When water released from WCA No. 3A is not sufficient to keep WCA No. 3A from exceeding its schedule stage, additional "flood" releases are made to lower the stage in WCA No. 3A. The S-12 structures are the main means of discharging floodwaters. Minor flood releases can also be made, under certain conditions, westward into Big Cypress and eastward, via S-151, into WCA
No. 3B.

Average annual discharge of water into ENP through the S-12 structures for the period of January 1971 through December 1987 was about 392,000 acre-feet, which was 51 percent above the 260,000 annual minimum delivery schedule. The extra water was almost entirely a result of flood releases from WCA No. 3A that were made in order to keep the stage within the regulation schedule. Most of the excess was delivered during the months of July through October, which is during the normal wet season. The greatest release as a percentage of the delivery schedule occurred during the period March through August.

Water Quality. The quality of water delivered to ENP is frequently influenced by urban and agricultural activities elsewhere in the watershed. Of particular concern are floodwaters released from the Everglades Agricultural Area (EAA) into WCA No. 3A. The Everglades is a nutrient poor system and the introduction of nutrients, particularly phosphorus, from the agricultural areas is thought to have significantly affected sawgrass and wet prairie habitat in the water conservation areas through which EAA discharges pass en route to ENP. Large acreage in WCA Nos. 1, 2, and 3 has been converted to cattail, an otherwise uncommon plant in the Everglades, as a result of nutrient increases. Lower in the WCA system, particularly in the southern portion of WCA No. 3A and in the Shark River Slough, there is yet relatively little conversion to cattail. This is thought to be the result of the removal of nutrients by vegetation upstream. Water that reaches the S-12 release structures in L-29 through sheet flow over WCA No. 3A showed phosphorus levels of less than ten parts per billion total phosphorus, whereas water delivered through the L-67A canal frequently exceeded thirty parts per billion total phosphorus. However, total phosphorus concentrations vary seasonally with annual rainfall amounts and were often higher following periods of severe drought. The average seemed to vary between eight and fifteen parts per billion.

Periphyton. Periphyton is the community of small to microscopic algae that grow

attached to the stems and leaves of the dominant prairie and marsh plants. They are believed to be a crucial component of the marl-forming process. Loss of historic inflows has reduced the aquatic productivity of ENP by reducing the aerial extent of the periphyton community. Reduced flows also appear to have affected periphyton species composition. Studies have shown that the taxonomic composition of Park periphyton was significantly correlated with hydroperiod length and soil percent organic matter, which are both largely regulated by water management activities. Shortened hydroperiods and low percentages of soil organic matter favored the development of blue-green periphyton over other groups of algae, such as diatoms and green algae. Other studies have shown that both fish and invertebrate grazers selected against blue-greens, favoring diatoms or green algae as a preferred food source.

Vegetation. Wetland communities occupy most of the East Everglades. The most common community in the East Everglades is sawgrass marsh (about 37% of the area as stated in the 1992 GDM), with the combined mesic grass communities, such as muhly grass and beard grass, ranked second (about 30% of the area). In the NESRS, some ecological modifications to the natural plant communities occurred because of the changed hydroperiod and fire patterns.

Beginning in the 1930's, several exotic plant species became established in parts of ENP and adjacent areas. Aquatic weeds are present, but have yet to pose a major problem in ENP. Three woody exotics pose threats to ENP: Casuarina (Australian Pine), Melaleuca (Cajeput Tree), and Schinus (Brazilian Pepper). While exotics invade a variety of natural plant communities, their spread in wetlands is attributed primarily to the decline in vigor and health of the natural communities, mostly associated with reductions in water depths and hydroperiods. The invasion of Melaleuca has been a problem in NESRS.

Birds. About 300 species of birds have been identified in ENP. Southern Florida's location makes it a migratory crossroads for West Indian and Central and South American birds; numerous North American species are residents. Many of this continent's species of wading birds, shorebirds, and waterfowl are represented here at some time of the year. Many of them are nesting residents, including some which seldom range farther north and others that have disappeared from areas where they once occurred.

Between the late 1970's and 1987, nesting colonies of wood storks and other colonial nesting wading birds in ENP experienced perhaps the most rapid rate of decline of any decade in south Florida history. The mean annual breeding population of storks was only 374 pairs in the 1980's. Fewer than 2,000 pairs of great egrets and 1,500 pairs of snowy egrets nested in mainland colonies of ENP and WCA No. 3 in the 1980's. Only 2,500 pairs of white ibis in 1986, and 5,000 pairs in 1987, nested in the entire region.

Beginning in the early 1960's the distribution of water deliveries has affected wading birds mainly in two ways. First, the concentration of southward water flow in the Everglades into the northern portion of ENP resulted in a longer hydroperiod in the wetlands that received the flow, and in long-delayed and incomplete dry season

drawdowns. Often, food was never sufficiently concentrated and available to support major wading bird nesting attempts. Or, as was commonly the case with wood storks, food became available only late in the dry season, and nesting was delayed so that it could not be completed before the beginning of the summer rains. Second, the already reduced foraging area available to wading birds was sharply diminished by eliminating flow to NESRS. This probably resulted in a substantial decline in aquatic productivity and loss of a significant portion of the available early dry season feeding habitat. Loss of these early season foraging areas meant that storks shifted their feeding to the more deeply flooded central Shark River Slough. Thus, it abruptly became the drier years, when water was low enough in the central slough to support early winter foraging by waders, that became the successful nesting years. Because of additional reductions of productive foraging area, however, nesting attempts have also become increasingly subject to disruption by dry season rainfall events that interrupt the seasonal drawdown.

Fisheries. ENP's waters support a large variety of fish in both freshwater and saltwater habitats. Fish populations in ENP's portion of Shark River Slough are seasonally and annually variable, being affected by both ambient and antecedent water conditions. Density and diversity are highest during extended high-water periods without severe drawdown. In contrast, high water conditions without seasonal fluctuations do not make fishes available to wading birds. Fish populations in NESRS are about thirty percent less dense than those in the slough marshes within ENP. These lower densities are attributed to the long-term reduction of hydroperiods in NESRS marshes since the early 1960's.

Endangered Species. In 1992, the MWD study area included sixteen animal species that were listed as threatened or endangered under the Endangered Species Act. The Environmental Impact Statement (EIS) attached to the 1992 GDM includes additional information about these species.

Fire. In the drier conditions of the last four decades, destructive fires, primarily of the incendiary dry season type, have destroyed or damaged numerous tree islands, pinelands, and wetlands with organic soils in ENP. Many of these fires have entered ENP from East Everglades, where unusually dry conditions have permitted fires to spread rapidly and broadly. These fires, along with unfavorable hydrologic conditions, have weakened individuals of native plant species, permitting the establishment of exotic species, particularly Schinus on tree islands and Melaleuca in marshes and islands.

Development in East Everglades. Human development in the study area in the early 1990s was limited to the East Everglades. This included about 6,900 acres primarily in residential development, about 5,600 acres in agricultural development, and about 107,600 acres in the southern portion of NESRS in private and public ownership (SFWMD owned 35,000 acres) that is essentially undeveloped. There were approximately 8,300 private owners in the NESRS portion of the East Everglades.

Residential Development. Residential land lies primarily in a narrow tract parallel with and extending several miles west of L-31N. As of 1978, there were 139 permanent homes, including 60 mobile homes, in the area serving as residences for farmers and

commuters to Miami. The total resident population of the entire East Everglades in 1992 was estimated to be 430 individuals.

Much of the East Everglades is flood prone under current conditions. Recognizing the wetland nature of much of the area, zoning restrictions have been imposed by Dade County to curtail further residential development. However, current zoning restrictions have not been enforced. Parts of the residential area are developed more densely than the current zoning would allow because many houses in the area were constructed when the zoning limit was one unit per five acres.

Commercial Development. Commercial enterprises in the East Everglades were along the eastside and consisted of several nurseries, a kennel, a fruit-packing house, and a rabbit farm. On the Tamiami Trail, there was a commercial airboat operation, a gas station, a restaurant, and souvenir shops.

Agricultural Development. About 3,000 acres of land were under agricultural cultivation within and adjacent to the East Everglades residential area paralleling L-31N. In the order of total acreage planted, the primary crops were: winter vegetables (tomatoes, squash), tropical vegetables, tropical fruits (Persian limes, lemon-limes, mangoes), and ornamentals. The Natural Resource Conservation Service of the U.S. Department of Agriculture considered the area to be unique farmland because it is in a frost-free climate permitting the production of winter crops.

Recreation. ENP is the primary recreational resource in the study area. In 1992, the average annual Park attendance was estimated at about one million visitors. ENP contains numerous sites and interpretive trails for observing the natural environment. At Flamingo, which is adjacent to Flamingo Bay at the southern tip of mainland Florida, there are facilities for boating, fishing and camping. Chekika State Park, located on Grossman Hammock in the East Everglades, includes camping, picnicking, and interpretive nature facilities. The Kendall Gliderport near the State Park provides opportunities for soaring and skydiving. Most of NESRS is used for recreational activities such as air boating, hunting, and fishing.

Cultural Resources. The MWD study area contained several cultural resource sites. Historical use of the Everglades by aboriginal peoples is evidenced primarily by black earth middens and burial grounds, both usually located on high ground such as tree islands. The middens were typically seasonal camps used by small bands of people in foraging for wildlife and growing food crops. The Shark River Slough contains many such middens or burial grounds located on the characteristic tree islands. The site of Fort Henry, the Army supply depot in the Everglades during the Seminole Wars, is located in the East Everglades. Approximately ten sites in the East Everglades are now included on the State of Florida Archives Master Site File and many more lie within ENP.

3.2.2 Base 95

This represents existing conditions related to the operating plan currently in effect as authorized in the 1995 experimental deliveries plan for hydrologic conditions. All other conditions of concern are being addressed in detail through development of a Supplemental EIS ongoing concurrently with this analysis. A summary of existing conditions is included below.

Hydrologic Conditions. Local rainfall is a key component of the local hydrology in the 8.5 SMA. The area receives an average of about 58 inches per year. Rainfall often saturates the local aquifer, resulting in standing water throughout much of the area. Groundwater flows toward the east and southeast. The Biscayne Aquifer, the principal surficial aquifer in southeast Florida, is between 60 and 150 feet in the region and breaches the surface throughout the 8.5 SMA. These outcrop areas can be a significant source of recharge for the aquifer.

Potable water is provided through private wells and wastewater is treated using individual septic systems. Phosphate and nutrient levels fall within the range expected for mixed residential/ agricultural areas. Elevated pesticide levels have not been documented in the 8.5 SMA.

Monitoring wells in the 8.5 SMA have detected low levels of heavy metal. A USGS study indicated that groundwater in a shallow monitoring well in the 8.5 SMA detected no anthropogenic fecal coliform/fecal streptococci (FC/FS) bacteria.

Vegetation and Wildlife. The native vegetative communities within 8.5 SMA include marl prairies (graminoid- and herb-dominated), shrubby wetlands, forested wetlands (both native and exotics dominated), and shrubby uplands. Many of these communities, particularly in the eastern portion of the 8.5 SMA, have been soil disturbed.

Conditions within the 8.5 SMA likely provide important resources to opportunistic small animals of avian, mammalian and reptilian origin. Species that depend upon wetlands for critical resources dominate, including 142 species of birds, 21 species of mammals, several small fish species, two species of frog, and a variety of aquatic invertebrates representative of Everglades wetland complexes.

The primary federally listed species in the region are the snail kite, wood stork, and Cape Sable seaside sparrow (CSSS), with the latter of particular concern for the 8.5 SMA and adjoining parklands. The CSSS is an endemic bird species restricted to six subpopulations within short-hydroperiods wetlands of the southern Everglades and Big Cypress Swamp. Sparrow populations have experienced precipitous declines since the early 1980s. Subpopulation F is located immediately southwest of the 8.5 SMA. Areas that sustain the short hydroperiod prairies are considered essential for the sparrow to

successfully breed and to ensure the survival of the species.

Air Quality and Noise. Miami-Dade County was redesignated on April 25, 1995, as attainment for ozone under the 1990 Clear Air Act in CFR, Part 81, and is currently classified as an air quality maintenance area. Noise impacts are not an issue.

Socio-Economic Setting. Residential and agricultural uses are predominant to the eastern half of the 8.5 SMA, with vacant land and wetlands dominating the western half. Approximately 1625 acres along the western periphery are in public holding. Miami-Dade County's comprehensive plan designates the 8.5 SMA as "Open Land," which is intended for uses other than urban development, such as recreation and conservation. The County currently provides fire and emergency services for the 8.5 SMA, plans and coordinates all emergency medical rescue activities, and provides police services. Electricity is provided by Florida Power and Light (FP&L) and telephone service is provided by Bell South. The County currently does not provide water, sewer, solid waste, or mass transit services to the 8.5 SMA, but currently maintains approximately 6.5 miles of roadway including SW 136th Street and SW 168th Street.

The western portion of the study area overlooks adjoining ENP parklands, famed for its expansive, picturesque marshes, wet prairie, and tree islands. Several opportunities for passive recreation, such as hiking, birding, and nature photography are available in the publicly owned lands in western portions of the
8.5 SMA.

Prime And Unique Farmlands. Although no prime farmland occurs within the 8.5 SMA, most of the 8.5 SMA qualifies as unique farmland. There are about 2642 acres of agricultural land within the 8.5 SMA, featuring a variety of row and field crops, trees and ornamental plant nurseries, and specialty farms.

Hazardous Materials. A review of available Federal and State lists suggests that the 8.5 SMA has not been directly impacted by hazardous or petroleum wastes or products. The presence of underground fuel tanks within the 8.5 SMA constitutes a potential source for petroleum contamination of the Biscayne aquifer due to its close proximity to ground surface and the shallow water table.

Cultural Resources. There are no known archaeological or historical sites within the 8.5 SMA. A few recorded sites are found in tree islands immediately north and west of the 8.5 SMA. There is a high probability that unrecorded archaeological sites are present at one or more of the ten to twelve tree islands that were historically present within the 8.5 SMA. The Miccosukee Tribe owns one undeveloped parcel in the 8.5 SMA.

3.2.3 Future Without Project Condition

The Future Without Project condition represents the conditions of the area of potential effect as it would be expected to exist in the future, after the authorized plan was

implemented. Under this scenario, all components of the MWD project would be allowed to be operated as generally described in the 1992 GDM and specifically described in subsequent study and design efforts. This would result in increased stages and flows in the NESRS from water released from Water Conservation Areas (WCA) 3A and 3B. The levee and seepage canal system constructed around the 8.5 SMA would provide flood mitigation from these increased flood stages. Consequently, increased stages in ENP would restore flows and hydropatterns to the ENP expansion area as predicted in the 1992 GDM. This condition was determined in the GDM, and approved by the Secretary of the Army, as meeting the goals of the 1989 Act.

An estimate of the environment for this condition has been projected as a result of this reevaluation. A description of the natural and physical environment expected from the implementation of the authorized plan is provided in Section 4.6 of the SEIS.

3.2.4 Specific Problems and Opportunities

The categories of issues facing the study team in evaluating the alternatives include structural, operational, environmental, hydrologic, social, economic, and others. Some of the specific issues that were considered for each include:

- Accommodating the MWD goal of getting the appropriate amount of water into the appropriate place at the appropriate time within the NESRS and ENP Expansion areas.
- The difference of providing flood protection versus flood mitigation within the 8.5 SMA and the effect on hydrologic conditions within the ENP.
- The number and nature of residential units that will be impacted or taken.
- Impact on adjacent areas outside of the 8.5 SMA.
- Local Costs.
- Long term O&M cost considerations.
- Operational requirements and compatibility with the existing system.
- Potential future use of areas after plan is implemented.

- Needs for infrastructure improvements within 8.5 SMA.
- Impact on wetlands.
- Impact on natural habitat for flora and fauna.
- Water quality impacts.
- Water supply impacts.
- Impact on existing or future restoration or protection projects in the area.
- The schedule of implementation for each alternative.

3.3 PLANNING CONSIDERATIONS

3.3.1 General

The enactment of the ENP Protection and Expansion Act (PL 101-229, December 13, 1989; Section 104) authorized and directed the Secretary of the Army, upon completion of GDM, to construct modifications to the C&SF project to improve water deliveries into ENP and to take steps to restore the natural hydrological conditions within ENP to the maximum extent practicable. The Act also authorized and directed the Secretary to construct a flood mitigation system for the residential area known as the "Eight and One-Half Square Mile Area" (8.5 SMA), if it was determined that it would be adversely impacted by the C&SF Project modifications.

As a result of the ENP Expansion Act, the Secretary of the Army was tasked to develop a solution that would accomplish two primary goals:

1. Provide restoration of natural hydrologic conditions in ENP relative to timing, location and volume of surface and ground water.

2. Protect the residents of the 8.5 SMA from higher water stages resulting from the MWD project.

These goals present a challenge of implementing a solution that would address the conflicts between environmental restoration goals of the ENP and flood protection needs of the community
(8.5 SMA landowners and residents).

3.3.2 Previous Evaluations

1992 MWD GDM. This study included the evaluation of several mitigation alternatives to "reduce or prevent increased flood damages in the developed East Everglades area" (including the
8.5 SMA). Alternatives included both non-structural and structural measures as described below:

<u>Non-Structural Measures</u>

- Land Acquisition – Total acquisition of all land and property within the 8.5 SMA.

- Flowage Easements – Acquisition of perpetual flowage easements for all property within the 8.5 SMA.

<u>Structural Measures</u>

- Plan A – Double levee north and west of residential (8.5 SMA) area; single levee south; single pump of seepage water into NESRS.

- Plan B – Double levee north and west of residential area, continuing south to include agriculture area (south of 8.5 SMA); two pumps for seepage water into NESRS.

- Plan C – Same canal, levee and pump alignments as Plan A; sizes increased for additional flows.

- Plan D – Double levee system for only the developed area on north and west side of 8.5 SMA; single levee on south side; internal canal and pump S-357 to return seepage water from
L-31N; pump S-356 to discharge flows into NESRS.

- Plan E – Same levee and canal alignment as Plan D; internal pump S-357 discharge seepage and flood flows into L-31N; pump S-356 discharge flows from L-31N to L-29.

- Plan F – Same levee, canal and pumps as Plan E except levee on south side of area eliminated.

- Plan G - Same layout of canals and levees as Plan F; pump S-357 located on northeast corner of 8.5 SMA and discharge into L-31N; seepage canals on west and north sides sized to convey additional flows.

A detailed description of each of the above alternatives can be found in the 1992 GDM.

Plan G was selected because it was the lowest cost plan of all of the alternatives evaluated and met the objectives of the MWD project. This was the plan that the USACE was authorized to construct under the provisions of the ENP Protection and Expansion Act.

East Everglades 8.5 SMA Study Committee. In 1994, Governor Lawton Chiles established the East Everglades 8.5 Square Mile Area Study Committee for the purpose of evaluating the recommendations of the USACE in the MWD GDM. This committee evaluated three types of alternatives:

- Land Acquisition Alternatives – These included full buy-out, partial buy-out, and voluntary buy-out.

- Structural Alternatives – The USACE authorized plan and variations.

- Flow-Way and Flow-Way/Buffer Alternatives – A flow-way seepage collector system of swales in place of canals and levees.

The committee determined that the flow-way/buffer alternative was the best and should be adopted as the locally preferred alternative. A full description of the analysis by the Governor's committee can be found in its *Report to Governor Lawton Chiles*, April 1995.

PEER Report. In response to the Governor's East Everglades 8.5 SMA Study Committee, the SFWMD contracted PEER Consultants, P.C. to evaluate the flow-way/buffer and other alternatives for the 8.5 SMA. This consultant team developed and evaluated the following six alternative plans:

1. USACE Authorized Plan - As described in the MWD GDM (Plan G).

2. Modified USACE Authorized Plan – Several pumps discharge seepage water from the west perimeter levee to the ENP.

3. Water Preserve Areas – Western part of 8.5 SMA used as shallow impoundment to treat seepage water discharged from the 8.5 SMA.

4. Modified Water Preserve Area – Same as 3 except boundaries of the protected area revised.

5. Seepage Barrier – Impermeable barrier around perimeter of 8.5 SMA eliminates seepage flow into the protected area.

6. Total Buy-Out – Acquisition of all property within the 8.5 SMA.

A complete description of the analysis conducted by PEER can be found in the report titled *Alternative Land Use Analysis, 8.5 SMA (1998).*

3.3.3 Technical Issues

There are several technical issues that were considered during the development of the alternatives for this reevaluation. They are described below.

Relation to Other Components of and Related to the MWD Project. The flood mitigation for the 8.5 SMA is only one of several components of the MWD project that is currently being reevaluated. Specifically, the raising of a portion of Tamiami Trail, and the control of seepage and conveyance from WCA 3A and 3B, are very much related to the hydrology of the 8.5 SMA system. In addition, the C-111 project located south of the 8.5 SMA will have an influence on this project. Very close coordination was required by the 8.5 SMA study team to assure that effects from these projects were considered in this evaluation.

Flood Mitigation and Flood Protection. Flood mitigation, for the purposes of this project, was defined as having no increase in stage for a given future flood event above that which would be experienced under conditions prior to the MWD project. Five of the structural alternatives were defined to provide flood mitigation.

Two of the structural alternatives were defined to provide flood protection. Flood

protection, as defined by the USACE for this project, is protection from inundation for a 1 in 10-year flood event. In the 8.5 SMA, a stage of 7.7 ft was determined to be the elevation above which lands would be afforded flood protection. In addition, Miami-Dade County has a definition of flood protection that it uses to define development opportunities in the County. This is defined as the protection from inundation from a 1 in 10-year storm event. Calibrations of the Miami-Dade County flood protection criteria to the USACE flood protection criteria showed that the County criteria would be met in all areas where flood stages remained below the USACE's defined protection stage of 7.7 ft.

The remaining two alternatives provide flood mitigation through non-structural measures.

Structural and Nonstructural Mitigation Measures. Much like the previous studies on the 8.5 SMA, the study team evaluated both structural and nonstructural methods for providing flood mitigation and protection. The structural methods included features such as levees, canals, berms, swales, pump stations, and seepage barriers. The nonstructural methods included fee simple land acquisition, flowage easements, or life estates with flowage easements. It was anticipated that physical constraints and conditions may not allow for structural methods alone to meet the mitigation or protection goals of an alternative. In those cases, nonstructural alternatives would be used to supplement structural methods when the structures alone could not provide the levels or coverage of mitigation or protection desired.

Modification of Alternatives. The initial development of structural alternatives was conducted largely without benefit of technical evaluation to determine specific structure sizes and capacities. Therefore, the initial design was performed based on previous studies and best professional judgement. After the features were set, the alternative was run through a very complicated and time consuming hydrologic model. If the model showed that an alternative did not meet the mitigation or protection goal, then it could be adjusted, or redesigned, and rerun in the model. This process could be repeated, each time adjusting the features of the system, until the alternative either met the performance goal, or showed that physical constraints would not allow it to perform as intended. These adjusted alternatives were designated by number and letter (i.e., 2B, 6B, 8A)

3.4 ALTERNATIVES CURRENTLY UNDER CONSIDERATION

One of the objectives of conducting this new analysis of alternatives is to evaluate as many feasible alternatives as could be reasonably accommodated within available time and resources. The original MWD project goals were made minimum requirements for each alternative: restore hydrologic flows to the ENP while providing flood mitigation to the residents in the 8.5 Square Mile Area. The following alternatives were developed for evaluation:

1. **Authorized GDM Plan**

2. **Modified GDM Plan**

3. **Deep Seepage Barrier Plan**

4. **Landowner's Choice Land Acquisition Plan**

5. **Total Buy-Out Plan**

6. **Western Portion of 8.5 SMA as Buffer**

7. **Raise All Roads Plan**

8. **Western Portion of 8.5 SMA as Flow-way**

9. **Adaptive Refinement of GDM Plan**

A discussion of each of these alternatives is included in the following sections. All alternative features are included in Table 2 of this document. Specific features of each alternative, including dimensions of structures, are included in Table 2. Each alternative is shown graphically in Figures 4 through 12.

3.4.1 Alternative No. 1 – Authorized GDM Plan

Congress authorized the Original GDM Plan for implementation per the General Design Memorandum prepared by the USACE Jacksonville District in 1992. It includes a major levee along the
8.5 SMA perimeter starting at the L-31N on the north side of the area, and moving west and south to high ground on SW 168th Street. A seepage canal will be constructed

adjacent to and just inside of the major levee to collect groundwater underflow. A minor levee, or berm, will be constructed adjacent to and just inside the seepage canal to prevent surface water flow from running into the canal from the 8.5 SMA. There is concern that runoff from the 8.5 SMA could possibly be polluted, and the interior berm will keep potentially contaminated water from mixing with the cleaner seepage water from ENP. This alternative offers flood mitigation for all residents of 8.5 SMA.

A new pump structure (proposed S-357) will be located in the canal at the northeastern edge of the 8.5 SMA near the L-31N canal. This pump will discharge water from the seepage canal into L-31N. A future pump structure S-356 (not included in this project) will pump from L-31N canal into L-29 canal. This system will re-circulate cleaner seepage water back to NESRS and ENP. Surface water runoff from within the 8.5 SMA will be contained by the berm, and eventually infiltrate into the ground. See Figure 4 for details of this Alternative.

3.4.2 Alternative No. 2B – Modified GDM Plan

The development of this alternative was a direct result of the completion of the C&SF Restudy plan sent to Congress in July 1999. Many of the scoping comments received requested that the Authorized Plan be modified to accommodate higher flows and stages expected after the Restudy is implemented. This Alternative was developed to address this issue. This alternative has the same basic layout of Alternative No. 1, and also provides flood mitigation for all residents of 8.5 SMA. It includes the same basic major levee, seepage canal, and interior berm system along the 8.5 SMA boundary southwest from L-31N to high ground on SW 168th Street. Three iterations of the model runs were required before the design of the system was optimized. The final iteration, called "2B" included a single pump (proposed S-357) installed at the southwest corner of the 8.5 SMA at the terminus of the berm at
SW 168th Street. This structure will discharge seepage water south to the C-111 System, via a 120 inch diameter pipeline. As in Alternative No. 1, surface water runoff from within the 8.5 SMA will be contained by the berm, and will infiltrate into the ground. See Figure 5 for further details of this Alternative.

3.4.3 Alternative No. 3 – Deep Seepage Barrier Plan

This alternative reevaluated work from previous studies that considered constructing a deep seepage barrier around the protected area. The intent was to reduce or eliminate groundwater underflow from the ENP Expansion area to the 8.5 SMA. This was designed as a flood protection plan that would provide protection from a 1 in 10-year flood event. Under this plan, the outer perimeter levee follows the same alignment as the Authorized Plan, along the 8.5 SMA boundary southwest from L-31N to high ground on SW 168th Street. A seepage barrier follows the same path (located within the levee). The seepage

barrier will be made of an engineered barrier or curtain wall such as slurry wall, sheet piles, etc. The barrier must be installed at an elevation below the aquifer (estimated 50 to 70 feet). This will eliminate the need for the seepage canal and interior berm. Surface water runoff from within the 8.5 SMA will be contained by the levee, and infiltrate or run overland into L-31N, and be controlled by existing structures in the L-31N canal. A graphic representation of this Alternative is shown as Figure 6.

3.4.4 Alternative No. 4 – Landowner's Choice Land Acquisition

Many of the comments received in the scoping process suggested that the residents may respond more favorably to a voluntary land acquisition alternative. Many residents indicated that they would be willing to stay and endure the increased flooding if they were shown the extent of the impact. Therefore, an alternative was developed by the study team that provided for acquisition of land in the 8.5 SMA through three different means. Current owners have a choice:

a. Buy-Out: Government purchase (fee simple)

b. Flowage Easement: Pay property owners cash as mitigation for periodic flooding. Owner retains ownership rights to property.

c. Life Estates with Flowage Easement: Pay property owners cash as mitigation for periodic flooding. Owners retain ownership and use of property for duration of current owner's life. Then the property goes to ownership of the Government.

Specific rules and assumptions regarding these choices are detailed in the Real Estate Appendix. Modeling would be performed to graphically demonstrate to the owners the elevations and extent of flooding. This will assist the owners in making their choice.

Under this alternative, no canal, levees, or pumping structures are proposed, and no significant changes in operation of existing structures or system features would occur. A graphic representation of this Alternative can be seen in Figure 7.

Under this plan, a combination of flowage easements for life estates may need to be considered for short-term implementation.

3.4.5 Alternative No. 5 – Total Buy-Out Plan

Total buyout was originally developed and evaluated as an alternative in the 1992 GDM. The Governor's East Everglades
8.5 SMA Study Committee also considered total buyout as an alternative, as did the PEER Report. Under this plan, all land in
8.5 SMA will be obtained either from willing sellers or by condemnation. No structural improvements are proposed, and no significant changes in operation of existing structures and system will be required. Consideration for demolition of existing structures, restoration of natural conditions and long-term maintenance needs were included in the evaluation of this alternative. An illustration of this Alternative is shown in Figure 8.

3.4.6 Alternative No. 6B – Western Portion of the 8.5 SMA as Buffer Plan

The Governor's East Everglades 8.5 SMA Study Committee developed and evaluated several alternatives that utilized the western portion of the 8.5 SMA as a flow-way or buffer area. This concept was further studied in the PEER Report and the analysis confirmed that it was a feasible concept. Therefore, the 8.5 SMA technical team developed an alternative that would convert the western portion of the 8.5 SMA to be used as a buffer between the developed area and ENP. This was designed as a flood protection alternative. Part of the 8.5 SMA will have a perimeter flood protection levee that runs approximately along 202nd Avenue south to 168th Street. A seepage canal is located just inside (i.e., east) the new levee and is designed to collect groundwater underflow. An interior berm located just inside the seepage canal will prevent surface water portions of the 8.5 SMA from running into the seepage canal and mixing with seepage water. A new proposed pumping structure (S-357) located at the southern terminus of the levee/canal system will discharge seepage through a 120-inch diameter pipe to be released south into a spreader swale and eventually to the C-111 project area. There will be no major changes to operations of existing structures in the system. The feature of this plan is shown in Figure 9.

The alignment of the proposed levee/canal system was chosen to be approximately 202nd Avenue for several reasons. First, this road generally runs along a topographic ridge, which would help minimize the height of the proposed levee needed to contain the flood stages. Also, from information obtained at field visits and review of aerial photography, this road seems to represent the western edge of the more densely developed area within the 8.5 SMA. This alignment appeared to the technical team as a best chance of minimizing the cost of construction and the number of relocations required. Three iterations of the model runs were required before the design of the system was optimized. The final iteration, called "6B", included the features as described above.

3.4.7 Alternative No. 7 – Raise All Roads Plan

As mentioned in the discussion of Alternative No. 4, public comments indicated the desire to allow use of the land within the 8.5 SMA after the implementation of MWD project, even without flood protection measures. The technical team developed an alternative that would improve roadway features within the area. This would be accomplished by raising all exiting roads and restoring them in-kind. The roads will be raised so that they will not be flooded as a result of the MWD Project. All areas within the roads will remain unimproved. Roads will be improved only to the condition in which they currently exist (paved will be paved, dirt will be dirt). Mitigation for other areas will be handled by obtaining flowage easements. Due to the nature of the subsurface conditions in the area, much of the surface water is expected to infiltrate. It is probable that septic tanks for numerous residences will require upgrading due to the higher water levels. Specific assumptions for providing mitigation through flowage easements is included in the Real Estate Appendix. This alternative is illustrated in Figure 10.

3.4.8 Alternative No. 8A – Western Portion of 8.5 SMA as Flow-way

This alternative evolved as a modification of the flow-way concept originally evaluated by the Governor's Study Committee. It uses a similar concept to Alternative No. 6B to protect the eastern, most inhabited portion of the area, and keep the western area as a more natural, undeveloped area. This western area will serve as a buffer zone to ENP west of the mitigation levee and as a natural flow-way for diverting flow from ENP to the C-111 area. The alignment of the proposed flow-way system was chosen to be approximately along the 7.0-ft contour. This represents general a topographic ridge, which would help minimize the height of the proposed levee needed to contain the flood stages. Also, as similarly described the discussion of Alternative 6B, this alignment seems to represent the western edge of the more densely developed area within the 8.5 SMA. This alignment appeared to the technical team as a best chance of minimizing the cost of construction and the number of relocations required.

Two iterations of the model were run to optimize the layout of this alternative. The second iteration, called "8A", included an interior perimeter levee starting just north of 120th Street, running south and west around the FAA tract, along 202nd Avenue down to 168th Street. An exterior diversion levee will run approximately parallel to the interior levee and serve as a containment barrier for a natural swale flow-way. The containment levee will be small enough to allow surface water flow from ENP into the flow-way, but big enough to direct flow contained within the flow-way. A new proposed structure (S-357) located at 168th Street will discharge seepage water into the C-111 system. There are no major changes to operations of existing structures proposed under this plan. Features of this Alternative are shown in Figure 11.

3.4.9 Alternative No. 9 – Adaptive Refinement of GDM Plan

Numerous comments were received during the public comment period and within

technical team discussions referencing the need to develop a plan that would be compatible with the CERP. This alternative evolved as a plan that is capable of integrating immediately with the system operation for implementation of the MWD Project, but constructed in a manner that can be modified to comply with the CERP Flows. In other words, build something that meets the needs for now, but will not need to be demolished and reconstructed to meet the needs of future conditions. For purposes of comparison, the result is basically a combination of Alternative No. 1 (Authorized GDM Plan) and Alternative No. 2 (GDM Plan Modified for Restudy Flows). It has the same layout of levees and seepage canals as Alternatives No. 1 and No. 2. It also includes pumping structures at locations on the northeastern corner of the 8.5 SMA, and at the intersection of L-31N and L-29 as proposed in Alternative No. 1. It also includes a future pumping structure located at the southern terminus of the seepage canal at the southwestern corner of the 8.5 SMA for construction after the CERP is implemented. This Alternative is shown in Figure 12.

Section 4.0

Evaluation Criteria

4.1 PROJECT GOAL

At the request of the Governing Board of the SFWMD, the USACE has agreed to develop, evaluate and present a full array of alternatives to the plan authorized in the 1992 GDM. The desired end result of this particular planning and study effort is to facilitate selection of a Locally Preferred Alternative (LPA) for the 8.5 SMA by the SFWMD Governing Board. The selected plan must still meet the original goal of the MWD project by providing a technical solution for the hydrological and ecological restoration of the Everglades National Park as specified in the 1989 Act while providing flood mitigation to the 8.5 SMA.

In achieving this goal, each of the alternatives will be evaluated relative to certain project requirements and objectives. A series of technical team meetings, made up of technical professionals from various stakeholder groups, was held to determine the criteria to be used for evaluating the alternatives. A description of the project requirements and project objectives to be used in this study effort is contained below.

4.2 PROJECT REQUIREMENTS

Regardless of the alternative selected, the project has certain requirements that it must accomplish in order to be considered viable. All alternatives must be designed and constructed to meet

each of these requirements. The five requirements identified by the study team are:

- Do not negatively impact higher stages in ENP as specified in the Modified Water Deliveries Project.
- Mitigate for increased stages within the 8.5 SMA resulting from implementation of the Modified Water Deliveries Project.
- Develop a solution that can be permitted by regulatory interests under current and reasonably foreseeable regulations.
- Ensure no significant impact to existing habitat of endangered or threatened species.
- Maintain current levels of flood protection for agricultural areas east of L-31N.

The evaluation of each of the alternatives' ability to meet these requirements, and thus be considered to be feasible, is described below:

RQ1. *Do not negatively impact higher stages in ENP as specified in the Modified Water Deliveries Project.* To meet this requirement, it must be established that stages authorized in the MWD project can be accommodated. This is verified by evaluating water depths (stages) in NESRS for each alternative to ensure that it provides for levels in accordance with those specified in the 1992 GDM. Estimated water levels will be evaluated for all areas throughout the ENP property for the authorized plan and each of the other alternatives.

RQ2. ***Mitigate for increased stages within the 8.5 SMA resulting from implementation of the Modified Water Deliveries Project.*** The 1989 Act stated that there could be no increase in flooding for any of the alternatives beyond that which existed prior to the MWD GDM. Flood mitigation, for the purposes of this analysis, is when surface water elevations due to similar climatic conditions are maintained at pre-project levels as established using the 1983 base conditions simulations. Water depths within the 8.5 SMA at pre-MWD conditions will be compared to water depths for each alternative to verify that it meets this requirement.

RQ3. ***Develop a solution that can be permitted by regulatory interests under current and reasonably foreseeable regulations (i.e. water quality, wetlands).*** It is required that the alternatives be designed and constructed to meet regulations and permit conditions currently in effect. Potential permitting issues and requirements were identified and evaluated for each alternative in order to make sure project features are incorporated to comply with these permit conditions.

RQ4. ***Ensure no significant impact to existing habitat of endangered or threatened species.*** Another requirement of each alternative is that it must not have a significant negative impact to any known endangered or threatened species. The model grid used in

the hydrologic simulation of the alternatives was evaluated to identify changes within the potential impact area where a critical habitat occurs. These areas are identified in the model as indicator cells. The water surface elevations within these indicator cells are evaluated and compared to existing and without project conditions and also compared to each of the alternatives.

RQ5. ***Maintain current levels of flood protection for agricultural areas east of L-31N.*** Each alternative must provide for the level of flood protection which currently exists in areas east of L-31N. Agricultural areas potentially impacted by any of the 8.5 SMA alternatives have been identified. Water levels at indicator cells within these agricultural areas will be evaluated for existing conditions and future conditions for each alternative in order to be certain that there are no significant changes in hydrology that might affect crop production.

4.3 PROJECT OBJECTIVES

Project objectives set the basis for determining if an alternative can meet the project goal. There are seven objectives of this study effort developed by the study team. The following objectives were established based on input from the multi-agency technical team:

OB1. ***Evaluate effects on hydropatterns in the NESRS.*** Hydroperiod impacts, water depths, effects on seasonal variability, and the duration of continuous flooding were measured in order to evaluate this objective.

OB2. ***Evaluate impacts to the landowners and residents of the 8.5 SMA resulting from implementation of the Modified Water Deliveries Project.*** Measures potential flood mitigation and flood protection damages, and potential direct or indirect loss to local business, residences, and agricultural lands.

OB3. ***Analyze Cost Effectiveness.*** The specific measure of cost effectiveness of the nine alternatives considers direct project costs, operations and maintenance costs, construction costs and local costs.

OB4. ***Analyze Effects to Ecological Functions.*** The simulation model was used to measure the spatial extent of wetlands in both the 8.5 SMA and the ENP area. Impacts to short and long hydroperiod wetland acreages were evaluated based for each alternative.

OB5. ***Evaluate effect on conditions favorable to Federal and State Listed Endangered Species survival.*** Effects to endangered species habitats were evaluated utilizing indicator cells obtained from the hydrologic simulation model.

OB6. ***Measure compatibility with Comprehensive Everglades Restoration Plan and C-111 Projects without adversely impacting the current level of flood protection east of L-31N.*** This objective measures the compatibility of the project with the flows and water

levels resulting from the CERP features. This measure also evaluates the ability of the alternative to accommodate the C-111 project requirements and quantify the potential increase in stage and/or duration to agricultural lands east of L-31N.

OB7. ***Analyze impacts and costs associated with time delays in implementation of alternatives.*** This objective measures each alternatives' ability to meet the December 31, 2003 implementation schedule and evaluate the impact of construction delays and administrative requirements on environmental and cultural resources.

4.4 MODEL SPECIFICATIONS

The model that has been selected for use in the evaluation of the alternatives for the 8.5 SMA is the MODBRANCH Model. This model is a coupling of two models developed by the United States Geological Survey (USGS), MODLOW and BRANCH. The model allows both surface and ground-water interactions that can be simulated by the coupled BRANCH and USGS modular, three-dimensional, finite-difference ground-water flow (MODFLOW) models, referred to as MODBRANCH. MODFLOW simulates steady and non-steady flow in an irregularly shaped flow system in which aquifer layers can be confined, unconfined, or a combination of confined and unconfined. BRANCH simulates steady or unsteady flow in a single open-channel reach (branch) or throughout a system of branches (network) connected in a dendritic or looped pattern by solving the one-dimensional equations of continuity and momentum for the river flow. Channel-aquifer flows are leakage through a confining layer or riverbed. Computation of this leakage in the ground water and surface-water systems allows these processes to be coupled for simulation purposes.

The ground-water flow equation is solved using the finite-difference approximation. The BRANCH model uses a weighted four-point, implicit, finite-difference approximation of the unsteady-flow equations. A leakage term has been added to the equations in the BRANCH model and was coupled through the leakage quantity to the MODFLOW-96 model.

In order to use MODFLOW, initial conditions, hydraulic properties, and stresses must be specified for every model cell in the finite-difference grid. BRANCH input data consist of channel geometry and initial flow conditions defined at all cross-section locations and boundary conditions defined at channel extremities.

Primary ground-water computational output is head, which can be written to the listing file or into a separate file. Other output includes the complete listing of all input data, drawdown, and budget data.

Budget data are printed as a summary in the listing file, and detailed budget data for all model cells can be written into a separate file.

Time series of computed surface-water flow results can be directly output in tabular or graphical form at all, or selected, cross-section locations. Tabular output options include discrete flow results at every time step or iteration; daily summaries of minimum, maximum, and average flow conditions; monthly flow-volume summaries; or river-mile locations of injected particles. Digital or line printer graphical options include hydrograph plots of computed water levels or discharges or comparative plots of computed results versus measured data. Output results can be either in metric or inch-pound units.

Specific details on the modeling specifications are provided in Appendix A. In addition to the hydrologic and geologic information typical to model input, model requirements of specific relevance to the simulation in this study include:

- Upstream Boundary Conditions
- Operating Procedures
- Precipitation
- C-111 Project Rules

These specific requirements are discussed as follows:

4.4.1 Boundary Condition. This represents the flow and head conditions along Tamiami Trail used in the model. There are three boundary conditions identified:

a. **Base 83.** This represents the conditions along Tamiami Trail at the time the MWD project was authorized.

b. **Base 95.** This represents the conditions along Tamiami Trail as they exist today, based on experimental operating conditions authorized in 1995.

c. **MWD Full Implementation (D13R)**. This represents the restored boundary conditions in the future with the MWD Project in place.

4.4.2 Operating Procedures. Rules govern the operation of the C&SF system and all of the other structures and facilities that control flow to the eastern portion of the Everglades and southern portion of Dade County. Operation of this system is modified based on many factors including climate, antecedent moisture conditions, elevations, flow and consumptive use needs.

The model has developed several sets of operating procedures with a goal of accurately simulating the impact of operational changes in the region. Thus, the operating procedures represent how the entire system is operated for a specific scenario.

a. **1983 Operations.** Represents the authorized canal levels and operations prior to the Experimental Water Deliveries Program Operation.

b. **1995 Operations.** Represents operation of the system as it was operated in 1995. This also approximates the current operation of the system.

4.4.3 Precipitation. The precipitation records used for the model runs are based on actual observed rainfall data. The precipitation is one of the primary driving forces of the regional hydrology. For the purposes of model simulation, actual observed rainfall data is used as the basis for the evaluation.

a. **1989: Dry year.** The 1989 rainfall is considered to be a dry year for the purposes of this evaluation. Thus, the effects to the system of lower than average rainfall can be assessed and the impacts of each alternative quantified.

b. **1995: Wet year.** In contrast to the 1989 precipitation, 1995 is considered to be representative of a year with higher than normal precipitation. In addition, the 1995 rainfall data set used in the model simulation has been modified to include a hypothetical 1 in 10-year rainfall event. This event, introduced in Week 26, allows for surcharging of the surficial aquifer levels to account for a major early season storm, and then allows the remainder of the 1995 wet year rainfall to depict actual conditions. Thus, the simulations in the model utilizing the 1995 rainfall represent hydrologic conditions expected for an above- normal wet year.

4.4.4 C-111 Project Rules. The runs for the future conditions assumed that the C-111 project would be in place. However, as of this writing, the operational rules have not been developed or approved for this project. Therefore, a set of general assumed operating conditions were developed for the C-111 portion of the simulation model grid and held constant for all model runs with future conditions.

4.5 PROJECT CONDITIONS

Project conditions represent the actual conditions existing or projected for each of the simulations. They are used as a basis for comparison of various alternative scenarios. For this analysis, there were five conditions identified. They are described as follows:

CD1. ***Base 83***: This condition assumes stage and flow conditions and operations as they existed prior to the MWD Project. This is the base condition against which the federal requirement for flood mitigation must be verified.

CD2. ***Base 95***: This condition assumes stage and flow conditions and operations as they currently exist. This is the basis for which impacts of the alternatives to existing conditions will be measured.

CD3. ***Base 83 + Future Without Project***: This condition assumes that the system is operating according to the 1983 operations, the MWD project will be implemented with C-111 in place, and the Authorized Plan (Alternative No. 1) will be constructed.

CD4. ***Base 95 + Future Without Project***: This condition assumes that the system is operating according to the 1995 operations, the MWD project will be implemented with C-111 in place, and the Authorized Plan (Alternative No. 1) will be constructed. This is the base against which the "future with project" conditions will be compared.

CD5. ***Future With Project***: This condition assumes that the MWD project will be implemented and the system is operating according to the 1995 operations with C-111 in place, and that any one of the potential LPAs (Alternatives Nos. 2B through 9) would be implemented.

Table 3 summarizes the features of each of the project conditions used in this analysis.

4.6 ALTERNATIVE COMPARISONS

The basis for determining the performance of the alternatives under various conditions will be evaluated using three comparisons: federal requirements, impacts to existing conditions, and LPA comparison.

CM1. ***Federal Requirement***: This comparison will verify that mitigation requirements are met by each of the alternatives. As defined, mitigation is achieved within the 8.5 SMA when water elevations are at or below the Base 83 condition.

CM2. ***Impacts of Existing Conditions***: This comparison will be made to determine the impacts of each alternative to current conditions
(Base 95).

CM3. ***LPA Comparison***: This comparison will be made in order to evaluate the Authorized Plan (Alternative 1) versus the proposed LPAs (Alternative Nos. 2B through 9) for current (Base 95) conditions.

Table 4 summarizes the comparisons used in this analysis.

4.7 PERFORMANCE MEASURES

Performance measures are quantitative or qualitative indicators of how well (or poorly) an alternative meets a specific objective. Ideal performance measures are quantifiable, have a specific target, indicate when that target has been reached, or measure the degree of improvement toward the target when it has not been reached.

A set of performance measures was developed to use as the basis for evaluation of the various alternatives for this project. These performance measures have specific metrics related directly to each of the seven project objectives. A complete list of the performance measures and their descriptions can be found in Table 5. A general description of the performance measures is as follows:

OB1: Evaluate effects on hydropatterns in NESRS:
PM1a. Hydroperiod Impacts: These impacts deal with increases or decreases in hydroperiods for areas within NESRS. They are measured by the change in aerial extent of areas with a greater inundation by identifying areas with an increase in stage and determining the total area.

PM1b. Water Depths: This performance measure evaluates increase or decrease in water depths for areas within NESRS. The total average annual increase or decrease in water depths is quantified. The evaluation consists of comparing the average change in water depth for each indicator cell within the NESRS area during the model year.

PM1c. Seasonal Variability: Effects on seasonal variability occur with a change in stage variation at key indicator cells. There are three key components used to evaluate the seasonal variation. These components are, minimum levels, maximum levels, and the range of levels. Key indicator cells were evaluated for these components.

PM1d. Flooding Duration: Duration of continuous flooding performance is determined by finding the number of consecutive weeks with surface water above ground surface for the Base 95 condition.

OB2: Evaluate impacts to the landowners and residents of the 8.5 SMA resulting from implementation of the Modified Water Deliveries Project:

PM2a. Flood Mitigation Damage. Flood mitigation damage considers the extent of project induced change in water levels to those areas that are designated for flood mitigation not addressed by each alternative's structural features. The total numbers of acres within the 8.5 SMA has been estimated where the total depth of inundation is

greater than the base condition depth in the same area.

PM2b. Flood Protection Damage: Flood protection damage evaluates the extent of project induced water elevation changes to those areas designated to receive 1-in-10 year flood protection. This will identify and quantify areas where the projected flood protection is not achieved by structural features. The total number of acres within the area to be protected where the stage is greater than the base condition during weeks 21-37 (wet season) of the 1995 model year quantifies the affected area.

PM2c. Impacts to Businesses: Potential direct or indirect loss to local business activity is considered an impact to business. The number of businesses impacted by PMs 2a and 2b will be determined.

PM2d. Impacts to Residences: The number of residences impacted by PMs 2a and 2b will determine the number of residents required to be relocated.

PM2e. Impacts to Agricultural Lands: The potential number of acres of agricultural lands, which will no longer be available for agricultural uses, is considered a loss. The number of acres of existing agricultural lands deleteriously impacted as determined by PMs 2a and 2b were used to quantify loss of agricultural lands.

PM2f. Unwilling Sellers: The potential number of property owners who are unwilling to sell their property is measured by a count of those considered to be "unwilling sellers." During implementation of the South Florida Water Management District's previous LPA (Total Buyout), information was collected on those owners who were willing and unwilling sellers. Actual unwilling responses along with a projection of additional unwilling responses will be quantified for each alternative.

OB3: Analyze cost effectiveness:

PM3a. Project Costs: Project costs are determined by the overall increase in expenses from the authorized plan (Alternative No. 1). This will be measured by the actual estimated cost of each alternative, including capital construction costs and O&M costs.

PM3b. Local Costs: Local costs are those secondary impact costs to Miami-Dade County and/or its residents. This is measured by estimating potential costs resulting from implementation of any alternative.

OB4: Analyze effects to ecological functions:

PM4a. Wetlands West of L-31N: The spatial extent of wetlands west of L-31N is measured by the number of acres with a water level not less than 1.0 feet below the ground surface with a hydroperiod of between 30 and 180 days for at least 18 consecutive days.

PM4b. Short Hydroperiod and Long Hydroperiod Wetlands: A short hydroperiod wetland is characterized by Marl Prairie dominated by muhly grass and other graminoid species, characterized by inundation periods ranging from 30 to 180 days per average year. Long hydroperiod wetlands are characterized by Marl Prairie dominated by sawgrass, typically peat forming, and by inundation periods greater than 180 days per average year. Water levels typically range between 1 foot below and 2 feet above ground level.

PM4c. WRAP Score: A WRAP (Wetland Rapid Assessment Procedure) score determines the function and value of wetlands at selected indicator cells.

OB5: Evaluate effects on conditions favorable to Federal and State listed endangered species survival:

PM5a. Cape Sable Seaside Sparrow: A Biological Assessment will be completed for the preferred alternative.

OB6: Measure the compatibility with CERP and C-111 projects without adversely impacting the current level of flood protection east of L-31N:

PM6a. Compatibility with CERP: Compatibility with CERP is the need for project features to be removed or significantly rehabilitated to accommodate the CERP features. This was measured through qualitative discussion and assessment of each alternative's ability to meet this objective.

PM6b. Compatibility with C-111: Compatibility with C-111 is the ability to accommodate the C-111 project requirements. This was measured through qualitative discussion and assessment of each alternative's ability to meet this objective.

PM6c. Agricultural Lands East of L-31N: Agricultural lands east of L-31N are assessed by the potential increase in either stage or duration. This was measured by the total number of acres of agriculture lands east of L-31N with an increase (+) or decrease
(-) in water depths, determined by comparing the average change in water depth for each cell during the model year (based on 52 7-day timesteps).

OB7: Analyze impacts and costs associated with time delays in implementation of alternatives:

PM7a. Environmental and Cultural Resources: Environmental and cultural resources are those lost environmental resources due to higher water levels in WCA 3A, WCA 3B, and NESRS. This was measured through qualitative discussion of the resources impacted if the schedule is extended.

PM7b. Implementation Schedule: Ability to meet the implementation schedule will be

a qualitative discussion with a statement of the expected completion date.

PM7c. Construction Delays: Construction delays are those unknowns associated with constructability (including land acquisition issues). This was measured through qualitative discussion of the implementation issues that will impact scheduling.

PM7d. Administrative Requirements: This includes potential delays associated with administration requirements for implementation of any potential LPA. This was measured through qualitative discussion of the administrative issues that will impact scheduling.

Section 5.0

Alternatives Analysis

The performance of each alternative was evaluated based on requirements, objectives and performance measures as described in Section 4.0 and Table 5. A discussion of the analysis of each alternative relative to the stated project evaluation criteria is included below.

5.1 ANALYSIS OF PROJECT REQUIREMENTS

Five Project Requirements were identified during a series of technical team meetings consisting of members of the USACE study team and representatives from various agencies and stakeholders groups. These requirements were identified as being mandatory for any alternative to be considered viable (described in Section 4.0.) A description of how each requirement was evaluated and the results of the evaluation are included below. The results are also summarized in Table 6.

RQ1: Do not negatively impact higher stages in ENP as specified in the Modified Water Deliveries Project.

The approval of the MWD GDM fulfilled the requirements of the Secretary of the Army under the 1989 ENP Expansion Act. The plan authorized by that approval included a structural flood mitigation system described in this GRR as *Alternative No. 1 – Authorized GDM Plan*. The performance of this plan, in conjunction with the other components of the MWD project, established the "goal" for hydrologic restoration in the adjacent ENP lands. Therefore, all other alternatives under consideration for this reevaluation (Alternatives Nos. 2 - 9) must accommodate stages at least as high as this goal in order to satisfy this requirement.

During the conduct of the modeling for each alternative, the water depths in ENP were

evaluated as compared to those stages specified in the 1992 MWD GDM for (Alternative 1). All alternatives have average water depths at least as high as or higher than the authorized plan. In addition, an analysis of hydrographs for specific indicator cells presented in Appendix A (Figures 27–108) consistently show that Alternatives Nos. 2-9 have stages equal to or higher than Alternative No. 1. Therefore, it is concluded that all alternatives meet Requirement No. 1.

RQ2: Mitigate for increased stages within the 8.5 SMA resulting from implementation of the Modified Water Deliveries Project.

All alternatives were designed to provide, at a minimum, for water elevation mitigation for the 8.5 SMA using structural and/or non-structural components. Alternatives Nos. 3 and 6B were designed to provide flood protection, above and beyond mitigation, from a 1 in 10-year flood event. In certain structural alternatives, the mitigation goal was not able to be met by design features of the alternative alone. In these cases, non-structural mitigation tools (i.e., flowage easements and land acquisition) were used to supplement the alternative to gain full compliance with this requirement.

Alternatives Nos. 1, 2B, and 6B provide mitigation through the proposed structural features associated with each alternative. Alternatives No. 4 and 5, by definition, provide mitigation through non-structural means, including buy-out of the property and flowage easements.

Alternative No. 3 complies with this requirement through a combination of structural and non-structural means. Approximately 27% of the 8.5 SMA is mitigated by structural measures and 73% is supplemented by non-structural features for Alternative 3. The modeling for this alternative showed that the structural features did not provide protection as anticipated due to subsurface permeability and aquifer depth (See Appendix C for additional details). Consequently, flowage easements covering the majority of the 8.5 SMA are used to supplement the structural features and provide the required mitigation.

Alternative No. 8A is similar to Alternative No. 3 in areas are not afforded mitigation by the structural elements of the alternative. Approximately 69% of the 8.5 SMA is mitigated by structural measures and 31% by non-structural features for Alternative 8A. Flowage easements are used to provide supplemental mitigation and meet this requirement.

Alternative No. 7 utilizes raising of roads to allow access to areas within the 8.5 SMA. However, access alone, does not qualify as mitigation as defined for this project. Therefore, flowage easements are required to supplement this alternative to achieve full mitigation.

The hydrographs presented in Appendix A provide additional information on the specific modeling results due solely to the structural elements for each alternative.

RQ3: Develop a solution that can be permitted by regulatory interests under

current and reasonably foreseeable regulations (i.e., water quality, wetlands).

Regulatory and coordinating agencies participated in the formulation of alternatives since the beginning of this reevaluation study. They have provided guidance in the development of the design features of each alternative to assure that any of these plans could be implemented in compliance with applicable regulations.

Several of the structural alternatives will impact existing wetlands located in or adjacent to the 8.5 SMA. However, it is anticipated that the benefit gained by the increased stages in the Everglades system will offset losses to these wetlands.

Water quality was carefully considered for each of the alternatives. Alternative Nos. 1, 2B, 3, 6B, 8B, and 9 all included interior berms to segregate the runoff from inside the 8.5 SMA so that it would not mix with cleaner seepage water from ENP. In addition, all alternatives that discharge water from a point source have design features that utilize water quality treatment impoundments or buffers.

There is no anticipated conflict with any known regulations that would affect the permitting of any of the alternatives.

RQ4: Ensure no significant impact to existing habitat of endangered or threatened species.

The USFWS is a cooperating agency with the USACE and has been an active participant in the development and evaluation of all alternatives. The Draft Coordination Act Report (DCAR) from the DOI (through the NPS and USFWS) identified several species of key concern including the Cape Sable Seaside Sparrow, the Wood Stork and the Snail Kite. The DCAR identifies the locations of significant habitats of concern and presents issues and strategies concerning the preservation and protection of these areas. The alternatives were designed with structural and non-structural measures such that there would be no impacts to these existing habitats.

At present time, the USFWS has indicated there appears to be no adverse impact to listed species of concern. However, they have acknowledged that the modeling results are inconclusive regarding the potential impact to these critical habitats. Section 106 consultation is ongoing, and will conclude after a plan is selected.

RQ5: Maintain current levels of flood protection for agricultural areas east of L-31 N.

All alternatives were designed to maintain flood protection in adjacent agricultural lands, located outside of the 8.5 SMA and east of L-31 N. The modeling for future conditions included boundary conditions which simulate stages that will occur following completion of MWD, C-111 and CERP, which are higher than that presently existing in the area (See discussion in Appendix A).

There appear to be limited impacts to the agricultural interests east of L-31N and northeast of the 8.5 SMA. However, these impacts appear to be attributable to restoration flows to NESRS and are independent of the 8.5 SMA alternatives. This issue will be dealt with under an Operational EIS for MWD and C-111, both of which are due for completion by the end of calendar year 2001.

5.2 ANALYSIS OF PROJECT OBJECTIVES AND PERFORMANCE MEASURES

Seven overall project objectives set the basis for measuring the performance of each of the alternatives. These objectives are further evaluated using a series of qualitative and quantitative performance measures. Specific definition of each of these objectives and performance measure is included in Section 4, and summarized in Table 5.

5.2.1 Data Sources

The data used in analyzing all the performance measures was obtained from a variety of sources, generally included as a part of this overall document. Those sources include:

- Supplemental Environmental Impact Statement
- Appendix A – Hydraulic and Hydrogeologic Model Report
- Appendix C – Preliminary Engineering and Costs
- Appendix D – Real Estate
- Appendix E – Social Impact Assessment
- Appendix F – Local Cost Analysis
- Appendix G - Draft Coordination Act Report

The Hydraulic and Hydrogeologic Model Report (Appendix A) provided the results of the hydrologic modeling for this evaluation. As such, it was used extensively for the hydrologic performance measures associated with Objectives 1, 2, 4, 5, and 6. In addition, the model report generated data used in the Social Impact Assessment, Local Cost Analysis, Real Estate Report, and Engineering Design and Costs report.

Other sources of data included field reconnaissance, land use data from DERM, public comment and input, CERP report, and coordination with CERP and C-111 project teams.

5.2.2 Methodology for Computing Performance Measures

A system for analyzing the alternatives against each performance measure was developed for purposes of this reevaluation. A series of Fact Sheets were set up to for each of the twenty-three performance measures. These fact sheets contain information regarding the source of data used in the analysis, the procedure or process by which the information

was used in the evaluation, and a summary of the results. These fact sheets are included in this GRR as Table 7.

The metrics for each of the performance measures was obtained from a variety of methods. These included calculation from raw data, direct incorporation from other sources, and qualitative assessments based on an understanding of each alternative's ability to meet an objective.

For several of the qualitative performance measures, alternatives were assessed as red, yellow or green. This terminology was selected due to its recent use for presentation and evaluation purposes in CERP. A red designation generally signifies that there is significant concern that conformance with the specified performance measure is feasible. A yellow designation indicates marginal concern and difficulties in meeting the specified performance measure. A green designation signifies relative confidence in achieving the stated objectives.

5.3 RESULTS OF ALTERNATIVES ANALYSIS

Table 8 presents the computed numeric or assigned qualitative metric for each of the performance measures. The values included in this table are absolute values (i.e., not comparison data) computed by the methodology outlined in Table 7. A summary of the results for the analysis of each performance measure is also included in Table 7.

There is no attempt to sum or process the results of the performance measures for each objective. As such, there is no attempt to make a determination of whether an objective has been "met." This information is provided for comparative purposes to be used at the discretion of the reviewer.

5.4 COMPARISON OF RESULTS

Two comparison tables were prepared for further evaluation of the results of this analysis. Table 9 contains comparisons of all alternatives to Base 95 conditions (existing conditions). This table contains the relative difference of the performance of each alternative as compared to current conditions. It demonstrates what would be expected to change if any one of the alternatives was implemented.

Table 10 compares Alternative Nos. 2B through 9 to Alternative No. 1 (Authorized Plan). This is referred to as the Locally Preferred Alternative comparison as it demonstrates the relative difference of the performance of any one of the potential LPAs (Alternative Nos. 2B through 9) to the authorized plan.

The formats of Tables 9 and 10 are consistent with Tables 5 and 8, which provide a description of each of the performance measures. In total, these tables complement each other in presenting the data compiled for all of the alternatives evaluated in this GRR.

SECTION 6.0

CHANGES TO APPROVED PROJECT

NOT INCLUDED IN DRAFT GRR

SECTION 7.0

Public and Interagency Coordination

7.1 SPONSOR VIEWS

The South Florida Water Management District desires to choose a local alternative that meets the goals of restoration while resulting in minimal impacts to the residents of the 8.5 SMA. The SFWMD is concerned with the displacement of people, cost of an LPA versus the Authorized Plan, and local costs associated with selection of an alternative. It is important to the SFWMD that they are provided with a full array of information on the possible alternatives that achieve these goals. They must be provided with facts that are technically sound, complete, objective, and inclusive of all issues.

7.2 VIEWS OF OTHER FEDERAL PARTNERS

Other Federal partners involved with this project include the Department of the Interior's National Park Service and the U.S. Fish and Wildlife Service. Both agencies have similar views of the goals of the project. Primary interests are to restore hydropatterns to ENP, assure that any water discharge into ENP is not contaminated, to protect existing habitats and enhance future habitats while ensuring that there is no impact to threatened and endangered species, and to avoid impact to the use of facilities within ENP. ENP is concerned with possible development in proximity to Park boundaries; therefore, they prefer those alternatives that demand full or partial acquisition in order to provide a buffer that will minimize impacts to

the ENP area. Segments of their specific objectives and preliminary evaluation of alternative performance are included in Section 4.3 of the SEIS.

Cost sharing between the Federal and local interests was discussed in Section 2.3.2 of this GRR. There is opportunity for addition Federal participation in funding is through DOI. Total potential Federal funding for this project based on current authorities in shown in Table 15.

7.3 VIEWS OF NON-FEDERAL AGENCIES

DERM will be affected by any alternative that impacts future development and future local costs. DERM interests in this project include the potential for increased development (density) within the 8.5 SMA, incurred costs due to implementation of any alternative, equitable distribution of costs for services to its citizens, and County requirements to provide local services to the area.

7.4 VIEWS OF MICCOSUKEE TRIBE

The Miccosukee Indian Tribe is concerned that implementation of the MWD project has been delayed due to the 8.5 SMA, resulting in the storage of excess water in their tribal area. They view this project as a possible threat to their traditional way of life, particularly to the tree islands in WCA 3A and WCA 3B. Therefore, the Tribe prefers the Authorized Plan since it could be implemented immediately. The primary concerns of the Tribe include the impacts of water currently stored on Tribal land and its detriment to agriculture interests and the cultural and religious practices of the tribe, possible flooding of tribal lands, the property rights of landowners, and delay in implementation of MWD.

7.5 VIEWS OF LANDOWNERS, 8.5 SMA

Many residents of the 8.5 SMA feel that Everglades restoration is not dependent on the 8.5 SMA and do not agree with relocation as an acceptable method of mitigation. The residents of the 8.5 SMA are in opposition to any alternative that results in relocation of residents or the loss property use within their community. Therefore, the preferred alternative is any plan that does not propose a buy-out as a component of flood mitigation.

7.6 VIEWS OF AGRICULTURAL COMMUNITY

Agricultural views on this project include the concern for potential effects resulting from the flooding of farmlands, change in stage and/or regulation schedules, impacts to west and south Miami-Dade farmers, and water quality impacts. They want assurance that the selected alternative will have no negative impact on agricultural lands, operations or facilities.

SECTION 8.0

Plan Implementation

This Draft GRR and SEIS will be delivered to the SFWMD Governing Board on April 3, 2000. The formal comment period for the NEPA process is April 14 – May 30. The purpose of this document is to facilitate selection of an LPA by the Governing Board of the SFWMD for the 8.5 SMA. The following steps will take place for full implementation of the selected plan:

- Draft decision document and SEIS delivered to Governing Board: April 3, 2000
- Public review and comment period: April 14, 2000 – May 30, 2000
- SFWMD Governing Board selects LPA and submits Letter Of Intent for review and comment during this time.
- Final decision document and SEIS to public: June 30, 2000
- USFWS submits final CAR during this time.
- Public review period: June 30, 2000 – July 31, 2000
- Compile responses to public review comments, append final decision document and SEIS, approval and Record of Decision: August 2000
- Project Cooperation Agreement (amendment): January 2001
- Design and construction completed: December 2003

Table 1
Summary of Public Coordination

Meeting / Event	Attended	Date	Site	Purpose
Pre-Scoping Meeting	Various agencies and interested stakeholders	April 1, 1999	Homestead	Introduction meeting, preliminary discussion of work effort for EIS.
Pre-Scoping Meeting (SERA)	Various agencies and interested stakeholders	April 8, 1999	Ft. Lauderdale	Agency and public comment on project.
Scoping	Public invited -	June 21, 1999	Homestead	Project description was

Meeting (NEPA requirement)	included all residents, agencies, and interested stakeholders			presented. Received public comment on project.
Technical Team Meeting	Technical representatives from various agencies.	August 4, 1999	West Palm Beach	Evaluate potential alternatives for further evaluation. Discuss modeling requirements.
Public Comment (Working Group of the SFERTF)	Public, various agencies, and interested stakeholders	Sept. 1-2, 1999	Homestead, Key Largo	Round table discussion with technical panel. Public comment received.
Public Workshop (NEPA requirement)	Public, various agencies, and interested stakeholders	October 6, 1999	Homestead	Presentation of 8.5 SMA alternatives. Public comment received.
Technical Team Meeting	Technical representatives from various agencies and interested stakeholders	October 7, 1999	Homestead	Discussion of critical issues, modeling needs, and performance measures.
Technical Team Meeting	Technical representatives from various agencies and interested stakeholders	October 27, 1999	Jacksonville	Modeling and alternatives analysis.
Technical Team Meeting	Technical representatives from various agencies and interested stakeholders	November 1999	Jacksonville	Modeling requirements and environmental issues.
SFWMD Governing Board Presentation	Governing Board and public	December 15, 1999	West Palm Beach	Presented status of project.
Technical Team Meeting	Technical representatives from various agencies and interested stakeholders	January 4, 2000	Miami	Local cost issues discussed.

Technical Team Meeting	Technical representatives from various agencies and interested stakeholders	January 10, 2000	Ft. Lauderdale	Performance measures and modeling.
Public Workshop (Hosted by SFWMD)	Public, various agencies, and interested stakeholders	January 18, 2000	Homestead	Presentation of performance measures, modeling, and schedule. Public comment received.
Technical Team Meeting	Technical representatives from various agencies and interested stakeholders	January 19, 2000	Homestead	Discussion of performance measures.
SFWMD Governing Board Meeting	Governing Board and public	February 23, 2000	West Palm Beach	Present performance measures.

Table 2
Features of Alternatives

Feature	Alt No. 1	Alt No. 2B	Alt No. 3	Alt No. 4	Alt No. 5	Alt No. 6B	Alt No. 7	Alt No. 8A	Alt No. 9
Name	Authorized GDM	Modified GDM	Deep Seepage Barrier	Landowner's Choice Acquisition	Total Buy-Out	Western Area as Buffer	Raise All Roads	Western Area as Flow-Way	Adaptive Refinement of GDM
DDR Figure No.	Figure 4	Figure 5	Figure 6	Figure 7	Figure 8	Figure 9	Figure 10	Figure 11	Figure 12
Level of flood protection/mitigation	Mitigation	Mitigation	Protection	Mitigation	Mitigation	Protection	Mitigation	Mitigation	Mitigation
Mitigation/protection method	Levees, seepage canal, pumps	Levees, seepage canal, pumps	Levee and Seepage barrier	Land acquisition	Land acquisition	Levees, seepage canal, pump	Raise roads	Levees, seepage canal, pump/gate	Levees, seepage canal, pumps
Approx. amount of 8.5 SMA mitigated/protected by structural measures	100%	100%	100%	0%	0%	35%	0%	50%	100%
Canal-levee system	Major Levee, seepage canal, minor levee	Major Levee, seepage canal, minor levee	Levee	None	None	Major Levee, seepage canal, minor levee	None	Major Levee, minor levee	Major Levee, seepage canal, minor levee
Length of new canals/levees	39,000 ft	39,000 ft	39,000 ft	n/a	n/a	23,000 ft	n/a	23,000 ft	39,000 ft
Amount of land acquisition needed	5%	5%	5%	TBD	100%	65%	0%	50%	5%
Seepage water management	Pump to L-31N	Pump to C-111 Buffer Area	Barrier - not needed	n/a	n/a	Pumped to C-111 Buffer Area	n/a	Pumped to C-111 Buffer Area	Pump to L-31N; Pump to C-111 Buffer Area
Seepage water treatment method	Discharge to L-31N	Overland Flow to C-111 Buffer Area	n/a	n/a	n/a	Overland Flow to C-111 Buffer Area	n/a	Overland Flow to C-111 Buffer Area	Discharge to L-31N; C-111 Buffer Area
Number of new structures	2	2	0	0	0	1	0	1	2; 1
Preliminary Cost Estimate ($Million)	$30.6	$33.9	$241	$132	$179	$144	$136	$142	$39.9

Table 3
Features of Project Conditions

ID No.	Project Condition	Operating Procedure	Boundary Conditions	C-111 Project	8.5 SMA Alts Considered
CD1	Base 83	1983	1983	No	None
CD2	Base 95	1995	1995	No	None
CD3	Base 83 + Future w/o Project	1983	MWD (projected full implementation)	Yes	Alt #1 (Authorized Plan)

CD4	Base 95 + Future w/o Project	1995	MWD (projected full implementation)	Yes	Alt #1 (Authorized Plan)
CD5	Future w/ Project	1995	MWD (projected full implementation)	Yes	Alts # 2-9 (Potential LPAs)

Table 4
Summary of Alternative Comparisons

ID No.	Comparison	Purpose of Comparison	Base Project Condition *	Proposed Project Condition *
CM1	Federal Requirement	Verify mitigation requirements met by each alternatives	CD1	CD4 & CD5
CM2	Impacts to Existing Conditions	Impacts of each alternative to current conditions	CD2	CD4 & CD5
CM3	LPA Comparison	Differences in proposed LPAs to authorized plan	CD4	CD5

*Refer to Table 3 for features of project conditions.

Table 5

Description of Performance Measures

1. Evaluate effects on hydropatterns in NESRS.			
Measure	Description	Metric/Comments	Comparison
a. Hydroperiod Impacts	Increase or decrease in acreage with	Total number of acres with increased or decreased hydroperiod as compared to the Base95 simulation for the area within NESRS. Determined by calculating the number of acres which have increased or decrease water levels and durations.	CM2, CM3

	increased hydroperiod.		
b. Water depths	Increase or decrease in water depths for areas within NESRS.	Total number of acres within NESRS with an increase (+) or decrease (-) in water depths. Determined by comparing the average change in water depth for each cell during the model year.	CM2, CM3
c. Effects on Seasonal variability	Change in stage variation (min, max, range) at key indicator cells.	Minimum/Maximum: Compare hydrograph for key indicator cells for four-week period (with min/max in middle). Range: Compare changes in ranges (max-min) for each indicator cell.	CM2, CM3
d. Duration of continuous flooding	Number of consecutive days with depths greater than 0.2 feet at key indicator cells.	Compare the number of consecutive days of depths > 0.2 feet for at key indicator cells in ENP.	CM2, CM3
2. Evaluate impacts to the landowners and residents of the 8.5 SMA resulting from implementation of the Modified Water Deliveries Project			

Measure	Description	Metric/Comments	Comparison
a. Flood mitigation damages	Extent of project-induced flood damages (area and duration) to areas designated for flood mitigation not prevented by mitigation structural features	Area: Total number of acres within the 8.5 SMA where the total depth of inundation is greater than the comparison base condition during weeks 21-37 of the 1995 model year.	CM2, CM3
b. Flood protection damages	Spatial extent of project-induced flood damages to areas designated to receive 1-in-10 year flood protect	Area: Total number of acres within designated protection area where the stage is greater than the comparison base condition during weeks 21-37 of the 1995 model year.	CM2, CM3

	ion not prevented by protection structural features.		
c. Impacts to business	Potential direct or indirect loss to local business activity.	Number of businesses impacted from PM 2a above.	CM2, CM3
d. Residents relocated	Potential number of residents required to be relocated.	Number of residents relocated from PM 2a above.	CM2, CM3
e. Lost agricultural lands	Potential number of acres of agricultural lands and associated annual losses.	Number of acres of agriculture lands and lost annual income which will no longer be available for agricultural uses from PMs 2a. and 2b.	CM2, CM3
f. Unwilling	Potenti	Number of owners unwilling to sell their property.	CM2, CM3

sellers	al number property owners unwilling to sell their property.		
3. Analyze Cost Effectiveness			
Measure	Description	Metric/Comments	Comparison
a. Project costs	Increase in overall project costs	Actual estimated cost of the alternative; includes real estate, capital/construction costs and O&M costs	CM3
b. Local Costs	Secondary impact costs to Miami-Dade County and/or residents	Local costs potentially incurred as a result of any alternative implementation in conformance with applicable local ordinances.	CM3
4. Analyze Effects to Ecological Functions			
Measure	Description	Metric/Comments	Comparison
a. Wetlands west of L-31N	Spatial extent of wetlands west of L-31N	Number of acres with water level > -1.0 feet from ground surface for at least 30 days, and hydroperiod of 30 days or greater during the average year.	CM2, CM3
b. Short	Spatial	Number of acres with depth between –1.0 feet and	CM2, CM3

Hydroperiod wetlands	extent of short hydroperiod wetlands (Marl forming)	2.0 feet for 30 to 180 days during the average year.	
Long Hydroperiod wetlands	Spatial extent of long hydroperiod wetlands (Marl forming)	Number of acres with water depth above –1.0 feet for greater that 180 days during average the year.	CM2, CM3
c. WRAP Score	Function and value of wetlands	Wetlands Rapid Assessment Procedure Functional Score at selected indicator cells.	CM2, CM3
5. Evaluate effects on conditions favorable to Federal and State Listed Endangered Species survival			
Measure	Description	Metric/Comments	Comparison
a. Cape Sable Seaside Sparrow	Evaluate key indicator cells at CSSS habitat Area F.	Biological Assessment will be completed for the preferred alternative.	CM2, CM3
6. Measure compatibility with CERP and C-111 projects without adversely impacting the current level of flood protection east of L-31N			
Measure	Descri	Metric/Comments	Comparison

	ption		
a. Compatibility with CERP	Need for project features to be removed or significantly rehabilitated to accommodate the CERP features	Qualitative discussion and assessment of ability of each alternative to meet this objective.	CM3
b. Compatibility with C-111	Ability to accommodate the C-111 project requirements	Qualitative discussion and assessment of ability of each alternative to meet this objective.	CM3
c. Agricultural lands east of L-31N	Potential increase in either stage or duration to agricultural lands east of L-31N	Total number of acres of agriculture lands east of L-31N with an increase (+) or decrease (-) in water depths. Determined by comparing the average change in water depth for each cell during the model year (based on 52 7-day timesteps).	CM2, CM3
7. Analyze impacts and costs associated with time delays in implementation of alternatives			

Measure	Description	Metric/Comments	Comparison
a. Environmental and cultural resources	Lost environmental resources due to higher water levels in WCA 3A, WCA 3B, and NESRS.	Qualitative discussion of the resources impacted if schedule is extended.	CM3
b. Ability to meet implementation schedule	Ability of each alt to be implemented before December 2003	Qualitative discussion with statement of expected completion date	CM3
c. Construction delays	Unknowns associated with constructability (including land acquisition issues)	Qualitative discussion of the implementation issues, that will impact scheduling	CM3
d.	Estima	Qualitative discussion of the administrative issues	CM3

Administrative requirements of alternatives	te potential delays associated with admin requirements of any potential LPA	that will impact scheduling.	

Table 6

Analysis of Project Requirements

Requirements	Alt 1	Alt 2B	Alt 3	Alt 4	Alt 5	Alt 6B	Alt 7	Alt 8A	Alt 9
1. Do not negatively impact higher stages in ENP as specified in MWD Project.	Meets	Meets	Meets	Meets	Meets	Meets	Meets	Meets	Meets
2. Mitigate for increased stages within the 8.5 SMA resulting from implementation of the MWD Project. (2)	Meets	Meets	Meets	Meets	Meets	Meets	Meets	Meets	Meets
3. Develop a solution that can be permitted by regulatory interests under current and reasonably foreseeable regulations.	Meets	Meets	Meets	Meets	Meets	Meets	Meets	Meets	Meets
4. Ensure no significant impact to existing habitat of endangered or threatened species. (3)	Meets	Meets	Meets	Meets	Meets	Meets	Meets	Meets	Meets
5. Maintain current levels of flood protection for agricultural areas east of L-31N.	Meets	Meets	Meets	Meets	Meets	Meets	Meets	Meets	Meets

Notes:

1. Full mitigation for the 8.5 SMA is provided for each alternative through the use of structural and/or non-structural (i.e., easements) features.
2. If alternatives required additional features (structural and non-structural) to meet the goal of mitigation, it is considered to meet with additions.
3. Modeling results are inconclusive, Section 106 Consultation will conclude after a plan is selected.

Table 7

Alternative Analysis Fact Sheets

Objective 1: Evaluate effects on hydropatterns in NESRS.
Performance Measure: PM1a: Hydroperiod Impacts
Source of Data: • MODBRANCH modeling results for Base 95 and all alternatives – See Appendix A, Table 73.
Procedure: • Determine, for the cells located within the NESRS, the total number of days where water surface is above the ground for the Base95 condition • Determine, for the cells located within the NESRS, the total number of days where water surface is above the ground for Alternative conditions. • Determine which cells have an increase in the number of days and which cells have a decrease in the number of days. • Calculate the total number of acres which have an increase or decrease in the number of days with water surface above the ground.

Results:

- All alternatives show an increase in hydroperiods as compared to the Base 95 condition. Increases range between a low of 29,799 acres for Alternative 2B to a high of 30,982 acres for Alternatives 3, 4, 5, 6B, 7, and 8A.

- Alternatives 1, 2B, and 9, the perimeter levee and seepage canal alternatives, show a decrease in hydroperiod for 775, 1,183, and 979 acres respectively, accounting for the edge affect of the seepage canal.

Objective 1: Evaluate effects on hydropatterns in NESRS.

Performance Measure:
PM1b: Water depths

Source of Data:

- MODBRANCH modeling results for existing conditions and all alternatives – See Appendix A, Tables 19-22, and Table 74.

Procedure:

- Computed area within ENP as the difference between the revised C-111 boundary and the 8.5 SMA

- Calculated the average annual depth of water within the NESRS for the Base83, Base95, and all alternatives for both 1995 (wet year) and 1989 (dry year) precipitation conditions.

- Calculated the average change in water depth for each cell.

- Calculated the number of acres with an increase (+) or decrease (-) in water depth.

Results:

- Data summarized on Tables 19-22 and Table 74 in Appendix A.
- All of the alternatives show an increase in average annual depth when compared to Base95 conditions.
- Average annual depth for alternatives ranges from a low of 2.33 for Alternative 2 to a high of 2.51 for Alternative 4, 5, 7, and 8. (Table 19, Appendix A)
- All alternatives show an increase in number of acres with increased depths. Increase range from approximately 59,500 for alternatives 1, 2B, and 9, to approximately 62,000 for the other alternatives.
- Only Alternatives 1, 2B, and 9 show a significant number of acres with a decrease in depths.

Objective 1: Evaluate effects on hydropatterns in NESRS.

Performance Measure:
PM1c: Seasonal variability

Source of Data:

- MODBRANCH models for existing conditions and all alternatives – See Appendix A, Tables 8 through 18.
- Modeling results included sliding 4-week average around maximum and minimum stages for all indicator cells in ENP.

Procedure:

- Computed a 4-week sliding average stage for the wet year for selected indicator cells.
- Reported the minimum and maximum 4-week stage for each selected indicator cell.
- The results from the indicator cells were averaged for each alternative for both maximum and minimum stages (See Table 11).
- The absolute range of stages were computed in the modeling for selected indicator cells in ENP Expansion Area. These values were averaged and reported (See Table 12).
- Locations of key indicator cells can be found in Figure 13.

Results:

- Data summarized in Tables 8 through 18 in Appendix A.
- All of the alternatives show an increase for both the four week average maximum and minimum when compared with Base 95 conditions.
- Alternatives 4, 5, and 7 have much higher minimum stages than the other alternatives. The maximum stages ranged from a low of around 8.05 (Alternatives 1, 2B, and 9) to a high of around 8.30 for all of the other alternatives.
- There was not a significant difference in ranges for the alternatives as all were between 1.95 and 2.02.

Objective 1: Evaluate effects on hydropatterns in NESRS.

Performance Measure:
PM1d: Flooding duration

Source of Data:

- MODBRANCH models for existing conditions and all alternatives – See Appendix A.
- Modeling results provided stages and groundwater elevations for each indicator cell in ENP.

Procedure:

- Used 9 indicator cells within the ENP Expansion Area.
- Determined the number of weeks within the 52-week simulations that the stage was above 0.2 feet for Base 95 conditions.
- Averaged the continuous flooding duration for all ENP indicator cells for each alternative (See Table 13).
- Locations of key indicator cells can be found in Figure 13.

Results:

- Weeks of continuous flooding duration range from 39 (Base 95 and Alternative 1) to 45 (Alternatives 6B and 8A).

Objective 2: Evaluate impacts to the landowners and residents of the 8.5 SMA resulting from implementation of the MWD Project.

Performance Measure:
PM2a: Flood Mitigation Damage

Source of Data:

- MODBRANCH models for all alternatives – See Appendix A.
- Social Impacts Analysis – See Appendix E
- Modeling results provided information on the extent and location of areas mitigated by the structural components within the 8.5 SMA.
- Graphics in Appendix A provide duration of continuous inundation for each alternative.

Procedure:

- Determined the number of acres where depth of inundation is greater that the base conditions in week 26 (i.e., worst cast scenario).
- Overlayed "mitigation area" graphics from modeling to determine extent of area not mitigated by structural features within 8.5 SMA.
- Estimated acreage not mitigated by structural features for each alternative.
- Calculated the percentage of the 8.5 SMA provided mitigation by structural features vs. non-structural features for each alternative.
- Alternatives 3 and 6B are <u>protection</u> alternatives, but are still analyzed for ability to provide mitigation.

NOTE: Alternatives 4 and 5 are <u>non-structural</u> alternatives only, and do not apply to this measure.

Results:

- Alternatives 1, 2B, and 9 are considered to provide mitigation utilizing structural means without additional non-structural features.
- Alternatives 7 and 8A require the purchase of flowage easements to provide supplemental mitigation for increased water depths.
- Alternative 3 provides limited mitigation through structural means (16%); Alternative 6B provides full mitigation for the area east of the levee/canal system.

NOTE: All properties receive full flood mitigation. Those areas not receiving through structural features will be supplemented through flowage easements or purchase of property.

Objective 2: Evaluate impacts to the landowners and residents of the 8.5 SMA resulting from implementation of the MWD Project.

Performance Measure:
PM2b: Flood Protection Damage

Source of Data:

- MODBRANCH models for all alternatives – See Appendix A.
- Social Impacts Analysis – See Appendix E
- Modeling results provided information on the extent and location of areas protected from the 1 in 10 year flood event by structural features of each alternative within the 8.5 SMA.

Procedure:

- Determined the number of acres where depth of inundation is greater that the base conditions in week 26 (i.e., worst cast scenario).
- Overlayed extent of "protection area" from modeling on 8.5 SMA.
- Estimated acreage of area not protected by structural features for each alternative.
- Calculated the percentage of the 8.5 SMA provided protection by structural features vs. the percentage provided mitigation by non-structural features for each alternative.

NOTE: Alternatives 1, 2B, 7, 8A, and 9 are mitigation alternatives and do not apply to this measure. Alternatives 4 and 5 are non-structural alternatives only, and do not apply to this measure.

Results:

- Alternatives 3 and 6B were projected to provide flood protection through structural measures.
- Alternative 6B provides full flood protection for all but 5% of the designated protection area.
- Alternative 3 provides protection from structural features for only 10% of the designated area, with 90% needing to be supplemented by non-structural measures.

Objective 2: Evaluate impacts to the landowners and residents of the 8.5 SMA resulting from implementation of the MWD Project.

Performance Measure:
PM2c: Impacts to Businesses

Source of Data:

- MODBRANCH models for all alternatives – See Appendix A.
- Social Impacts Analysis – See Appendix E
- Land Use data from DERM verified, as appropriate, by field reconnaissance

Procedure:

- Identified the number and location of commercial activities within the 8.5 SMA
- Identified those businesses within the boundaries of the non-mitigated area for each alternative that would require buy-out.
- Calculated the percentage of the businesses within 8.5 SMA requiring purchase by the government.

Results:

- 4 businesses are impacted from Alternatives 4 and 5 due to the non-structural measures (i.e., buy-out or flowage easements) imposed for the entire area.
- There are no impacts to businesses from any of the structural alternatives (Alternatives 1, 2B, 3, 6B, 7, 8A, and 9).

Objective 2: Evaluate impacts to the landowners and residents of the 8.5 SMA resulting from implementation of the MWD Project.

Performance Measure:
PM2d: Impacts to Residences

Source of Data:

- MODBRANCH models for all alternatives – See Appendix A.
- Social Impacts Analysis – See Appendix E
- Land Use data from DERM verified, as appropriate, by field reconnaissance

Procedure:

- Identified the number and location of residences within the 8.5 SMA
- Identified those residences within the boundaries of the non-mitigated area that would be impacted and/or required to be relocated as a result of each alternative.
- Calculated the percentage of the residences within 8.5 SMA, for each alternative, that were impacted.

Results:

- Impacts range from the relocation of a high of 208 owner occupied and 306 non-owner occupied residences in Alternative 5, to 1 relocated residence (for Alternatives 1, 2, 3, 7 & 9)
- Landowners who are engaged in farming activities would be impacted by various alternatives 5, 6B, and 8A. Impacts range from 2,642 taken out of production (Alternative 5) to 0 acres taken out of production (alternatives 1, 2B ,3 ,4 ,7, and 9).

Objective 2: Evaluate impacts to the landowners and residents of the 8.5 SMA resulting from implementation of the MWD Project.

Performance Measure:
PM2e: Impacts to Agricultural Lands

Source of Data:

- MODBRANCH models for all alternatives – See Appendix A.
- Social Impacts Analysis – See Appendix E
- Land Use data from DERM verified, as appropriate, by field reconnaissance

Procedure:

- Identified the location and extent of agricultural production within the 8.5 SMA.
- Identified those agricultural areas within the boundaries of the non-mitigated (or non-protected) area for each alternative.
- Calculated the percentage of the agricultural lands within 8.5 SMA provided protection by structural features vs. the percentage provided mitigation by non-structural features for each alternative.
- Estimated annual lost income for all (residential and non-residential) agricultural lands. (Appendix E).

Results:

- Impacts range from a high of 2642 acres (for Alt. 5) to a low of 0 acres (for Alt. 1, 2B, 3, 4, 6B, and 9).
- Lost annual income ranges from a high of $6.46M (Alt. 5) to a low of 0 (Alt. 1, 2B, 3, 4, 7 and 9)

Objective 2: Evaluate impacts to the landowners and residents of the 8.5 SMA resulting from implementation of the MWD Project.

Performance Measure:
PM2f: Unwilling Sellers

Source of Data:

- MODBRANCH models for all alternatives – See Appendix A.
- Social Impacts Analysis – See Appendix E
- Land Use data from DERM
- Public meetings and responses to a form letter. This number of unwilling sellers, however, is anticipated to be a low estimate and is not representative of all residents in 8.5 SMA.

Procedure:

- Identified the location of unwilling sellers within the 8.5 SMA.
- Identified those unwilling sellers within the boundaries of the non-mitigated (or non-protected) area for each alternative.
- Calculated the percentage of the unwilling sellers within 8.5 SMA provided protection by structural features vs. the percentage provided mitigation by non-structural features for each alternative.

Results:

- Impacts range from a high of 80 properties (for Alt. 4 & 5) to a low of 0 properties (for Alt. 1, 2B, 3, 7, and & 9).

Objective 3: Analyze cost effectiveness.

Performance Measure:
PM3a: Project costs

Source of Data:

- Engineering Design and Cost Estimates – Appendix C
- Real Estate Supplement - Appendix D

Procedure:

- The Engineering Appendix included cost estimates for all capital and operation and maintenance costs. Costs were derived from previous projects with similar construction requirements.
- The Real Estate Appendix included estimates of cost for the acquisition needs (buy-out and flowage easements) for each alternative.

Results:

- The highest real estate costs were for the buyout alternative (Alternative 5); the lowest costs were for Alts 1, 2B, and 9 where the property acquisition is minimal.
- The highest capital cost is for Alternative 3 due to the expense of constructing an impervious seepage barrier. The lowest cost is for Alternative 1.
- The highest annual operation and maintenance cost is for Alternative 7. Alternatives 3,4, and 5 have the lowest O&M costs.
- Annual costs for the alternatives range from a low of $2,765,000 for Alternative 1to a high of 18,434,000 for Alt 3 (See Appendix C)

Objective 3: Analyze cost effectiveness.

Performance Measure:
PM3b: Local Costs

Source of Data:

- Local Cost Analysis – Appendix F
- Social Impact Assessment – Appendix E
- Land Use Study from DERM

Procedure:

- A determination of existing land use was utilized from the DERM land use study.
- Future land use was calculated for various scenarios.
- The cost for local services was determined from the projected future land use and the associated need for local services.
- The local cost analysis was limited to Alternative 6B since this is the only alternative formulated to reduce flood stages to the 1 in 10-year flood event.

Results:

- Capital costs for local services for Alternative 6B is $35.8M.
- O&M costs for local for Alternative 6B is $0.9M.

Objective 4: Analyze effects to ecological functions.

Performance Measure:
PM4a: Wetlands West of L-31N

Source of Data:

- MODBRANCH Model results for all alternatives – See Appendix A
- Modeling results provided information on the stage and duration of areas in ENP Expansion area and the 8.5 SMA.

Procedure:

- Wetlands defined as those areas with water levels not less than –1.0 feet below ground level, and a hydroperiod between 30 and 360 days.
- The model output defined the areas within the area of potential effect that met this hydrologic criteria.
- Spatial extent of total wetlands within the study area is presented.

Results:

- Acreage values ranged from approximately 62,000 for Alternatives 1, 2B and 9, to approximately 66,000 for Alternatives 4, 5 and 7. This represents approximately a 6% variation.
- Most alternatives were between 64,000 and 66,000 acres.

Objective 4: Analyze effects to ecological functions.

Performance Measure:
PM4b: Short Hydroperiod & Long Hydroperiod Wetlands

Source of Data:

- MODBRANCH Model results for all alternatives – See Appendix A
- Modeling results provided information on the stage and duration of stages in ENP Expansion area.

Procedure:

- Computed spatial extent of short hydroperiod (marl forming) and long hydroperiod (peat forming) wetlands meeting the hydrologic definition for marl prairie.

- The model output provided a summary of areas meeting the criteria for long hydroperiond wetlands (water depth within –1.0 to 2.0 feet for 30 to 180 days); and for short hydroperiod wetlands (water depth less than –1.0 feet for more than 180 days)

Results:

- All alternatives resulted in a reduction in marl forming short hydroperiod wetlands when compared to existing conditions (base 95), suggesting an increase in hydroperiod, or possible wetland loss due to dry down associated with some structural alternatives. Reductions ranged from 4,901 (Alternative 3) to 3,572 (Alternatives 4, 5, and 7).

- Long hydroperiod wetlands (peat forming) increased in acreage for each alternative when compared to existing conditions. Increases ranged from 4,976 acres (Alternatives 4, 5, and 7) to 1,743 acres (Alternative 1).

- Increases in spatial extent of long hydroperiod wetlands appear to be a result of general increases in hydroperiod throughout the study area.

Objective 4: Analyze effects to ecological functions.

Performance Measure:
PM4c: WRAP score

Source of Data:

- Data was taken directly from the Draft CAR.

Procedure:

- Wetlands Rapid Assessment Procedure Functional Score at selected indicator cells.

Results:

- The WRAP scores ranged from 15,853 for Alts 4 & 5 to 10,640 for Alts 1, 2B, & 9.
- See Section 3.12 in the SEIS

Objective 5: Evaluate effects on conditions favorable to Federal and State listed endangered species survival.

Performance Measure:
PM5a: Cape Sable Seaside Sparrow

Source of Data:

- MODBRANCH models for all alternatives – See Appendix A.
- Modeling results provided information on the stage and duration of stages in certain indicator cells in Area F during the wet year

Procedure:

- Through the Draft Coordination Act Report, the USFWS has stated that impacts to the sparrow are not anticipated. Upon recommendation from the USFWS, a full assessment will be conducted to determine effects on the Cape Sable Seaside Sparrow following selection of a preferred alternative.

Results:

- To be prepared following selection of a preferred alternative.

Objective 6: Measure the compatibility with CERP and C-111 projects without adversely impacting the current level of flood protection east of L-31N.

Performance Measure:
PM6a: Compatibility with CERP

Source of Data:

- Restudy Report (CERP)
- Coordination with CERP project team

Procedure:

- The relative compatibility of the alternative with CERP was measured using qualitative indicators of red, yellow and green. These indicators were selected because their recent use in the CERP. Green indicates relative ease of incorporation into local and regional CERP components and objectives. Yellow indicates that alternative may need some manipulation to be in full compliance, while red indicates higher potential for non-compatibility.

Results:

- In a broad sense, all of the alternatives are considered to meet the general goal of CERP since they result in a significant increase in depth in the NESRS. Therefore each received a green indicator.

Objective 6: Measure the compatibility with CERP and C-111 projects without adversely impacting the current level of flood protection east of L-31N.

Performance Measure:
PM6b: Compatibility with C-111

Source of Data:

- C-111 project is being completed concurrently with this effort. Information gathered from discussions with project team.

Procedure:

- The relative compatibility of the alternative with the C-111 project was measured using qualitative indicators of red, yellow and green. These indicators were selected because their recent use in the CERP. Red indicates the potential for non-compatibility, while green indicates relative ease of incorporation into local C-111 components and objectives.

Results:

- Alternatives 2B, 6B, 8A and 9 were assigned with green indicators since these alternatives discharge all or portions of the flows to the south into the C-111 buffer area.

- Alternative 1 was assigned a red indicator because it discharges water directly away from the C-111 project area.

- All other alternatives (3, 4, 5 and 7) were assigned with yellow indicators. While not in conflict with C-111 project, they do not directly support the concept of the hydrologic buffer associated with the C-111 project.

Objective 6: Measure the compatibility with CERP and C-111 projects without adversely impacting the current level of flood protection east of L-31N.

Performance Measure:
PM6c: Agricultural Lands East of L-31N

Source of Data:

- MODBRANCH models for existing conditions and all alternatives – See Appendix A.

- Modeling results provided stages and groundwater elevations for each indicator cell in the agricultural lands east of L-31N.

Procedure:

- Stages were determined for indicator cells in the agricultural areas east of L-31N for all alternatives.
- Comparisons were made for each alternatives to the Base 95 and Alternative 1 scenarios.
- An average of the stages for all indicator cells was determined for the area.
- Locations of key indicator cells can be found in Figure 13.

Results:

- The stage for all alternatives ranged from 6.57 (Alternative 2B) to 6.72 (Alternative 1).
- The stage for the Base 95 condition is 6.35
- These results are highly influenced by boundary conditions (i.e., D13R flows and stages) and are not a direct result of the Alternatives. Alternative 1, because of its pump location, will have a slight negative impact on agricultural lands. It is recommended that an Operation EIS for the conveyance and seepage system be developed. Operational protocols can be modified to mitigate for impacts.

Objective 7: Analyze impacts and costs associated with time delays in implementation of alternatives.

Performance Measure:
PM7a: Environmental and Cultural Resources

Source of Data:

- Various research
- Restoration project data

Procedure:

- The loss of tree islands has an impact on the critical habitats and cultural resources. SFWMD staff presented rates of degradation of tree islands in WCA-3 to the Federal Working Group Panel Discussion on September 1, 1999. The total number of tree islands as well as the spatial extent of the tree islands within WCA-3 has been determined from photographs dated 1940 and 1995.

Results:

- This data shows a total decrease in the number and acreage for the 55-year period as 45% and 61%, respectively. Assuming a linear relationship for the changes in tree islands, this is estimated as loss of 8.4 islands and 246 acres per year. Delayed implementation of MWD will prolong the restoration and recovery process for the tree islands in WCA-3. Estimated values for full restoration of tree islands may ranged from $50,000 to $500,000 per acre.

Objective 7: Analyze impacts and costs associated with time delays in implementation of alternatives.

Performance Measure:
PM7b: Implementation Schedule

Source of Data:

- Engineering Appendix – Implementation schedule
- The current schedule anticipates full implementation of MWD components by December 2003.

Procedure:

- The relative compatibility of the alternative with the required implementation schedule was measured using qualitative indicators of red, yellow and green. Red indicates the potential for difficulty in meeting the deadline, while green indicates expected implementation by the specified deadline.
- Preliminary Implementation schedules were developed and presented in the Engineering Appendix.

Results:

- Alternatives 1, 2B, and 9 were assigned with green indicators since these alternatives are or closely approximate the authorized plan, where implementation could proceed with current authority and agreements.

- Alternative 3 was assigned with a yellow indicator because of overall concerns of implementation of this alternative due to both construction issues and easement requirements.

- Alternatives (4,5,6B, 7 and 8A) involving land acquisition or flow-way easements were assigned with red indicators due to the anticipated time requirements during the acquisition process.

- Alternatives 1, 2B, 3, and 9 can be expected to be completed by Dec. 2003. Other alternatives depend on the ability to acquire needed property or flowage easement.

Objective 7: Analyze impacts and costs associated with time delays in implementation of alternatives.

Performance Measure:
PM7c: Construction Delays

Source of Data:

- Engineering Appendix.

- Past experience with previous Everglades restoration and construction projects.

Procedure:

- The relative potential for construction delays was measured using qualitative indicators of red, yellow and green. Green indicates that there are no major concerns with delays associated with construction of the alternative. Red indicates an uncertainty in the construction sequence or methods, and a potential concern that constructability issues could delay implementation of the project.

Results:

- Alternatives 1, 2B, 6B, 7 and 9 were assigned with green indicators since the structural features included in these alternatives are typical construction activities in south Florida.

- Alternative 3 was assigned with a red indicator because of concerns of implementation of this alternative due to the construction of a deep seepage barrier.

Objective 7: Analyze impacts and costs associated with time delays in implementation of alternatives.

Performance Measure:
PM7d: Administrative Requirements

Source of Data:

- Discussions with USACE Project Management Staff

- Experience with other similar Federal projects.

Procedure:

- The anticipated administrative requirements for each alternative were measured using qualitative indicators of red, yellow and green.

- Red indicates the potential for significant delay associated with administrative requirements of the project.

- Green indicates that minimal administrative requirements are expected, or that any additional requirements can be accomplished in a timely manner.

Results:

- Alternatives 1, 2B, and 9 were assigned with green indicators since these alternatives are or closely approximate the authorized plan, and implementation could proceed with current authority and agreements.

- Other alternatives would require an amended PCA and were designated with a red indicator.

Table 8

Results of Alternatives Analysis

1. Evaluate effects on hydropatterns in NESRS.

Measure	Units	Base 95	Alt 1	Alt 2B	Alt 3	Alt 4	Alt 5	Alt 6B	Alt 7	Alt 8A	Alt 9
a. Hydroperiod Impacts [1]	Increased Hydroperiod (ac)	N/A	30,207	29,799	30,982	30,982	30,982	30,982	30,982	30,982	30,003
	Decreased Hydroperiod (ac)	N/A	775	1,183	0	0	0	0	0	0	979
b. Water depths[1]	Increased depth (ac)	N/A	59,427	59,694	62,396	62,125	62,125	62,068	62,125	62,029	59,560
	Decreased depth (ac)	N/A	2,538	2,271	0	0	0	0	0	95	2,405
c. Effects on Seasonal variability	Minimum stage, (ft)	5.68	6.61	6.69	6.95	8.25	8.25	6.86	8.25	6.91	6.65
	Maximum stage, (ft)	7.92	8.05	8.07	8.34	8.25	8.25	8.29	8.25	8.31	8.06
	Range of stage, (ft)	2.68	2.02	1.95	1.96	1.95	1.95	1.97	1.95	1.94	1.98
d. Duration of continuous flooding	Consecutive weeks of inundation	39	39	42	42	42	42	45	42	45	41

[1] Value represents the comparison of each alternative versus the Base 95 Condition

2. Evaluate impacts to the landowners and residents of the 8.5 SMA resulting from implementation of the Modified Water Deliveries Project

Measure	Units	Base 95	Alt 1	Alt 2B	Alt 3	Alt 4	Alt 5	Alt 6B	Alt 7	Alt 8A	Alt 9
a. Flood mitigation damages	Area of damages, (ac, %)	0	0	0	4693 73%	N/A	N/A	0	4404 69%	2013 31%	0
b. Flood protection damages	Area of damages, (ac, %)	0	N/A	N/A	5825 90%	N/A	N/A	319 5%	N/A	N/A	N/A

c. Impacts to business	No. of businesses impacted	0	0 0%	0 0%	0 0%	4 100%	4 100%	0 0%	0 0%	0 0%	0 0%
d. Residents relocated	No. of residences impacted	0	1 0.5%	1 0.5%	1 0.5%	17 8%	208 100%	143 69%	1 0.5%	129 62%	1 0.5%
e. Lost agricultural lands	Lost area (ac)	0	0 0%	0 0%	0 0%	0 0%	2642 100%	1175 44%	0 0%	900 34%	0 0%
	Lost annual income ($M)	0	0 0%	0 0%	0 0%	0 0%	6.46 100%	2.78 43%	0 0%	2.30 36%	0 0%
f. Unwilling sellers	No. of property owners	0	0 0%	0 0%	0 0%	80 100%	80 100%	59 74%	0 0%	52 65%	0 0%

3. Analyze Cost Effectiveness

Measure	Units	Base 95	Alt 1	Alt 2B	Alt 3	Alt 4	Alt 5	Alt 6B	Alt 7	Alt 8A	Alt 9
a. Project costs	O&M and Replacement Costs ($M)	0	.27	.33	0	0	0	.33	.43	.33	.37
	Real Estate Costs ($M)	0	4.1	4.1	110	123	165	113	112	115	4.1
	Capital Costs ($M)	0	27	30	131	9.2	14	31	24	27	36
	Total Initial Project Costs ($M)	0	31	34	241	132	179	144	136	142	40
b. Local Costs	Capital Cost ($M)	0	0	0	0	0	0	36	0	0	0
	Annual O&M Costs ($M)	0	0	0	0	0	0	0.90	0	0	0

1) Capital cost includes all design and construction management costs and contingency; it does not include real estate costs.
2) O & M and Replacement costs are presented as annual costs.
3) O&M costs do not include ecological O&M or water quality monitoring.
4) Real estate costs include all fee simple acquisition and flowage easements.

4. Analyze Effects to Ecological Functions

Measure	Units	Base 95	Alt 1	Alt 2B	Alt 3	Alt 4	Alt 5	Alt 6B	Alt 7	Alt 8A	Alt 9

a. Total Wetlands	Area (ac)	64,881	62,343	62,012	63,694	66,285	66,285	65,131	66,285	65,285	62,179
b. Short-Hydroperiod Marl Forming Wetlands	Area (ac)	5,971	1,690	1,249	1,070	2,399	2,399	2,074	2,399	1,908	1,470
Long-Hydroperiod Peat Forming wetlands	Area (ac)	58,910	60,653	60,763	62,624	63,886	63,886	63,057	63,886	63,377	60,709
c. WRAP Score	Functional Units	13,405	10,640	10,640	11,630	15,853	15,853	15,011	14,695	15,645	10,640
5. Evaluate effects on conditions favorable to Federal and State Listed Endangered Species survival											
Measure	Units	Base 95	Alt 1	Alt 2B	Alt 3	Alt 4	Alt 5	Alt 6B	Alt 7	Alt 8A	Alt 9
a. Cape Sable Seaside Sparrow		Through the Draft Coordination Act Report, the USFWS has stated that impacts to the sparrow are not anticipated. Upon recommendation from the USFWS, a full assessment will be conducted to determine effects on the Cape Sable Seaside Sparrow following selection of a preferred alternative.									
6. Measure compatibility with CERP and C-111 projects without adversely impacting the current level of flood protection east of L-31N											
Measure	Units	Base 95	Alt 1	Alt 2B	Alt 3	Alt 4	Alt 5	Alt 6B	Alt 7	Alt 8A	Alt 9
a. Compatibility with CERP	Qualitative (R/Y/G)	N/A	Green	Green	Green	Green	Green	Green	Green	Green	Green
b. Compatibility with C-111	Qualitative (R/Y/G)	N/A	Red	Green	Yellow	Yellow	Yellow	Green	Yellow	Green	Green
c. Agricultural lands east of L-31N	Stage (ft)	6.35	6.72	6.57	6.67	6.69	6.69	6.58	6.69	6.67	6.65
7. Analyze impacts and costs associated with time delays in implementation of alternatives											
Measure	Units	Base 95	Alt 1	Alt 2B	Alt 3	Alt 4	Alt 5	Alt 6B	Alt 7	Alt 8A	Alt 9

a. Environmental and cultural resources		See Table 7 for discussion of this measure									
b. Ability to meet implementation schedule	Qualitative (R/Y/G)	N/A	Green	Green	Yellow	Red	Red	Red	Red	Red	Green
c. Construction delays	Qualitative (R/Y/G)	N/A	Green	Green	Red	N/A	N/A	Green	Green	Yellow	Green
d. Administrative requirements of alternatives	Qualitative (R/Y/G)	N/A	Green	Green	Yellow	Red	Red	Red	Red	Red	Green

Table 9

Base 95 Comparison

1. Evaluate effects on hydropatterns in NESRS.											
Measure	Units	Base 95	Alt 1	Alt 2B	Alt 3	Alt 4	Alt 5	Alt 6B	Alt 7	Alt 8A	Alt 9
a. Hydroperiod Impacts	Increased Hydroperiod (ac)		30,207	29,799	30,982	30,982	30,982	30,982	30,982	30,982	30003
	Decreased Hydroperiod (ac)		775	1,183	0	0	0	0	0	0	979
b. Wate	Increased depth (ac)		59,427	59,694	62,396	62,125	62,125	62,068	62,125	62,029	59,560

r depths	Decreased depth (ac)		2,538	2,271	0	0	0	0	0	95	2,405
c. Effects on Seasonal variability	Minimum stage, (ft)		0.93	1.01	1.27	2.57	2.57	1.18	2.57	1.23	0.97
	Maximum stage, (ft)		0.13	0.15	0.42	0.33	0.33	0.37	0.33	0.39	0.14
	Range of stage, (ft)		-0.66	-0.73	-0.72	-0.73	-0.73	-0.71	-0.73	-0.74	-0.70
d. Duration of continuous flooding	Consecutive weeks of inundation		0	3	3	3	3	6	3	6	2
2. Evaluate impacts to the landowners and residents of the 8.5 SMA resulting from implementation of the Modified Water Deliveries Project											
Measure	Units	Base 95	Alt 1	Alt 2B	Alt 3	Alt 4	Alt 5	Alt 6B	Alt 7	Alt 8A	Alt 9
a. Flood mitigation damages	Area of damages, (ac, %)		0	0	4693 73%	N/A	N/A	0	4404 69%	2013 31%	0
b. Flood protection damages	Area of damages, (ac, %)		N/A	N/A	5825 90%	N/A	N/A	319 5%	N/A	N/A	N/A
c.	No. of		0	0	0	4	4	0	0	0	0

Impacts to business	businesses impacted		0%	0%	0%	100%	100%	0%	0%	0%	0%
d. Residents relocated	No. of residences impacted		1 0.5%	1 0.5%	1 0.5%	17 8%	208 100%	143 69%	1 0.5%	129 62%	1 0.5%
e. Lost agricultural lands	Lost area (ac)		0 0%	0 0%	0 0%	0 0%	2642 100%	1175 44%	0 0%	900 34%	0 0%
	Lost annual income ($M)		0 0%	0 0%	0 0%	0 0%	6.46 100%	2.78 43%	0 0%	2.30 36%	0 0%
f. Unwilling sellers	No. of property owners		0 0%	0 0%	0 0%	80 100%	80 100%	59 74%	0 0%	52 65%	0 0%
3. Analyze Cost Effectiveness											
Measure	Units	Base 95	Alt 1	Alt 2B	Alt 3	Alt 4	Alt 5	Alt 6B	Alt 7	Alt 8A	Alt 9
a. Project costs	O&M and Replacement Costs ($M)		.27	.33	0	0	0	.33	.43	.33	.37
	Real Estate Costs ($M)		4.1	4.1	110	123	165	113	112	115	4.1
	Capital Costs ($M)		27	30	131	9.2	14	31	24	27	36
	Total Initial Project Costs		31	34	241	132	179	144	136	142	40

	($M)										
b. Local Costs	Capital Cost ($M)		0	0	0	0	0	36	0	0	0
	Annual O&M Costs ($M)		0	0	0	0	0	0.90	0	0	0

1) Capital cost includes all design and construction management costs and contingency; it does not include real estate costs.
2) O & M and Replacement costs are presented as annual costs.
3) O&M costs do not include ecological O&M or water quality monitoring.
4) Real estate costs include all fee simple acquisition and flowage easements.

4. Analyze Effects to Ecological Functions

Measure	Units	Base 95	Alt 1	Alt 2B	Alt 3	Alt 4	Alt 5	Alt 6B	Alt 7	Alt 8A	Alt 9
a. Total Wetlands	Area (ac)		-2,538	-2,869	-1,187	1,404	1,404	250	1,404	404	-2,702
b. Short-Hydroperiod Marl Forming Wetlands	Area (ac)		-4,281	-4,722	-4,901	-3,572	-3,572	-3,897	-3.572	-4,063	-4,501
Long-Hydroperiod Peat Forming	Area (ac)		1,743	1,853	3,714	4,976	4,976	4,147	4,976	4,467	1,799

wetlands											
c. WRAP Score	Functional Units		-2,765	-2,765	-1,775	2,448	2,448	1,606	1,290	2,240	-2,765
5. Evaluate effects on conditions favorable to Federal and State Listed Endangered Species survival											
Measure	Units	Base 95	Alt 1	Alt 2B	Alt 3	Alt 4	Alt 5	Alt 6B	Alt 7	Alt 8A	Alt 9
a. Cape Sable Seaside Sparrow		Through the Draft Coordination Act Report, the USFWS has stated that impacts to the sparrow are not anticipated. Upon recommendation from the USFWS, a full assessment will be conducted to determine effects on the Cape Sable Seaside Sparrow following selection of a preferred alternative.									
6. Measure compatibility with CERP and C-111 projects without adversely impacting the current level of flood protection east of L-31N											
Measure	Units	Base 95	Alt 1	Alt 2B	Alt 3	Alt 4	Alt 5	Alt 6B	Alt 7	Alt 8A	Alt 9
a. Compatibility with CERP	Qualitative		Better	Better	Better	Better	Better	Better	Better	Better	Better
b. Compatibility with C-111	Qualitative		Worse	Better	Same	Same	Same	Better	Same	Better	Better

c. Agricultural lands east of L-31N	Stage (ft)		0.37	0.22	0.32	0.34	0.34	0.23	0.34	0.32	0.30
7. Analyze impacts and costs associated with time delays in implementation of alternatives											
Measure	Units	Base 95	Alt 1	Alt 2B	Alt 3	Alt 4	Alt 5	Alt 6B	Alt 7	Alt 8A	Alt 9
a. Environmental and cultural resources		Not Applicable for this Comparison									
b. Ability to meet implementation schedule											
c. Construction delays											
d. Administrative											

requirements of alternatives		

Table 10

Locally Preferred Alternative Comparison

1. Evaluate effects on hydropatterns in NESRS.											
Measure	Units	Base 95	Alt 1	Alt 2B	Alt 3	Alt 4	Alt 5	Alt 6B	Alt 7	Alt 8A	Alt 9
a. Hydroperiod Impacts	Increased Hydroperiod (ac)			-408	775	775	775	775	775	775	-204
	Decreased Hydroperiod (ac)			408	-775	-775	-775	-775	-775	-775	204
b. Water depths	Increased depth (ac)			276	2,969	2,698	2,698	2,641	2,698	2,602	133
	Decreased depth (ac)			-276	-2,538	-2,538	-2,538	-2,538	-2,538	-2,443	-133
c. Effects on Seasonal variability	Minimum stage, (ft)			0.08	0.34	1.64	1.64	0.25	1.64	0.30	0.04
	Maximum stage, (ft)			0.02	0.29	0.29	0.20	0/24	0.20	0.26	0.01
	Range of stage, (ft)			-0.07	-0.06	-0.07	-0.07	-0.05	-0.07	-0.08	-0.04
d. Duration of continuou	Consecutive weeks of inundation			3	3	3	3	6	3	6	2

s flood ing											
2. Evaluate impacts to the landowners and residents of the 8.5 SMA resulting from implementation of the Modified Water Deliveries Project											
Measure	Units	Base 95	Alt 1	Alt 2B	Alt 3	Alt 4	Alt 5	Alt 6B	Alt 7	Alt 8A	Alt 9
a. Flood mitigation damages	Area of damages, (ac, %)			0	4693 73%	N/A	N/A	0	4404 69%	2013 31%	0
b. Flood protection damages	Area of damages, (ac, %)			N/A	5825 90%	N/A	N/A	319 5%	N/A	N/A	N/A
c. Impacts to business	No. of businesses impacted			0 0%	0 0%	4 100%	4 100%	0 0%	0 0%	0 0%	0 0%
d. Residents relocated	No. of residences impacted			0	0	16	207	142	0	128	0
e. Lost agricultural lands	Lost area (ac)			0 0%	0 0%	0 0%	2642 100%	1175 44%	0 0%	900 34%	0 0%
	Lost annual income ($M)			0 0%	0 0%	0 0%	6.46 100%	2.78 43%	0 0%	2.30 36%	0 0%
f.	No. of			0	0	80	80	59	0	52	0

Unwilling sellers	property owners			0%	0%	100%	100%	74%	0%	65%	0%

3. Analyze Cost Effectiveness

Measure	Units	Base 95	Alt 1	Alt 2B	Alt 3	Alt 4	Alt 5	Alt 6B	Alt 7	Alt 8A	Alt 9
a. Project costs	O&M and Replacement Costs ($M)			0.06	-0.27	-0.27	-0.27	0.06	0.16	0.06	0.10
	Real Estate Costs ($M)			0.0	105.9	118.9	160.9	108.9	107.9	110.9	0.0
	Capital Costs ($M)			3	104	-18	-13	4	-3	0	9
	Total Initial Project Costs ($M)			3	210	101	148	113	105	111	9
b. Local Costs	Capital Cost ($M)			0	0	0	0	36	0	0	0
	Annual O&M Costs ($M)			0	0	0	0	0.90	0	0	0

1) Capital cost includes all design and construction management costs and contingency; it does not include real estate costs.
2) O & M and Replacement costs are presented as annual costs.
3) O&M costs do not include ecological O&M or water quality monitoring.
4) Real estate costs include all fee simple acquisition and flowage easements.

4. Analyze Effects to Ecological Functions

Measure	Units	Base 95	Alt 1	Alt 2B	Alt 3	Alt 4	Alt 5	Alt 6B	Alt 7	Alt 8A	Alt 9

a. Total Wetlands	Area (ac)			-331	1,351	3,942	3,942	2,788	3.942	2,942	-164
b. Short-Hydroperiod Marl Forming Wetlands	Area (ac)			-441	-620	709	709	384	709	218	-220
Long-Hydroperiod Peat Forming wetlands	Area (ac)			110	1,971	3,233	3,233	2,404	3,233	2,724	56
c. WRAP Score	Functional Units			0	990	5,213	5,213	4,371	4,055	5,005	0
5. Evaluate effects on conditions favorable to Federal and State Listed Endangered Species survival											
Measure	Units	Base 95	Alt 1	Alt 2B	Alt 3	Alt 4	Alt 5	Alt 6B	Alt 7	Alt 8A	Alt 9
a. Cape Sable Seaside Sparr		Through the Draft Coordination Act Report, the USFWS has stated that impacts to the sparrow are not anticipated. Upon recommendation from the USFWS, a full assessment will be conducted to determine effects on the Cape Sable Seaside Sparrow following selection of a preferred alternative.									

ow		

6. Measure compatibility with CERP and C-111 projects without adversely impacting the current level of flood protection east of L-31N

Measure	Units	Base 95	Alt 1	Alt 2B	Alt 3	Alt 4	Alt 5	Alt 6B	Alt 7	Alt 8A	Alt 9
a. Compatibility with CERP	Qualitative			Same	Same	Same	Same	Same	Same	Same	Same
b. Compatibility with C-111	Qualitative			Better	Same	Same	Same	Better	Same	Better	Better
c. Agricultural lands east of L-31N	Stage (ft)			-0.15	-0.05	-0.03	-0.03	-0.14	-0.03	-0.05	-0.07

7. Analyze impacts and costs associated with time delays in implementation of alternatives

Measure	Units	Base 95	Alt 1	Alt 2B	Alt 3	Alt 4	Alt 5	Alt 6B	Alt 7	Alt 8A	Alt 9
a. Environmental and	Qualitative (R/Y/G)	See text for discussion of this measure									

cultural resources											
b. Ability to meet implementation schedule	Qualitative (R/Y/G)			Same	Worse	Worse	Worse	Worse	Worse	Worse	Same
c. Construction delays	Qualitative (R/Y/G)			Same	Worse	N/A	N/A	Worse	Worse	Worse	Same
d. Administrative requirements of alternatives	Qualitative (R/Y/G)			Same	Worse	Worse	Worse	Worse	Worse	Worse	Same

Table 11

Four Week Average Around Minimum Weekly Average Groundwater Head for Selected ENP Indicator Cells						
Plan Description	ENP Model Indicator Cells[1]					Average
	19990	20378	20890	21271	24577	[ft]
Base 95	7.09	5.88	6.69	4.89	3.84	5.68
Alt No.1	8.00	6.82	7.53	6.28	4.43	6.61
Alt No. 2B	7.97	6.73	7.55	6.71	4.49	6.69
Alt No. 3	8.13	7.75	7.74	6.73	4.41	6.95
Alts No. 4,5 & 7	9.27	8.54	8.67	8.03	6.75	8.25
Alt No. 6B	8.06	7.13	7.68	6.95	4.49	6.86
Alt No .8A	8.08	7.23	7.68	7.10	4.43	6.91
Four Week Average Around Maximum Weekly Average Groundwater Head for Selected ENP Indicator Cells						
Plan Description	ENP Model Indicator Cells[1]					Average
	19990	20378	20890	21271	24577	[ft]
Base 95	8.78	8.25	8.34	7.56	6.64	7.92
Alt No.1	9.15	8.08	8.52	7.74	6.74	8.05
Alt No. 2B	9.13	7.83	8.54	8.10	6.76	8.07
Alt No. 3	9.35	8.81	8.73	8.07	6.75	8.34
Alts No. 4,5 & 7	9.27	8.54	8.67	8.03	6.75	8.25
Alt No. 6B	9.26	8.33	8.70	8.40	6.77	8.29
Alt No .8A	9.28	8.52	8.68	8.33	6.75	8.31

Notes:
1. Indicates cell numbers in layer 3 of MODBRANCH model grid.

Table 12

Average Range of Indicator Cells for ENP Expansion Lands

Category	Cell	Alternatives						
		Base 95	Alt 1	Alt 2B	Alt 3	Alts 4,5,7	Alt 6B	Alt 8A
ENP Indicator Cells	21271	3.33	2.01	1.85	1.83	1.83	2.00	1.79
	21791	3.60	1.95	1.73	1.74	1.75	1.79	1.72
	20890	2.11	1.60	1.60	1.60	1.60	1.62	1.61
	19990	2.15	1.59	1.60	1.66	1.62	1.64	1.64
	20378	2.87	2.07	1.88	1.70	1.65	1.61	1.70
	24577	3.42	2.96	2.87	2.94	2.95	2.88	2.92
	24587	2.87	2.63	2.53	2.65	2.63	2.59	2.59
	19177	2.05	1.91	1.92	1.95	1.93	1.95	1.94
	19213	1.76	1.50	1.59	1.61	1.58	1.61	1.59
AVG		2.68	2.02	1.95	1.96	1.95	1.97	1.94

Table 13

Continuous Flooding Duration of Indicator Cells for ENP Expansion Lands

Category	Cell	Indicator Cells in ENP Expansion Land						
		Base 95	Alt 1	Alt 2B	Alt 3	Alts 4,5,7	Alt 6B	Alt 8A
ENP Indicator Cells	21271	27	28	31	31	31	34	34
	21791	30	31	52	34	34	52	52
	20890	52	52	52	52	52	52	52
	19990	52	52	52	52	52	52	52
	20378	31	31	31	52	52	52	52
	24577	30	27	31	31	31	31	31
	24587	25	26	28	26	26	28	26
	19177	52	52	52	52	52	52	52
	19213	52	52	52	52	52	52	52
AVG		39	39	42	42	42	45	45

Table 14
Average Stage of Indicator Cells for Agricultural Lands

Category	Cell	Indicator Cells in Agricultural Lands East of L-31N						
		Existing	Alt 1	Alt 2B	Alt 3	Alts 4,5,7	Alt 6B	Alt 8A
Agricultural Indicator Cells	19761	6.82	7.29	7.09	7.22	7.23	7.13	7.21
	19766	6.17	6.70	6.50	6.63	6.64	6.53	6.62
	20031	6.77	7.24	7.04	7.22	7.22	7.11	7.20
	20036	6.11	6.57	6.39	6.52	6.53	6.43	6.51
	20390	6.89	7.25	7.04	7.17	7.23	7.09	7.20
	20396	5.47	5.64	5.60	5.61	5.64	5.59	5.63
	20931	6.55	6.89	6.74	6.82	6.87	6.68	6.84
	20936	5.99	6.20	6.14	6.17	6.20	6.10	6.18
AVG		6.35	6.72	6.57	6.67	6.69	6.58	6.67

Table 15

Potential Federal Funding Based on Current Authorities

Estimated Project Costs										
Category	Units ($M)	Alt 1	Alt 2B	Alt 3	Alt 4	Alt 5	Alt 6B	Alt 7	Alt 8A	Alt 9
Project Costs	O&M/Replacement	.27	.33	0	0	0	.33	.43	.33	.37
	Real Estate Cost	4	4	110	123	165	113	112	115	4
	Capital Cost	27	30	131	9	14	31	24	27	36
	Total Initial Cost	31	34	241	132	179	144	136	142	40

1) O & M and Replacement costs are presented as annual costs.
2) O&M costs do not include ecological O&M or water quality monitoring.
3) Real estate costs include all fee simple acquisition and flowage easements.
4) Capital cost includes all design and construction management costs and contingency; it does not include real estate costs.

Potential Federal Funding										
Category	Units ($M)	Alt 1	Alt 2B	Alt 3	Alt 4	Alt 5	Alt 6B	Alt 7	Alt 8A	Alt 9

Potential Federal Funding	O&M/Replacement	.20	.20	.20	.20	.20	.20	.20	.20	.20
	Real Estate Cost	4	2	55	62	83	57	56	58	2
	Capital Cost	27	30	31	9	14	31	24	27	31
	Total Initial Cost	31	32	86	71	97	88	80	85	33

Assumptions:

1. Alternative 1 is the current authorized federal plan and DOI funds 100% of project costs and COE funds 75% of O&M costs

2. Up to $31 million of present capital and Real estate costs from Alternative 1 are available for capital costs for Alternatives 2B-9

3. Up to 50% of real estate costs can be made available through supplemental DOI funding

4. Up to $0.20 million of present O&M costs from Alternative 1 are available from COE for Alternatives 2B-9

5. If total costs change, federal funding could change

6. If the federally preferred project changes, federal funding changes

7. If DOI or USACE authority changes, federal funding could change

Notes:

1. All figures represent the upper limit of present DOI or UASCE authority, given the assumptions stated above, and are not representative of an actual DOI or USACE funding decision or appropriations

2. Approximately $50 million in Land and Water Conservation Fund (LWCF) grant funds are appropriated and available

3. Approximately $12 Million in MWD funding and $47 million in LWCF grant funding are included in the FY 2001 DOI budget request currently under consideration by Congress