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National Park Service
U.S. Department of the Interior

Everglades National Park

Florida

FINDING OF NO SIGNIFICANT IMPACT

CAPE SABLE CANALS DAM RESTORATION PROJECT /

ENVIRONMENTAL ASSESSMENT / ASSESSMENT OF EFFECT

February 2010

Implementation of the project to restore the failed dams on the East Cape Extension and Homestead canals in the Cape Sable area of Everglades National Park does not constitute an action that normally requires preparation of an Environmental Impact Statement (EIS). The Selected Alternatives will not have a significant effect on the human environment. Negative environmental impacts that could occur are short- or long-term and negligible to moderate in intensity. There will be no significant impacts on public health, public safety, threatened or endangered species, or other unique characteristics of the site. There are no unmitigated adverse impacts on sites or districts listed in or eligible for listing in the National Register of Historic Places (NRHP). No uncertain or controversial impacts, unique risks, significant cumulative effects, or elements of precedence were identified. Implementation of the selected alternatives will not violate any federal, state, or local environmental protection law or result in the impairment of park resources or values.

Based on the foregoing information, the National Park Service has determined that an EIS is not required for this project and thus will not be prepared.

Recommended: for Keith A. Whisenant 02/12/10

Dan B. Kimball — Date

Superintendent, Everglades National Park

Approved: David Vela 2-17-10

David Vela — Date

Director, Southeast Region

Attachments

A. Response to Comments
B. Errata Sheets
C. Statement of Findings for Wetlands

INTRODUCTION

This Finding of No Significant Impact (FONSI) has been prepared by the National Park Service for the *Cape Sable Canals Dam Restoration Project/Environmental Assessment (EA)/Assessment of Effect.* This FONSI replaces and supercedes the previous FONSI dated August 2009, recommended on August 12, 2009, by Everglades National Park Superintendent, Dan Kimball and approved on August 14, 2009, by National Park Service Southeast Region Director, David Vela. Since the completion of the National Environmental Policy Act (NEPA) process, new information was provided by two local specialty marine equipment contractors during the development of the design documents causing a revision to the previously selected Alternative D1 for Homestead Canal. The decision not to proceed with Alternative D1 was based on new information that the use of ultra light/specialized marine equipment with shallow drafts can be utilized to transport the necessary sheetpile equipment into the Homestead Canal without impacting the substrate of Lake Ingraham. Therefore, a hybrid alternative (Alternative D/D1-Hybrid) was developed to replace Alternative D1. The hybrid alternative is explained in detail under the Selected Alternatives description below. A new FONSI is needed to document the NPS decision to implement Alternative D/D1-Hybrid.

BACKGROUND

Everglades National Park (park) is one of 391 units of the National Park System administered by the National Park Service (NPS), U.S. Department of the Interior. Established in 1947, the park's original boundaries contained 460,000 acres. Subsequent legislation increased its size to 1,509,000 acres, including most of Florida Bay. The most recent addition came in 1989 when Congress added 109,506 acres in the East Everglades area of the park, including a portion of the Northeast Shark River Slough, a waterway that is critical for the protection of park resources and hydrologic restoration.

The Cape Sable peninsula extends from the southwestern tip of Florida, within the park, into the Gulf of Mexico and Florida Bay. The cape contains stretches of shell beaches fringed by a mix of mangrove trees and marsh. Beyond the mangroves lies Lake Ingraham, the largest of the cape's lakes. The lake is backed by a narrow marl ridge that shelters the cape's numerous interior freshwater to brackish marshes.

In the early 20th century, a network of canals was dredged through the marl ridge to drain the cape's interior marshes for agricultural uses and cattle grazing. These canals have triggered substantial change in the ecology of the area. At least seven canals were constructed, exposing the cape's interior marshes and lakes to Florida Bay and the Gulf of Mexico. Incoming tides now push marine waters and sediments inland, increasing salinity and transporting sediments to lakes and marshes. Outgoing tides drain freshwater from marshes north of the marl ridge and transport sediments toward Lake Ingraham and Florida Bay.

The constant movement of water through man-made canals on the cape has widened several canals. The main East Cape canal has widened from 20 feet to more than 250 feet, resulting in a substantial loss of coastal habitat. The expansion of these canals has exacerbated sediment deposition in the cape's open waters and is converting Lake Ingraham into a tidal mud flat.

The freshwater ecosystems of Cape Sable have changed substantially from exposure to the sea. The incursion of saltwater into formerly freshwater marshes because of canal building and sea level rise has lead to the physical

collapse of these marshes. Peat soil is lost, and freshwater marsh communities are being replaced by open water saline communities. Higher salinity in the interior marshes has altered vegetation patterns, reduced the quality of wildlife habitat, and lowered the productivity of forage fishes, potentially impacting the survival of various wading birds. Higher salinity in interior marshes reduces juvenile crocodile habitat suitability and potentially affects the ability for wading birds and other fauna to forage efficiently. Seawater and sediment entering the lakes and marshes have brought about changes that are compromising the function of coastal habitats that are important to sea turtles, recreational fish, and other plants and animals that are dependent on the cape for survival. As the canals on Cape Sable continue to widen, it is believed the rate of change will continue to accelerate, emphasizing the need for timely corrective action. In addition, the existing failed sheetpile dams allow illegal access to the area by motorized boats and are a safety hazard for non-motorized boaters attempting to navigate the strong current moving through the dam breaches or approaching the dams during spring tides.

The NPS has long recognized the importance of addressing impacts from the Cape Sable canals. Stopping tidal flow into the cape's interior marshes is the key to revitalizing the function of these freshwater marshes. Although this landscape is naturally dynamic, slowing the rate of human-induced change on this landscape may also bring about greater resilience to the cape in the face of predicted sea level rise and the possibility of more frequent and intense hurricanes.

The NPS plugged several of the canals at the marl ridge with earthen dams in the late 1950s and early 1960s. Over time, natural forces compromised two of these early structures, and by 1992 they had failed. The earthen dams were replaced in 1997 with sheetpile dams, although these also failed after a few years, possibly because of vandalism, which increased erosion of the canal banks. Openings at the failed plugs continue to widen because of erosional processes and transport marine waters eastward along the Homestead Canal as far as Bear Lake. These structures are located along the East Cape Extension and Homestead canals.

PROJECT PURPOSE AND OBJECTIVES

The NPS will replace the failed dams on the East Cape Extension and Homestead canals within the Cape Sable area of the park. This project is intended to provide sustainable solutions to issues associated with saltwater intrusion into and degradation of freshwater and brackish marshes north of the marl ridge, illegal motorized boat access into the Marjory Stoneman Douglas Wilderness area, and unsafe conditions for motorized and non-motorized boaters at the dam sites.

The following objectives were established for the project:

Natural Resources

- Restrict the flow of saltwater into freshwater and brackish marshes north of the Cape Sable marl ridge through these canals, thereby restoring the natural hydrology of the area.
- Reduce freshwater loss from freshwater and brackish interior marshes through the East Cape Extension and Homestead canals.
- Improve habitat for juvenile crocodiles, wading birds, forage fish, and other wildlife within the freshwater and brackish marshes north of the marl ridge.

- Slow the rate of marsh collapse and loss of sediment and nutrients from the interior freshwater and brackish marshes.
- Reduce/eliminate adverse impacts on marine resources.

Cultural Resources

- Avoid adverse impacts on the Homestead and East Cape Extension canals, which are historic structures, through project design or mitigation measures.

Replacement Structure Longevity

- Design replacement dams or geotubes to prevent vandals from breaching a dam by trenching around or through it, or damaging the geotubes.
- Design replacement structures to last at least 50 years (barring severe damage by catastrophic hurricanes) with annual/bi-annual maintenance.

Visitor Use and Experience

- Provide safe passage over restored dams for canoeists/kayakers.
- Resolve safety issues associated with the failed sheetpile structures.
- Improve the wilderness visitor experience by eliminating/reducing illegal motorized boat entry into the Marjory Stoneman Douglas Wilderness Area.

THE SELECTED ALTERNATIVES

East Cape Extension Canal

The NPS Selected Alternative for the East Cape Extension Canal is described as "Alternative D, the Preferred Alternative" in Chapter 2 of the Cape Sable Canals Dam Restoration Project EA.

This alternative includes the extraction of the existing free-standing sheetpile wall (existing dam structure) with the use of heavy equipment positioned from a barge, and construction of a new dam structure at a narrower more suitable location within the canal located just south of the existing structure location that is in better alignment with the marl ridge. The new dam structure will be constructed as an approximately 100-foot long by 60-foot wide earthen plug contained by pile-driven steel sheetpile walls on either side to reduce the erosion impacts. The sheetpile will be driven to an approximate depth of 9 - 10 feet below the bottom of the canal (approximately -18.50 feet NAVD88 or deeper). The top of the sheetpile wall across the canal will be installed at approximate elevations varying from +1.0 to +2.0 with an average of approximately 1.5 feet NAVD88. The plug area between the two walls will be filled with fine to medium limerock sand to be obtained from an offsite upland source or local vendor and planted with wetland vegetation to reduce the potential for erosion. Landward sheetpile will also be installed in all four quadrants of the plug (design elevations are similar to the sheetpile in the canal) to form flow deflector wingwalls to promote surface sheetflow away from the dam structure and thus prevent seepage and tunneling through the marl. Deflector walls in the side bank areas will be sloped to match existing ground surfaces at their inland termination points. During the final design phase of the project, the initial sheetpile dam construction design proposed in the EA (wingwall construction with rip-rap erosion protection along the banks), was slightly modified to provide a wider navigational channel at the dam plug site to better accommodate visitor access conditions. The original design included the use of riprap material along the canal bank (2.5:1 placement slope) which

reduced the navigational width of the canal plug and drastically hindered use of both the boat and canoe ramps during low tidal conditions. Thus, to minimize reduction of the existing navigational channel, the design plans which included the use of rip-rap erosion protection along the canal bank was replaced with sheetpile. Additionally, riprap material will be placed adjacent to each sheetpile wall to substantially increase the lateral support for the dam. Graded limerock riprap (underlain by filter fabric) will also be placed on top of the fill material along the outside face of the sheetpile walls, along the deflector wingwalls, and along the exposed canal banks to provide erosion resistance. The riprap will be transported to the dam construction site on shallow draft barges staged in the construction staging area in the East Cape Canal and placed by mechanical equipment.

In addition to the above, this alternative will also include the following features to enhance visitor usage and to provide safe passage over the restored East Cape Extension Canal dam (100-foot plug area) for non-motorized boaters (canoeists/kayakers):

- Access ramp and interlocked articulated concrete block pathway over the dam plug for canoe/kayak access. The concrete block pathway will be underlain with geotextile fabric.
- Floating boat dock guided with pile hoops around steel piles with a ribbed deck gangway/walkway for access to the concrete block pathway over the dam plug. The piles will be driven by mechanical equipment transported to the site by a small draft boat or barge.
- Three permanent boat mooring piles downstream of the plug along the south side of the canal.
- Appropriate signage.

Under the Selected Alternative for the East Cape Extension Canal, the dam structure will function for a 50-year life-cycle, the natural and cultural resources will be protected, and the safety hazards from the existing dam structure will be removed, resulting in improvements to visitor safety and experience. The advantages of Alternative D, compared to the other action alternatives, will be similar with the exception that the construction costs greatly vary between the alternatives due to different engineering techniques. The cost is lower, and the advantages are higher for Alternative D; therefore, Alternative D will provide the most cost-effective solution for the park for the East Cape Extension Canal dam.

Homestead Canal

The original NPS Selected Alternative for the Homestead Canal was described as "Alternative D1, the Preferred Alternative" in Chapter 2 of Cape Sable Canals Dam Restoration Project EA. Since the completion of the National Environmental Policy Act (NEPA) process, new information was provided by two local specialty marine equipment contractors during the development of the design documents causing a revision to Alternative D1, as described below in the "Other Alternatives Considered" section. The decision not to proceed with Alternative D1 was based on the new information provided by these specialty marine contractors that the use of ultra light/specialized marine equipment with shallow drafts can be utilized to transport the necessary sheetpile equipment into the Homestead Canal without impacting the substrate of Lake Ingraham. Therefore, a hybrid alternative (Alternative D/D1-Hybrid) was developed to replace Alternative D1.

The new NPS Selected Alternative for the Homestead Canal is Alternative D/D1-Hybrid (the "Preferred Alternative"). This alternative combines the sheetpile design alternative evaluated in the EA (Alternative D, described below in the "Other Alternatives Considered") with the hydraulic pipeline material transportation method developed for Alternative D1. The decision to include the pipeline for material transportation was based on the volume and weight of fill required for the plugs and the general understanding that the transportation of the plug fill material using shallow draft barges might not be as practical or economically feasible. Therefore, the hydraulic pipeline approach to pumping limestone sand fill to the dam site, as proposed in Alternative D1, was included with Alternative D/D1-Hybrid to provide more flexibility with the transportation of material.

Similar to the dam structure described for the East Cape Extension Canal, Alternative D/D1-Hybrid includes the extraction of the free-standing sheetpile wall (previous dam structure) with the use of heavy equipment positioned from a shallow-draft barge, and the construction of a new dam structure at a narrower more suitable location within the canal that is in better alignment with the marl ridge. Once the existing sheetpile has been removed, the new dam will be placed just east of the existing structure location that is in better alignment with the existing marl ridge. The proposed design includes the construction of an earthen plug approximately 100 feet in length contained by pile-driven steel sheetpile walls on either side to reduce the erosion impacts. The sheetpile will be driven to an approximate depth of 9 - 10 feet below the bottom of the canal (approximately -18.50 feet NAVD88 or deeper). The top of the sheetpile wall across the canal will be installed at approximate elevations varying from +1.0 to +2.0 with an average of approximately 1.5 feet NAVD88. The plug will be filled hydraulically with a slurry mixture of limestone sand fill material (originating from an off-site upland location or local vendor) and water. The slurry will be transported to the dam site through a temporary pipeline running from the dam construction site to a construction staging area located in the western terminus of the Ingraham Canal waterway, just east of Lake Ingraham. The 8-inch temporary pipeline would be constructed using a very shallow-draft floating barge. The barge will string sections of pipe together and anchor them in place with temporary marine anchors within the proposed pipeline corridor to prevent lateral movement during operations. The fill will be spread and graded by mechanical means at the dam site. The plug area between the two walls will be planted with wetland vegetation to reduce the potential for erosion.

Landward sheetpile will also be installed in all four quadrants of the plug (design elevations are similar to the sheetpile in the canal) to form flow deflector wingwalls to promote surface sheetflow away from the dam structure and thus prevent seepage and tunneling through the marl. The deflector walls in the side bank areas will be sloped to match existing ground surfaces at their inland termination points. The sheetpile design will provide a wider navigational channel at the dam plug site to better accommodate visitor access conditions. Graded limerock riprap (underlain by filter fabric) will also be placed on top of the fill material along the outside face of the sheetpile walls, along the deflector wingwalls, and along the exposed canal banks to provide erosion resistance. Due to the weight of the riprap, it will be transported to the Homestead Canal dam site via helicopter. The helicopter will be staged at an existing upland site in the Flamingo area of Everglades National Park. The riprap will be staged on a shallow draft barge anchored in the construction staging area at the eastern terminus of Lake Ingraham. The riprap will be transported to the dam construction site by the helicopter and

dropped in place from a height not exceeding three feet above the filter fabric.

In addition to the above, this alternative will also include the following additional elements to enhance visitor usage and to provide safe passage over the restored Homestead Canal (100-foot plug area) for non-motorized boaters (canoeists/kayakers):

- Thirteen permanent channel markers to be placed within five feet of the top of the main channel bank and the Homestead Canal approach channel within Lake Ingraham. The markers will be installed in accordance with NPS protocols and NPS will assume responsibility for the markers. During the construction activities the channel markers will be used to anchor the temporary pipeline in place and will be lighted to provide additional safety measure during the project.
- Access ramp and interlocked articulated concrete block pathway over the dam plug for canoe/kayak access. The concrete block pathway will be underlain with geotextile fabric.
- Floating boat dock guided with pile hoops around steel piles with a ribbed deck gangway/walkway for access to the concrete block pathway over the dam plug. The piles will be driven by mechanical equipment transported to the site by a small draft boat or barge.
- Three permanent boat mooring piles downstream of the plug along the east side of the canal.
- Appropriate signage.

Also, per the results of the digital terrain survey that was conducted in the Homestead Canal, it was determined that a low elevation area exists along the southern bank of the canal in the proximity of the existing failed sheetpile dam. This approximately 0.11-acre area will be filled with limerock sand to a higher grade (approximately 2.0 feet NAVD88) to prevent a potential failure of the canal bank at this location. The fill material will also be hydraulically pumped through the 8-inch pipeline to the work area. Immediately following completion of grading activities, the area will be planted with wetland vegetation to minimize erosion of the sediments.

Under Alternative D/D1-Hybrid, the dam structure will function for a 50-year life-cycle, the natural and cultural resources will be protected, and the safety hazards from the existing dam structure will be removed, resulting in improvements to visitor safety and experience. The advantages of Alternative D/D1-Hybrid, compared to the other action alternatives, will be similar, with the exception that the construction costs vary between the alternatives because of different engineering techniques. The cost is lower and the advantages are higher for Alternative D/D1-Hybrid; therefore, Alternative D/D1-Hybrid will provide the most cost-effective solution for the park for the Homestead Canal dam.

Site Access and Equipment/Materials Staging

Site access and equipment/materials staging details were further refined following completion of the NEPA process. Mobilization of materials and equipment is anticipated to occur from existing upland areas in Key West or Fort Myers. Barge/vessel access routes from these upland staging areas were determined using current NOAA Nautical Charts. The charts indicate sufficient water depth from the upland staging areas to the entrance to the East Cape Canal. However, bathymetric survey data collected during the final design phase of the project determined that a wide shallow shoal exists in Florida

Bay near the southern mouth of the East Cape Canal restricting access from deep water barges into the East Cape Extension and Homestead canals (vessel draft depth being the limiting factor with maintaining one foot of clearance above the existing substrate).

The presence of this shallow shoal requires the utilization of an offshore staging area for the transfer of fill material and equipment from heavy loaded barges onto shallow draft barges and other vessels (boats, tugs, etc.) for safe and unimpeded transportation to the dam sites. The proposed 300-foot by 200-foot offshore staging area is located approximately three miles south-southwest of the southern entrance to the East Cape Canal, outside the limits of the Everglades National Park and Florida Bay within the Gulf of Mexico, in order to avoid additional impacts to Park resources, Outstanding Florida Waters (OFW), and federally designated smalltooth sawfish (*Pristis pectinata*) critical habitat. Once transferred to the shallow draft barges/vessels, the material and equipment will be transported to the dam construction site staging areas.

Minor impacts to seagrass habitat dominated exclusively by paddle grass (*Halophila decipiens*) at less than 1% coverage will result from spudding (anchoring) activities at the offshore staging area. Based on the amount of fill material and equipment needed for construction of the dams, a maximum of 30 "spud downs" is anticipated as a result of fill material and equipment transfers from lager deep water draft barges to shallow water draft barges/vessels. Spud diameters vary significantly; thus, as a precaution, the total anticipated impact to this benthic habitat was calculated using 24-inch diameter spuds, which is in the higher range of diameter sizes for these type of vessels times four spuds per each "spud down" for a total impact of 12.56 square feet (3.14 square feet x 4 spuds). Therefore, the maximum anticipated impact to this underlying seagrass habitat is 0.01-acre (376.80 square feet). The minor impacts to the benthic substrate will be compensated through the enhancement of the nearshore waters of Florida Bay as a result of restoring the dams. The nearshore waters are currently degraded due to the accelerated rate of suspended sediments and sediment deposition as a result of marsh collapse and loss of sediment and nutrients from the interior freshwater and brackish marshes. The construction of the dams would improve habitat for marine organisms and potentially allow for the growth of submerged aquatic vegetation within these nearshore waters where it's been restricted due to the degraded water quality. For the purposes of this project, the area of nearshore waters expected to receive the highest benefit from this project was determined to be within an approximate one mile radius from the southern mouth of the East Cape canal encompassing approximately 320 acres. The utilization of this offsite staging area was discussed with representatives of the South Florida Water Management District (SFWMD), U.S. Army Corps of Engineers (USACE) and NOAA National Marine Fisheries Service (NMFS).

For the East Cape Extension Canal dam, the 300-foot by 100-foot temporary barge/construction staging area will be located just south of the proposed dam construction site within the East Cape Canal at the approximate intersection of the Ingraham Canal. For the Homestead Canal, the approximately 300-foot by 100 foot temporary barge/construction staging area will be located at the western terminus of the Ingraham Canal east of Lake Ingraham due to the shallow water depths of Lake Ingraham. This staging area is needed to store the fill material that will be hydraulically pumped through the proposed 8-inch pipeline to the dam construction site at the Homestead Canal.

Due to the site specific constraints of the Homestead Canal, the maximum navigational dimensions of the marine vessel will be limited to a width of

30-feet and a length of 50-feet. The maximum marine vessel draft depth will not be allowed to exceed 3.75 feet. The maximum water depth of the shallow shoal at the mouth of the East Cape Canal is 4.75-ft. at MHHW. Therefore, to ensure a one-foot off bottom clearance and prevent contact of the loaded marine barge with the subsurface, the contractor will be required to adjust the loaded barge weight in accordance with the site water table conditions (tidal fluctuations) to ensure total vessel draft will not exceed 3.75-feet. Therefore, if the water depth is less than 4.75 feet, the load weight can be reduced to maintain a 1-foot off bottom clearance.

Additional staging will be required in the Flamingo Marina area of Everglades National Park (located approximately 11 miles from the project sites). Contractor construction staff will be housed in motor homes/trailers at existing Park camp areas or within temporary houseboats docked in the marina. A contractor's construction trailer will be located at an existing contractor construction trailer site located just northeast of the marina. In addition, the helicopter will be staged from an existing helicopter landing site just northwest of the marina. All of these areas are located in existing cleared upland areas (with the exception of the houseboats, which will be located within existing marina slips) within the Park.

OTHER ALTERNATIVES CONSIDERED

The previously selected (approved on August 14, 2009) original preferred alternative (Alternative D1) for the Homestead Canal, fully analyzed in the Cape Sable Canals Dam Restoration Project EA is described below:

The geotube alternative (Alternative D1) was developed as a modification to Alternative D for the Homestead Canal that allowed for further avoidance and minimization of impacts to natural resources by eliminating the need to dredge a navigational channel through Lake Ingraham as described below for Alternatives D and G for dam site access. In Alternative D1, geotubes would supplant the sheetpile walls associated with Alternative D. Geotubes are large tubular sand bags that are filled in place by pumping sand or slurry through a pipe from a barge. For this modified alternative, fill material would be transported to the Homestead Canal work area through a constructed floating pipeline, as described above in the preferred alternative for the Homestead Canal (Alternative D/D1-Hybrid). This alternative was replaced by the new preferred Alternative D/D1-Hybrid due to new information provided by local specialty marine contractors about the availability of ultra light/specialized marine equipment with shallow drafts can be utilized to transport the necessary sheetpile equipment into the Homestead Canal without impacting the substrate of Lake Ingraham.

In addition to the Selected Alternatives, three other action alternatives and a No-action Alternative were fully analyzed in the Cape Sable Canals Dam Restoration Project EA:

The No-action Alternative (Alternative A) involves leaving the existing sheetpile in the East Cape Extension and Homestead canals where it is today and allowing the channels to continue to widen through natural erosion processes. This alternative would fail to accomplish the goals of the NPS and the U.S. Fish and Wildlife Service (USFWS), which are to improve fish and wildlife habitat, correct safety hazards associated with the failed structures, and prevent motorized vessel entry into Cape Sable wilderness. In addition, the no-action alternative would also require NPS personnel to continue their routine inspection and maintenance program of the failed dam structures in perpetuity to prevent access to unsafe and dangerous areas.

A repair-in-place alternative (Alternative C) consisted of repairing the existing steel sheetpile walls and extending them further inland. This alternative would strengthen the dams by adding additional sheetpile landward of both dams. The sheetpile would be installed to form a flow deflector wingwall to prevent seepage and tunneling through the marl. The deflector wingwalls would also help prevent illegal motorized boat entry into the wilderness area, thus minimizing opportunities for vandals to alter the banks beyond the edge of the sheetpile walls. In addition, Alternative C for the Homestead Canal dam site would require dredging a temporary access channel within Lake Ingraham because of its shallow water depths. Given the potential adverse impacts, this alternative was not selected for implementation.

New plugs at the marl ridge location (Alternatives D and G). These alternatives included the extraction and relocation of the existing free-standing sheetpile walls (previous dam structures) to narrower, more suitable locations that are in better alignment with the marl ridge. Additionally, earthen plugs would be constructed by installing a second sheetpile wall upstream or downstream of the first wall within the canals. In addition to the above, Action Alternative D or G for the Homestead Canal dam site would require dredging a temporary access channel as described in Alternative C. Given the potential adverse impacts for the Homestead Canal, these alternatives were not selected for implementation for the Homestead Canal.

Homestead Canal modified alternative (Alternative G1) would have provided a construction option for the Homestead Canal dam site (only) that allowed for further avoidance and minimization of impacts to natural resources by eliminating the need to dredge a navigational channel through Lake Ingraham as described above for Alternatives D and G for dam site access. This alternative was not selected because it required additional fill material that would have caused environmental impacts, emitted more greenhouse gases due to higher fuel consumption, and was more costly.

Alternatives Considered and Dismissed

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

Action Alternative B — Relocate Existing Failed Sheetpile Dams to Narrower Locations: This alternative would relocate the existing failed sheetpile dams to a narrower location upstream in the canals. The relocated dams would be strengthened by adding sheetpile wingwalls landward of both dams. The wingwalls would deflect surface flows away from the dams, help prevent illegal motorized boat entry into designated wilderness, and reduce opportunities for vandals to alter the banks beyond the edge of the sheetpile walls. This alternative was considered but dismissed because it is similar to retained Alternative C, it would require extracting and moving the existing sheetpile to currently undisturbed areas, and because a more sustainable solution, such as a plug configuration, would be preferable.

Action Alternative E — Plug from Mouths of Canals Upstream to the Existing Dams: This alternative proposed plugging the two canals from their mouths upstream to the site of the existing dams to reduce tidal inflow up to the repaired dams. A sheetpile or geotube dam would be installed at the mouths of the canals, which would be filled up to the existing dams or a reasonable distance beyond the highest elevation point of the marl ridge (based on the

digital terrain model described in the EA). This alternative was considered but dismissed because it is similar to retained Alternatives G and G1 and would not be optimally cited along the high topographical point along the marl ridge. Furthermore, it was deemed economically infeasible due to the increased costs of filling longer reaches of the canals.

Action Alternative F — Backfill East Cape Canal from Florida Bay to the Existing Dam: This alternative proposed backfilling the East Cape Canal from Florida Bay to the existing failed dam, or a reasonable distance across the marl ridge at the East Cape Canal Extension. It would also consist of plugging the Homestead Canal across the width of the marl ridge. This stretch of the East Cape Canal is approximately 1 mile long, 250 feet wide, and 10 feet deep. Because of the extensive size and volume of fill required for the East Cape Canal, this alternative was deemed economically infeasible and could not be implemented in a timely manner. In addition, filling the East Cape Canal from Florida Bay to the existing failed dam at the East Cape Extension Canal would cut off boat access to Lake Ingraham and the backcountry from the southern edge of Cape Sable, requiring park visitors to travel almost 8 miles to the western entrance to Lake Ingraham. For these reasons, this alternative was dismissed from further consideration.

Action Alternative H — Backfill as Much of the Canals as is Feasible: This alternative proposed backfilling as much of the East Cape Extension and Homestead canals as is feasible. This alternative would be very similar to two other retained alternatives, Alternatives G and G1, which include an amount of fill that was considered to be economically feasible. In addition, the East Cape Extension and Homestead canals are NRHP-eligible historic resources, and backfilling substantial portions of the canals would substantially affect the historic character of the resources. Backfilling the East Cape Extension and Homestead canals would also cut off non-motorized boat access into the designated wilderness from Lake Ingraham and the East Cape Canal. This change would likely be controversial and potentially result in a moderate to major adverse effect on visitor use and experience. For these reasons, this alternative was dismissed from further consideration.

Action Alternative I — Plug Canals in Several Places with Geotubes or Fill: This alternative would plug the East Cape Extension and Homestead canals in several places rather than the current configuration of only one dam at each canal. One of the objectives of the dam restoration project is 50-year sustainability of the replacement structure. This alternative would be less likely to fail than Alternatives B or C but probably would not be substantially more reliable than Alternatives D or G. Therefore, the alternative of multiple plugs in each canal was determined to be unnecessarily redundant because other alternatives put forward with only one dam location were designed to meet the 50-year sustainability objective. Therefore, this alternative was dismissed from further consideration.

Action Alternative J — Completely Fill In the Canals: This alternative proposed backfilling the entire length of the East Cape Extension and Homestead canals. The extensive size and volume of fill required for this alternative makes it economically infeasible, and it could not be implemented in a timely manner. In addition, the East Cape Extension and Homestead canals are both NRHP-eligible historic resources, and backfilling substantial portions of the canals would substantially affect the historic character of the resources. Backfilling the East Cape Extension and Homestead canals would also cut off non-motorized boat access into the designated wilderness from Lake Ingraham and the East Cape Canal. This change would likely be controversial and potentially result in a moderate to major adverse effect on

visitor use and experience. For these reasons, this alternative was dismissed from further consideration.

Action Alternative K — Repair Middle Cape at Gulf and East Cape Canal at Florida Bay: This alternative proposed repairing the Middle Cape Canal at the Gulf of Mexico and the East Cape Canal at Florida Bay. Blocking these larger canals at the coast may substantially limit spring tide incursions into the interior marshes; however, because of the extensive size and volume of fill required for this alternative, it was found to be economically infeasible and could not be implemented in a timely manner. In addition, filling of the Middle Cape Canal and East Cape Canal would entirely sever boat access to Lake Ingraham and the backcountry, prohibiting park visitors from traveling into these areas. This change would likely be controversial and potentially result in a moderate to major adverse effect on visitor use and experience. For these reasons, this alternative was dismissed from further consideration.

RATIONALE FOR THE SELECTED ALTERNATIVES

The Selected Alternatives represent the NPS's chosen approach for achieving the proposed action and define the rationale for the action in terms of resource protection and management, visitor use and operational use, and other applicable factors.

During the Environmental Assessment process, a value analysis called Choosing By Advantages (CBA) was used to evaluate the project alternatives and select the preferred alternatives described in the Chapter 2 of the EA. The CBA team focused on the core purpose of the project, which is the ability of the dam alternatives to function for a 50-year life-cycle. There was consensus among the CBA team that the ability of the dams to function for 50-years is the primary goal, since it would have secondary beneficial affects such as: 1) preventing the loss of natural and cultural resources, 2) providing greater visitor enjoyment, and 3) improving the efficiency of other park operations. Under the No Action Alternative, the existing dam structure would not be able to function for a 50-year life-cycle since it has already failed. The secondary effects from the No Action Alternative would cause the natural and cultural resources to continue to degrade, the visitor experience would also continue to degrade due to the existing safety concerns of the dam, and monitoring and enforcement of the failed dam structures would increase for park staff. The following factors were used in the CBA process to evaluate the alternatives.

1. Protect cultural and natural resources
    a. Prevent loss of natural resources and improve fish and wildlife habitat to enhance long-term sustainability
    b. Prevent loss of cultural resources
    c. Prevent illegal motor-boat access in designated wilderness area
    d. Impacts during construction
2. Provide for visitor enjoyment
    a. Provide non-motorized boat access into the designated wilderness area for recreational opportunities
    b. Protect public health, safety, and welfare from safety hazards of proposed dams
3. Improve efficiency of park operations
    a. Improve operational efficiency
    b. Provide for functional longevity of structure
    c. Constructability - time

d. Complexity of the of the construction process
e. Routine and cyclic maintenance of structure

4. Provide cost-effective, environmentally responsible, and otherwise beneficial development for the NPS

Based on the CBA analysis, the NPS preferred alternative for the East Cape Extension Canal was Alternative D and the preferred alternative for the Homestead Canal was Alternative D1 as described in Chapter 2 of the EA. These alternatives were selected for implementation in the FONSI approved on August 14, 2009.

Following the CBA and NEPA process, the original NPS Selected Alternative for the Homestead Canal was replaced with the hybrid alternative, Alternative D/D1-Hybrid, due to new information that specialized marine equipment with shallow drafts can be utilized to transport the necessary sheetpile equipment into the Homestead Canal without impacting the substrate of Lake Ingraham. This will enable the installation of sheetpile end walls at the canal plug instead of the less durable geotubes.

The Selected Alternatives, Alternative D and Alternative D/D1-Hybrid, have been chosen for implementation because they will accomplish the project objectives and are less costly than the environmentally preferred alternatives (G and G1), which only provided marginal benefits in comparison to the extra costs.

ENVIRONMENTALLY PREFERRED ALTERNATIVE

Section 2.7 D. of the "Handbook for the NPS Director's Order 12" (DO-12, Conservation Planning, Environmental Impact Analysis, and Decision-Making), states that the environmentally preferred alternative is the alternative that will promote national environmental policy as expressed in Section 101 of NEPA, which includes the following six criteria:

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

The Council on Environmental Quality's Forty Questions (#6a) further clarifies the identification of the environmentally preferred alternative, stating "ordinarily, this means the alternative that causes the least damage to the biological and physical environment; it also means the alternative which best protects, preserves and enhances historic, cultural and natural resources." Alternative G for the East Cape Extension Canal and Alternative G1 for the

Homestead Canal best meet the criteria for the Environmentally Preferred Alternative.

A description of how each action alternative would or would not achieve the requirements of section 101 of the NEPA criteria is provided below.

Criterion 1 — The park is a unit of the National Park System, and as the trustee of this place, the NPS would continue to fulfill its obligation to protect this area for future generations. Alternative A would not adequately protect and preserve the Cape Sable area for future generations. Conditions associated with the failed sheetpile dams would continue and potentially increase the impacts on erosional processes within the two canals and the greater Cape Sable area, further deteriorating the environmental values of the area. Each of the action alternatives would meet the objectives of preventing further saltwater intrusion and restoring the freshwater marshes of the area; however, the long-term sustainability of the Alternative C design is less than that of Alternatives D/G and D1/G1. Therefore, Alternatives D/G and D1/G1 would do a better job of providing a long-term solution for the area — they would provide the greatest level of protection for park resources over time.

Criterion 2 — Alternative A would not provide safe, healthful, productive, and culturally pleasing surroundings for all Americans because existing conditions would continue and likely worsen. The failed sheetpile dams would continue to pose safety concerns to park visitors and staff using the area. The eroded canal conditions would continue to appear unnatural and cause undesirable consequences to the natural and aesthetic resources of the area. Alternative C would pose safety concerns to park visitors because the elevation of the sheetpile would be lower than that of the marl ridge and would allow water to flow over the dam itself, presenting a hazard to park visitors. Alternatives D/G and D1/G1 would all provide the same level of human safety through a design that provides for safe and effective portage of the dams for park visitors with non-motorized vessels such as canoes and kayaks. Alternatives D/G and D1/G1 include the planting of mangroves and other native vegetation on top of the plug, offering more natural and aesthetically pleasing surroundings. Furthermore, the canal and buoy system that would be required under Alternative C would be considered a visual detraction and nuisance to some visitors.

Criterion 3 — Alternative A would continue to cause substantial adverse impacts to the environmental resources of the area. The Cape Sable system and its resources would continue to degrade, resulting in undesirable environmental consequences that limit the beneficial uses and services that the environment provides to the South Florida region. The action alternatives would minimize adverse impacts to natural resources by decreasing the velocity of water passing through the canals during tidal flows, thereby reducing erosional processes along the canal banks. This would result in an increase in the retention of freshwater in the interior freshwater and brackish marshes during wet season rains. However, because of the design of Alternative C, saltwater intrusion and freshwater loss would occur more frequently than under Alternatives D/G and D1/G1, which include an earthen plug that would attempt to re-create the natural marl ridge topographic conditions that provide greater resistance from occasional overtopping with saline waters. Overtopping would still occur during high tide and major storms, but the saline waters would have to pass over the marl ridge plug and would result in more natural environmental conditions than would occur under Alternative C. Furthermore, Alternatives D1/G1 would reduce adverse impacts to natural resources in the area by not including the dredging of portions of

Lake Ingraham required under Alternatives D/G. Therefore, Alternatives D1/G1 provide the greatest level of beneficial use of the environment while limiting unintended consequences.

Criterion 4 — Alternative A does not adequately preserve the natural and cultural resources of the area, and existing conditions limit visitor access and use of the area. Alternative C includes the least amount of impact to natural resources from construction because of the smaller footprint of the dam structures, while Alternatives D and G would cause greater impacts because of the dredging of Lake Ingraham needed to reach the Homestead Canal. The long-term sustainability of Alternative C is less than that of Alternatives D/G and D1/G1; therefore, over time, Alternatives D/G and D1/G1 would better protect and preserve natural and cultural resources. The action alternatives also include the same level of recreational access and opportunities that lead to supporting diversity and individual choice. All of the action alternatives also would prevent boaters from illegally accessing the interior of the designated wilderness area.

Criterion 5 — Alternative A does not adequately protect and enhance the environmental benefits of area. The area would still be used by park visitors, but not to the degree that fulfills the societal benefits and uses that the park is trying to provide. Each of the action alternatives protects and enhances the environmental values of the area and provides increased opportunities for resource use and enjoyment by society.

Criterion 6 — Each of the action alternatives would result in enhancing the quality of renewable resources through NPS management in the project area. According to the carbon footprint analysis (an analysis of greenhouse gas emissions resulting from the use and combustion of fuel, a nonrenewable resource, used for the project) conducted for the project, Alternative C would result in the lowest level of use of depletable resources. Alternatives G/G1 consume the highest amount of fuel and would result in the lowest amount of recycling of depletable resources.

MITIGATIVE MEASURES

Under the Selected Alternatives for the East Cape Extension and Homestead canals, best management practices and mitigation measures will be used to prevent or minimize potential adverse effects associated with the project. These practices and measures will be incorporated into the project construction documents and plans. Resource protection measures undertaken during project implementation will include, but will not be limited to, those listed below.

General Construction Mitigation Measures

- Pre- and post-construction erosion control best management practices (BMPs) will be implemented, including the installation and inspection of silt fences, straw bale barriers, sediment traps, or other equivalent measures, and re-vegetation of the area to control erosion, preserve water quality, protect wildlife and habitat, protect marine resources and essential fish habitat (EFH), and prevent soil contamination. Erosion and sediment control best management practices will be inspected and maintained on a regular basis and after each measurable rainfall to ensure that they are functioning properly.
- Steps will be taken to minimize the introduction of nonnative species and will include washing equipment before entering the park; minimizing disturbances; and initiating re-vegetation of disturbed areas immediately

after construction. The NPS will follow all of the guidelines outlined in the "Draft South Florida and Caribbean Parks Exotic Plant Management Plan" and the "Everglades National Park Hurricane Plan."

- Environmental training will be implemented to help educate construction personnel with the intent of reducing impacts on water quality, wetland resources, wildlife, and marine resources and essential fish habitat.
- All construction areas will be protected to confine potentially adverse activities to the minimum area required for construction. All protection measures will be clearly stated in the construction specifications, and workers will be instructed to avoid conducting activities beyond the construction zone. The use of previously undisturbed areas will be minimized to the extent possible by selectively choosing staging areas and clearly defining and marking construction zones and perimeters.

Geology, Topography and Soils

- Spill prevention, control, and countermeasure procedures, as well as stormwater pollution prevention measures, will be implemented to protect soils from erosion and contamination.
- The use of tarps or similar cover materials will be used on stockpiled fill and other erosion-prone areas during construction to minimize erosion as a result of storms.

Water Resources

- A spill prevention, control, and countermeasures plan will be completed and implemented for any fuel storage tanks, which will meet all applicable standards for construction and leak detection. Areas used for refueling will be limited to areas where these activities currently occur.
- Equipment containing fuels will be checked frequently for leaks.
- Construction procedures will include the use of turbidity curtains to contain disturbed sediments and reduce water quality impacts.
- A turbidity monitoring plan will be implemented to ensure compliance with State water quality criteria.
- A temporary "no wake zone" will be established in and near the project area during construction to eliminate further dispersal of suspended sediments.
- Impacts on wetland resources will be avoided and minimized to the maximum extent feasible through the implementation of construction best management practices. All unavoidable impacts will be mitigated.

Wildlife and Habitat

- Re-vegetation efforts will include using seeds from native species; monitoring reclamation; and implementing exotic species control as necessary.
- Pre- and post-survey construction surveys for selected species (e.g., crocodiles, manatees, Eastern indigo snakes, and smalltooth sawfish) will be implemented.
- Spill prevention, control, and countermeasure procedures, as well as stormwater pollution prevention measures, will be implemented to reduce the potential for petroleum products from leaking equipment or vehicles to reach surface waters.
- Per NPS *Management Policies 2006*, artificial lighting will not be used in locations where its presence will disrupt wildlife that are dependent on the dark; minimal-impact lighting techniques will be used (e.g., consideration of yellow versus white lights, use of timers); artificial lighting will be shielded and directed, where necessary, with regard for natural night sky conditions. Due to safety concerns, minimal artificial

lighting required for safety will be required and will consist of downward-cast and dim lights located on the barges/boats at the construction sites and staging areas, as well as along the temporary pipeline within Lake Ingraham for navigational purposes.

Marine Resources and Essential Fish Habitat

- Construction procedures will include the use of turbidity curtains to contain disturbed sediments and reduce water quality impacts.
- A turbidity monitoring plan will be implemented to ensure compliance with state water quality criteria.
- Impacts to marine resources will be avoided and minimized to the maximum extent feasible through the implementation of construction best management practices and standard USFWS, National Oceanic and Atmospheric Administration-National Marine Fisheries Service (NOAA-NMFS), and Florida Fish and Wildlife Conservation Commission (FFWCC) protection measures. All unavoidable impacts will be mitigated.
- To prevent contact of the loaded marine barge with the subsurface of Lake Ingraham or the Ingraham Canal and any associated benthic resources, the contractor will be required to:
  1. Provide the Park with a Project Access Plan (PAP) prior to mobilizing to the site for review and approval by the Park. This requirement is part of the 013600 Risk Management Plan requirements under section 3 A.D.1 that states "The Plan shall include a listing and cut sheets of specific shallow draft barges to be used in the work along with engineering draft depth calculations and/or plots of unloaded and loaded draft depths for the barges."
  2. Utilize a shallow draft ultralight marine barge with dimensions no larger than a width of 30-feet and a length of 50-feet, with an empty draft of one-foot or less. Adjust the loaded barge weight in accordance with the site water table conditions (tidal fluctuations) to ensure a one-foot off-bottom clearance during any barge movement.
  3. Monitor daily tidal fluctuations and restrict barge movement to times of the day during which high tide occurs.
  4. Install thirteen permanent channel markers to be placed within five feet of the top of the main channel bank and the Homestead Canal approach channel within Lake Ingraham. The markers will be installed in accordance with NPS protocols and NPS will assume responsibility for the markers.

Special Status Species

- To reduce potential impacts on wildlife, construction activities occurring near sensitive habitats will be scheduled to minimize potential impacts during periods of breeding, nesting, and rearing of young (especially noting the American crocodile nesting season). Construction will occur only during daylight hours to reduce effects on nocturnal foraging or rest.
- Pre-construction surveys will be conducted to identify any Federal and State listed species occurring in the area. Should individuals or nest sites be identified, additional measures will be taken to avoid impacts (e.g., fencing nest sites, providing information to contractors about the species).
- Construction will follow all applicable environmental regulatory agencies' standard protection measures (including, but not limited to, manatee, sea turtle, and smalltooth sawfish), and no wake zones and monitoring during construction. Should additional specific measures be identified during

Section 7 consultation with the agencies for the project permits, they will also be implemented.

- Project workers will receive environmental training prior to construction activities.
- Measures listed under "Wildlife" and other resource protection mitigation will also serve to reduce impacts on special status species.

Wilderness

- Construction procedures will follow the minimum tool analysis for construction and will include provisions to minimize impacts on natural resources that contribute to wilderness values (including the use of turbidity curtains during construction).
- Measures listed above under "Water Resources" and "Wildlife" will help protect wilderness values and quality as well.

Cultural Resources

- To avoid damage to previously unknown archeological resources, archeological surveys and testing activities in previously unsurveyed and/or undisturbed areas will be conducted before ground-disturbing activities. If any resources are encountered, mitigation of project impacts (in consultation with appropriate agencies) or adjustment of the project design will take place to avoid or limit the adverse effects on prehistoric and historic archeological resources. Stop-work provisions will be included in the construction documents should archeological or paleontological resources be uncovered. However, it should be noted there is a low probability that the project area contains undiscovered archeological resources.
- Monitoring will be done if any excavation exceeds the depth of existing ground disturbance. In the event that cultural resources are encountered during any necessary excavation work, project work will be halted and the discovery process will be initiated.
- If previously unknown archeological resources are discovered, work will be stopped in the area of any discovery and the NPS staff will consult with affiliated tribes, pursuant to Native American Graves Protection and Repatriation Act (NAGPRA) and the "Draft Park NAGPRA Plan of Action for Inadvertent Discoveries, Everglades National Park and Associated Tribes" (May 2008).

Visitor Use and Experience / Public Safety

- Construction information and general information about the project will be posted at the park, distributed to visitors, and made available on the park's website. Signs and notices will be used to inform visitors about the purpose of the project and to protect visitor and staff safety during construction activities.
- Artificial lighting, including minimum illumination levels, light-emitting diodes (LED), limited color spectrum (e.g., yellow) lights, and timers and sensors will be used, where applicable, to ensure safety. Due to safety concerns, minimal artificial lighting required for safety will be required and will consist of downward-cast and dim lights located on the barges/boats at the construction sites and staging areas, as well as along the temporary pipeline within Lake Ingraham for navigational purposes.
- The use of artificial lighting will be restricted to areas where security, basic human safety, and specific cultural resource requirements must be met.

Noise/Soundscapes

- Construction activities for the Cape Sable Canals Dams Restoration Project will involve multiple pieces of heavy equipment for placement of sheetpile and fill material. Best management practices for noise, such as using mufflers on heavy equipment and noise-muffling construction materials will be implemented at Cape Sable, resulting in short-term minor impacts to soundscapes. Assuming that heavy equipment operates at 80 to 90 decibels (dB), and that sound levels decrease approximately 6 dB with the doubling of distance (Harmon 2006), it will be estimated that natural attenuation will decrease the noise from these activities to no greater than 32 to 42 dB at a distance of about 1,500 feet from the work area. Noise will continue to dissipate with increased distances from the area.

Air Quality

- The park enjoys a Class I clean air status. If dust is generated during construction, best management practices for dust suppression will be initiated. Emissions from construction vehicles will be kept to a minimum by restricting idling time.

WHY THE SELECTED ALTERNATIVES WILL NOT HAVE A SIGNIFICANT IMPACT ON THE HUMAN ENVIRONMENT

As defined in 40 CFR Section 1508.27, significance is determined by examining the following criteria:

1. *Impacts that may have both beneficial and adverse aspects and which on balance may be beneficial, but that may still have significant adverse impacts which require analysis in an Environmental Impact Statement (EIS).*

   Whether taken individually or as a whole, impacts of the project do not reach the level of significance that would require analysis in an EIS.

   Implementation of the Selected Alternatives will not result in major adverse impacts and will result in beneficial impacts to natural resources, including geology, topography, and soils; hydrology; water quality; vegetation and wetlands; wildlife and wildlife habitat; marine resources and essential fish habitat; special status species; and wilderness. The extent and intensity of the beneficial effects is uncertain. Impacts on cultural resources will be minor during construction, but beneficial in the long-term because the historic character of the canals will be preserved. Additionally, implementation of the Selected Alternatives will result in minor adverse impacts during construction and long-term beneficial impacts on visitor use and experience and park management and operations.

2. *The degree to which public health and safety are affected.*

   The project will have beneficial effects on public health and safety. The unsafe and undesirable conditions at the failed dam sites will be remedied, including the provision for a safe portage over the dams and prevention of illegal motorized boaters beyond the dams into the wilderness area.

3. *Any unique characteristics of the area (proximity to historic or cultural resources, wild and scenic rivers, ecologically critical areas, wetlands or floodplains, and so forth).*

   As a result of replacing the Cape Sable canal dams, just over one acre (1.04 acres) of wetlands/surface waters will be affected by the physical

footprint (placement of the new sheetpile, earthen fill, and riprap for the new plug; stabilization and armoring; placement of the additional sheetpile needed for the deflector wingwalls as well as the placement of riprap for support and armoring); and barge anchoring at the offshore staging area. However, these impacts will be compensated through the overall benefit to local and regional marine waters in the greater Cape Sable area as a result of dam construction.

- The areas to be affected by the physical footprint of the alternatives are a mixture of regularly flooded mangrove wetlands and irregularly flooded shrub-scrub buttonwood/saltwort/mangrove wetlands as well as the open water area of the canal. The wetlands are part of and contiguous with the estuarine wetland system of the greater Cape Sable area near the marl ridge. The primary functions of these wetlands include surface and subsurface water storage, support of the biogeochemical processes (nutrient cycling, peat accretion, etc.), support of characteristic plant community, and providing suitable habitat for native fish and wildlife. Functionality of the wetlands in the immediate construction footprint of the project will be affected, but the functionality of the wetland system as a whole will be improved by the project.

- To minimize wetland resource impacts, best management practices will be implemented during construction. These practices will include employment of staked silt fence and turbidity barriers. The barriers will be employed in the canals before starting construction and maintained throughout the construction phase of the project. After construction is completed, temporarily disturbed areas will be restored to pre-existing conditions (e.g., regraded, compacted, etc.) and replanted with native coastal wetland vegetation. The turbidity barriers and silt fences will be removed at the work areas in the canals once turbidity has subsided following construction of the dams. Floating mooring buoys will also be installed downstream (towards Lake Ingraham) of the dam structure for motorized vessel anchoring. Mooring buoy anchors will minimize potential secondary impacts to the canal bottom. Minor short-term temporary secondary impacts are anticipated to occur just landward of the dam construction sites due to the lack of a vegetative buffer between the construction area and the adjacent wetlands, and temporary avoidance of foraging by birds and small mammals within close proximity to the construction area will likely occur. However, these secondary impacts will be compensated through the overall benefit to local and regional marine waters in the greater Cape Sable area as a result of dam construction.

- The potential for long-term secondary impacts resulting from the project were also analyzed because of the lack of a vegetative buffer between the proposed dam sites and the adjacent wetlands. However, because the area is in the backcountry of the park and no active roadways or trails lead to this area, continued long-term disturbance at the dam sites is not anticipated.

- No adverse impacts will occur to the watershed as a result of the proposed project because of the derived benefits. Although a small area of existing wetland vegetation will be permanently impacted with construction proposed in the Selected Alternatives, the upstream and downstream benefits to existing wetland functions for Lake Ingraham (approximately 1,863 acres) and the interior marshes of Cape Sable (approximately 55,894 acres based on aerial the footprint north of the

marl ridge to the southern edge of Whitewater Bay) far exceeds the wetland functional loss attributed to the construction footprint of the dams.

- Minor impacts to seagrass habitat dominated exclusively by paddle grass (*Halophila decipiens*) at less than 1% coverage will result from spudding (anchoring) activities at the offshore staging area. However, the offsite enhancement of approximately 320 acres of nearshore Bay waters as a result of dam construction far outweighs 0.01 acres of temporary impacts to seagrass habitat offering a net benefit to local and regional marine waters in the greater Cape Sable area.

4. *The degree to which impacts are likely to be highly controversial.*

   There were no highly controversial effects identified during the preparation of the EA or during the public review period.

5. *The degree to which the potential impacts are highly uncertain or involve unique or unknown risks.*

   There are no highly uncertain, unique, or unknown risks associated with implementation of the Selected Alternatives.

6. *Whether the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration.*

   Implementation of the project will neither establish an NPS precedent for future actions with significant effects, nor will it represent a decision in principle about a future consideration. Future proposals for canal dams will be evaluated through additional project-specific planning processes that incorporate requirements of the NEPA process and NPS management policies.

7. *Whether the action is related to other actions that may have individual insignificant impacts but cumulatively significant effects. Significance cannot be avoided by terming an action temporary or breaking it down into small component parts.*

   Impacts will be limited only to those direct and indirect impacts resulting from implementation of the Selected Alternatives. There will be no measurable cumulative impacts. For more information on the cumulative project impacts and the determinations of negligible impacts, see Section 1.4.5 and Section 3.2.3, respectively, in the EA.

8. *The degree to which the action may adversely affect properties in or eligible for listing in the NRHP, or other significant scientific, archeological, or cultural resources.*

   The historic Ingraham Highway, Homestead Canal, and East Cape Extension Canal are currently proposed for listing in the NRHP. The Florida State Historic Preservation Office (SHPO) concurred that with the NPS's commitments to protect and preserve cultural resources in the project area, the Selected Alternatives will have *no adverse effect* on these historic properties. No known archeological resources are present in the project area. A cultural resources survey will be conducted in all areas proposed for ground disturbance and impacts to the canals will be minimized through project design or mitigation measures. The park will

forward the final cultural resources survey report to the SHPO for review and comment prior to implementation of any ground disturbing activities.

9. *The degree to which the action may adversely affect an endangered or threatened species or its habitat.*

   The NPS has determined that implementation of the Selected Alternatives *may affect, but is not likely to adversely affect* federally listed species that could occur in the project area (see Table 1).

TABLE 1. ESA EFFECT DETERMINATIONS FOR FEDERALLY LISTED SPECIES FOR THE SELECTED ALTERNATIVES

Species	Status	Effect Determination	Reason
Florida panther (*Puma concolor coryi*)	Endangered	May affect, not likely to adversely affect	The proposed project is not located within the Panther Conservation Area, and no evidence was found of panthers inhabiting the wetlands of the Cape Sable area.
American crocodile (*Crocodylus acutus*)	Threatened	May affect, not likely to adversely affect	Loss of potential nesting habitat along the banks of the canal.
West Indian manatee (*Trichechus manatus*)	Endangered	May affect, not likely to adversely affect	The FFWCC standard protection measures will be implemented before and during all in-water construction activities.
Wood stork (*Mycteria Americana*)	Endangered	May affect, not likely to adversely affect	One active nesting colony is located approximately 14.2 miles northeast of the project area, within the Core Foraging Area
Eastern indigo snake (*Drymarchon carais couperi*)	Threatened	May affect, not likely to adversely affect	Project location lacks the preferred snake habitat; USFWS standard protection measures will be used during construction.
Atlantic hawksbill sea turtle (*Eretmochelys imbricate*)	Endangered	May affect, not likely to adversely affect	No suitable nesting habitat is within the project area; NOAA-NMFS standard protection measures will be implemented before and during all in-water construction activities.
Green sea turtle (*Chelonia mydas*)	Endangered	May affect, not likely to adversely affect	No suitable nesting habitat is within the project area; NOAA-NMFS standard protection measures will be implemented before and during all in-water construction activities.
Kemp's Ridley sea turtle (*Lepidochelys kempii*)	Endangered	May affect, not likely to adversely affect	No suitable nesting habitat is within the project area; NOAA-NMFS standard protection measures will be implemented before and during all in-water construction activities.
Leatherback sea turtle (*Dermochelys coriacea*)	Endangered	May affect, not likely to adversely affect	No suitable nesting habitat is within the project area; NOAA-NMFS standard protection measures will be implemented before and during all in-water construction activities.

Species	Status	Effect Determination	Reason
Loggerhead sea turtle (*Caretta caretta*)	Threatened	May affect, not likely to adversely affect	No suitable nesting habitat is within the project area; NOAA-NMFS standard protection measures will be implemented before and during all in-water construction activities.
Smalltooth sawfish (*Pristis pectinata*)	Endangered	May affect, not likely to adversely affect	Construction impacts to proposed smalltooth sawfish critical habitat (e.g., trimming or removal of red mangroves) will be insignificant and discountable. Long-term effects on proposed critical habitat will be beneficial. The NOAA-NMFS standard protection measures will be implemented during all in-water construction activities.

By letter dated August 5, 2009, the USFWS concurred with the NPS's determination of effects on listed species under its jurisdiction that may occur in the project area.

On July 29, 2009, the NOAA-NMFS identified the need for additional consultation on potential impacts to listed species under its purview as project implementation details are developed. The NOAA-NMFS has requested detailed information on potential impacts to proposed critical habitat for the smalltooth sawfish, specifically the number of red mangroves that would be trimmed or removed and tidal inundation data. The NPS has obtained this data during the project design phase and has provided it to the U.S. Army Corps of Engineers (USACE) and the South Florida Water Management District (SFWMD) as part of the environmental permit application. The NPS is committed to working closely with NOAA-NMFS to address all of their concerns during Section 7 consultation on the project permits.

10. *Whether the action threatens a violation of Federal, State, or local law or requirements imposed for the protection of the environment.*

    The Selected Alternatives will not violate any Federal, State, or local environmental protection laws.

Summary

On consideration of the criteria above, the NPS has determined that there are no major adverse or beneficial impacts that will require further analysis in an EIS.

IMPAIRMENT OF PARK RESOURCES OR VALUES

In addition to reviewing the list of significance criteria, the director of the NPS Southeast Region has determined that implementation of the Selected Alternatives will not constitute an impairment to the park's resources and values. This conclusion is based on a thorough analysis of the environmental impacts described in the project's EA, relevant scientific studies, and the professional judgment of the decision-maker guided by the direction of NPS management policies. As described in the EA, project implementation will not

result in major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation, (2) key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park; or (3) identified as a goal in the park's *General Management Plan* or other relevant NPS planning documents.

PUBLIC INVOLVEMENT AND AGENCY CONSULTATION

Public Scoping

The public scoping process began in September 2008 with the publication of a scoping newsletter and other project announcements. A newsletter was distributed by electronic and conventional mail to approximately 2,000 individuals, organizations, agencies, and American Indian Tribes. News releases were issued and paid advertisements announcing the public scoping meetings were published in the *Miami Herald* and *El Nuevo Herald* on September 29, 2008.

On October 8, 2008, a public scoping meeting was held at the South Dade Regional Library in Miami, Florida. Comments were received by one of the following methods: in person during the meeting, email, telephone, hard copy letter via mail, or via the NPS Planning, Environment, and Public Comment (PEPC) website. A certified court reporter transcribed the entire public hearing in which all comments were written into a typed document.

During the comment period, 49 pieces of correspondence were received with 102 comments. Respondents were overwhelmingly (>97 percent) in favor of the project, and many respondents were concerned about the dams not being restored sooner. The comments in opposition to the project were concerned mainly about the cost, longevity, and sustainability of the project, arguing that sea level rise would negate the benefit of the investment, that the project lacked funding because of Federal budget constraints and that other pressing Everglades restoration needs exist. The comments, concerns, and suggestions of the respondents fell into several categories including range of alternatives, environmental impacts, socio-cultural impacts, historic/archeological impacts, the cost/benefit value of the project, and visitor use and experience.

Agency Consultation

An agency scoping meeting was held on November 12, 2008, at the NPS South Florida Ecosystem office in Homestead, Florida. The purpose of the meeting was to initiate agency involvement in the early planning stage of the proposed project and obtain feedback regarding the initial concepts for development of the Cape Sable Canals Dam Restoration EA. Several agencies participated in the meeting, as described below.

Representatives from the SHPO have been involved in consultations throughout the process. As part of the Section 106 process, NPS staff sent letters to the SHPO and the Advisory Council on Historic Preservation September 16, 2008. The SHPO reviewed the EA and, on July 20, 2009, concurred with the NPS finding that implementation of the Selected Alternatives will have *no adverse effects* on historic properties, subject to the identified commitments and mitigative measures that will be carried out through site planning, design, and during construction.

Personnel from the USFWS are aware of the project and have been involved in consultations throughout the process. In accordance with Section 7 of the

Endangered Species Act (16 *United States Code* 1531 et seq.), NPS staff contacted the USFWS by letter on September 16, 2008, to initiate informal consultation and request verification of the list of threatened and endangered species that may occur within the project area. The USFWS personnel also participated in an internal scoping meeting on September 19, 2008. Issues and concerns raised during the meetings by USFWS staff were incorporated into the development of the EA. By letter dated August 5, 2009, the USFWS concurred with the NPS Section 7 determination that implementation of the preferred alternatives "*may affect, but is not likely to adversely affect*" the Florida panther, American crocodile, West Indian manatee, wood stork, Eastern indigo snake, Atlantic hawksbill sea turtle, green sea turtle, Kemp's Ridley sea turtle, leatherback sea turtle, and loggerhead sea turtle.

Personnel from the NMFS are aware of the project and have been involved in consultations throughout the process. In accordance with Section 7 of the Endangered Species Act and the Magnuson-Stevens Fishery Conservation and Management Act, NPS staff contacted the NMFS by letter on September 29, 2008, to initiate informal Section 7 consultation, to request verification of the Federally-listed species under NMFS jurisdiction with potential to occur in the project area, and to initiate consultation regarding Essential Fish Habitat (EFH). The NOAA-NMFS personnel also participated in an interagency scoping workshop on November 12, 2008. Issues and concerns raised during the meetings by NMFS staff were incorporated into the development of the EA. By letter dated May 4, 2009, the NMFS stated that "In most cases, NMFS supports restoration of historical hydrologic conditions. Improving the hydrology at Cape Sable should benefit the larger Everglades National Park, Florida Bay, and fishery resources that use these ecosystems. NMFS believes there will likely be a net benefit to EFH from this project and that long-term adverse impacts to EFH are unlikely."

On July 29, 2009, the NMFS identified the need for additional consultation on potential impacts to listed species under its purview as project implementation details are developed. NMFS has requested detailed information on potential effects on proposed critical habitat for the smalltooth sawfish, specifically the number of red mangroves that would be trimmed or removed and tidal inundation data. The NPS obtained this data in the project design phase and provided it to the Army Corps of Engineers and the South Florida Water Management District as part of the environmental permit application. The NPS is committed to working closely with NMFS to address all of their concerns during Section 7 consultation on the project permits.

Additionally, consultation was conducted with the SFWMD and NMFS during the environmental permitting pre-application process in order to determine an appropriate area for offshore staging of the barge. NPS consultants utilized data available from previous benthic resource analyses by the United States Geologic Survey (USGS) and NMFS to determine an assessment area outside the ENP boundary that appeared to be devoid of significant benthic resources. However, through consultation with the SFWMD and NMFS, it was determined that a further detailed study was deemed necessary to determine the specific resources present at the proposed offshore barge staging area. Under ideal circumstances a visual survey is performed by marine biologists in order to determine the presence or absence of benthic resources within a given area. However, due to the continuous high turbidity in this area of Florida Bay (low to no visibility), and the known presence of marine predators (e.g., large concentration of bull sharks, etc.), a visual in-water survey was determined to be infeasible and potentially dangerous. Therefore, NPS consultants, in consultation with NMFS and SFWMD, developed an alternate

method (i.e., PONAR "clamshell" grab-sampling along transects) to assess the benthic resources within the survey area.

The park provided the Florida State Clearinghouse with the scoping notice for processing through the appropriate state agencies. Representatives from several state agencies have been engaged in consultations concerning the project. These include the Florida Department of Environmental Protection (FDEP), the South Florida Regional Planning Council, the Florida Fish and FFWCC, the Florida Department of State, and the SFWMD.

On June 11, 2009, the NPS mailed copies of the EA and letters requesting comments to the Florida State Clearinghouse for processing through appropriate State agencies. On July 13, 2009, the NPS received a letter from the Clearinghouse transmitting comments from the FDEP, the FFWCC and the SFWMD. The agencies strongly support the project and provided comments. Substantive comments and NPS responses are summarized below.

An environmental permitting pre-application meeting for this project was held on October 6, 2009, at the SFWMD West Palm Beach office. Attendees present at the meeting included key project personnel from NPS and their consultant as well as key personnel from the regulatory agencies that would be involved in the permitting phase of the project, including the SFWMD, USACE, NMFS, USFWS, and FFWCC. The meeting began with a project overview background and a discussion of the project design alternatives. The meeting continued with a detailed discussion of proposed project impacts (i.e., direct wetland impacts, secondary wetland impacts, and protected species impacts) and mitigation measures. The meeting concluded with a discussion of the proposed project schedule and the proposed permitting timeline.

The Environmental Resource Permit application for this project was submitted via SFWMD's online e-submittal on January 4, 2009. No comments have been received to date from any of the regulatory agencies regarding the permit application.

Native American Tribes Consultation

A letter to initiate government-to-government consultations and provide information about the project was sent to the following tribes on September 16, 2008: Miccosukee Tribe of Indians of Florida, Seminole Tribe of Florida, and the Seminole Nation of Oklahoma.

A letter from Willard Steele, tribal historic preservation officer with the Seminole Tribe of Florida, dated October 16, 2008, was received stating the tribe is awaiting further correspondence from the park for consultation.

On June 11, 2009, the NPS mailed copies of the EA and letters inviting government-to-government consultations to the Tribes noted above. By letter dated July 7, 2009, the chairman of the Miccosukee Tribe of Indians indicated he saw no need for consultations regarding this project. No response was received from the Seminole Tribe of Florida or the Seminole Nation of Oklahoma.

Summary of Comments on the Cape Sable Canals Dam Restoration Project EA

Correspondence on the Cape Sable Canals Dam Restoration Project EA was overwhelmingly in favor (86 percent) or neutral (14 percent) about implementation of the project. Neutral comments posed questions or concerns about particular aspects of the project (e.g., engineering specifications, mitigation measures, etc.) but did not support or oppose implementation of the project. No comments were received expressing direct opposition to the

project. The comments, concerns, and suggestions of the respondents fell into several categories including general support for the project, environmental impacts, engineering specifications, permitting, and visitor use and experience. A total of 14 pieces of correspondence were received via PEPC (8), hard copy letter (5), and email (1).

Correspondence from agencies included letters and comments from the following agencies with the number of correspondences denoted in parentheses: the FDEP (2), the FFWCC (1), and the SFWMD (1). A letter was also received from the Miccosukee Tribe of Indians of Florida. Correspondence from organizations included letters and comments from the following organizations with the number of correspondences denoted in parentheses: National Parks Conservation Association (1), Sierra Club (1), Florida Keys Fishing Guides Association (1), and Audubon Society (1). One piece of correspondence was received from an individual representing the Conservancy of Southwest Florida, Sierra Club, Cornell Lab of Ornithology, and Natural Resources Defense Council. Correspondence from 4 individuals with no affiliation was also received.

ATTACHMENT A: RESPONSES TO SELECTED COMMENTS RECEIVED DURING THE PUBLIC REVIEW OF THE ENVIRONMENTAL ASSESSMENT

The following substantive comments and concerns were received during the public review of the EA. Substantive comments are defined by NPS Director's Order 12 (DO-12, Section 4.6A) as one that does one or more of the following:

- Question, with a reasonable basis, the accuracy of information in the EA;
- Question, with a reasonable basis, the adequacy of the environmental analysis;
- Present reasonable alternatives other than those presented in the EA; and/or
- Cause changes or revisions in the proposal.

The substantive comments have been summarized below along with NPS responses. The substantive comments are presented as either direct excerpts (or representative quotes) from the original comments or as text that has been paraphrased from the original comments.

TABLE 2. SUBSTANTIVE COMMENTS AND NPS RESPONSES

Comment(s) or Concern(s)	Response
Alternative D would be the best option I am just concerned about the sediments and the effects on Florida Bay with the algae blooms.	The resulting restored dams would decrease the velocity of currents dramatically during tidal flows, thus reducing erosional processes along the banks of the East Cape Extension and Homestead canals. Thus, erosion and channel widening would be expected to decrease, consequently reducing sediment deposition in the interior marshes and Lake Ingraham, providing a benefit to these systems. Also, reducing erosional processes would, in turn, reduce the release of nutrients (e.g., phosphorus and nitrogen) downstream of the dam site locations potentially reducing the potential for algal/phytoplankton blooms.
For both canals, we support the idea of better aligning the dams with the marl ridge. We also suggest the use of marl slurry pumped from Lake Ingraham via the floating pipeline for filling the area between the two walls. This is most likely a more cost effective alternative than buying fill material and then barging this material to the dam site.	Marl is not suitable for fill as it is a very light material and won't settle out. Clean washed quartz sand is a denser material that will settle rapidly. Also, using marl slurry pumped from Lake Ingraham would cause further ecological impacts at the Lake that would need to be evaluated. Thus, the use of the sediments from Lake Ingraham will not be feasible.
In addition, the park should take the opportunity afforded by the planning and construction of the two dams to collect any additional scientific data that might be important to identifying long-term restoration solutions for the Cape Sable wetlands.	The park staff will continue to monitor the surrounding ecosystems following construction. Some funding is currently available for a monitoring program that will include collecting data for salinity, fish, and vegetation.

Comment(s) or Concern(s)	Response
The preferred alternatives propose using shallow draft barges and a pipeline to convey materials to fill the Geotubes, and helicopters to transfer additional shoreline riprap fill material to the restoration sites. Please address in the final EA whether the possibility of moving the filled Geotubes by helicopter was evaluated to further reduce impacts from the movement of pipelines, barges and other associated watercraft.	This option was evaluated and not considered feasible. Geotubes are too large to transport to the Homestead dam site via helicopter. Each geotube will be filled with approximately 100 cubic yards of sediment totally approximately 130 tons each. The maximum load for a standard helicopter is approximately 5 tons. Also, the geotube fabric would not be able to hold the fill while being transported by air.
A safe portage for non-motorized boaters (canoeists/kayakers) is also critical. Would it be possible to include a small shaded rest area, with a privy, and possibly a trash drop? There is no way to escape the hot sun in that area in mid-day.	The suggested facilities would create an additional significant maintenance issue for the park and would adversely affect wildlife and wildlife habitat. The facilities are not necessary or appropriate to meet the project objectives.
Any construction activities in uplands that generate stormwater runoff from upland construction, as well as dredging and filling in wetlands and other surface waters may require an Environmental Resource Permit (ERP) from the State, under Part IV of Chapter 373, Florida Statutes. ERP permit applications are processed by either the Department or one of the Water Management Districts, in accordance with the division of responsibilities specified in operating agreements between FDEP and the water management districts. The Department's South District Office has determined that this project falls under the permitting jurisdiction of SFWMD. Thus, any required ERP permit(s) should be obtained from the SFWMD.	The NPS acknowledges that an Environmental Resources Permit is required from the SFWMD prior to commencement of construction.

Comment(s) or Concern(s)	Response
Because manatees (Trichechus manatus latirostris), are known to frequent the Cape Sable area, we recommend adherence to the "Guidelines for Manatee Conservation during Comprehensive Everglades Restoration Plan [CERP] Implementation" prepared by the CERP Interagency Manatee Task Force in October of 2006. The manatee conservation guidelines include protection measures to be implemented during project design and construction to avoid any adverse impacts, such as physical harm or entrapment, to manatees. If any of the activities proposed for this project are discussed in these guidelines, the plan should include the conservation measures provided in this document. Construction work should take place outside of the American crocodile nesting season. If avoiding the nesting season is not possible, surveys of crocodile nests should be conducted prior to and during construction.	The "Guidelines for Manatee Conservation during Comprehensive Everglades Restoration Plan Implementation" prepared by the CERP Interagency Manatee Task Force in October of 2006 will be employed during all phases of construction to avoid any potential impacts to this species. Construction activities will not occur during crocodile nesting season. Access to Lake Ingraham and Florida Bay will remain open through natural waterways, such as the Eastside Creek. This creek is located east of the East Cape Extension Canal, with an opening to the south of the proposed dam location. This creek is deep enough to allow passage of motorized boats (although prohibited in wilderness) and will remain open, allowing for access for protected species. Manatees could also access the Homestead Canal in the northeastern part of Cape Sable by passing through Coot Bay, Mud creek, Mud Lake, and Bear Lake.
Regions of the park, including the project sites, are designated as American crocodile (Crocodylus acutus) critical habitat. Crocodile nesting in the Florida Bay region occurs between March and September. Chapter 2 of the EA states that during 2007 and 2008 combined, 108 nests where located along the two project sites. The FFWCC recommends that construction work take place outside the crocodile nesting season. Surveys for crocodile nests should be conducted prior to and during construction if avoiding the nesting season is not possible.	Construction activities will not occur during crocodile nesting season. The NPS will also survey the project area for crocodile nests prior to construction.
The FFWCC advises that there have been numerous recorded sightings of smalltooth sawfish (Pristis pectinata) within the proposed project sites and past the existing East Cape Sable dam from 1998 to 2009. Further, juveniles have been able to get past the existing East Cape Sable dam. The FFWCC recommends that the multiple natural channels through the Buttonwood Embankment be maintained open to prevent the sawfish from being trapped on the wrong side of the dams and to give them access to Lake Ingraham and Florida Bay.	No construction activities are proposed within any areas other than the man made East Cape Extension and Homestead canals. Eastside Creek is located east of the East Cape Extension Canal, with an opening to the south of the proposed dam location. This Creek is deep enough to allow passage of motorized boats (although prohibited in wilderness)and will remain open, allowing for access for protected species. Sawfish could also access the Homestead Canal in the northeastern part of Cape Sable by passing through Coot Bay, Mud creek, Mud Lake, and Bear Lake.

Comment(s) or Concern(s)	Response
There are many wading birds that use the Cape Sable region of the park for foraging and nesting. Common wading birds found in the proposed project site include the wood stork (Mycteria americana), great egret (Ardea alba), great blue heron (Ardea herodias), green heron (Butorides virescens) and black-crowned night-heron (Nycticorax nycticorax). In cases where wading bird species may be impacted by construction, we recommend compliance with all federal and state regulations and recommendations concerning each species. Specifically, compliance with the Migratory Bird Treaty Act concerning nesting colonial wading birds is recommended. In addition, we recommend that project workers be instructed on potential listed wildlife species that may occur in the project area and provided guidance on actions to take if species are observed.	Section 7 Consultation with the USFWS has been completed and consultation with the NMFS will be completed during project permitting. The NPS will adhere to all conditions of the environmental permits and Federal/State regulations with respect to wildlife. Additionally, the contractor will be required to conduct environmental training for identification of threatened and endangered species for all on-site personnel. All applicable standard protection measures will be complied with.
Will the vegetative communities landward of the proposed dam structures tolerate a salinity shift to a more freshwater driven system?	The existing vegetation is expected to be sustained after a shift in salinity occurs. It is important to note that the shift in salinity will be a slow, gradual transition to a more freshwater system and will occur over time, allowing for the vegetation to adapt to the new conditions. The system is expected to remain brackish over most of the area, as saltwater will still come in through the Eastside Creek and during high tide events (approximately 80 times per year).
How will the park ensure that animals (e.g., manatees, sea turtles, etc.) be prevented from being entrapped landward of the replaced dam structures?	No construction activities are proposed within any areas other than the man made East Cape Extension and Homestead canals. The Eastside Creek is deep enough to allow passage of motorized boats (although prohibited in wilderness)and will remain open, allowing for access for protected species. It is located east of the East Cape Extension Canal, with an opening to the south of the proposed dam location. Additionally, the contractor will be required to conduct environmental training for identification of threatened and endangered species for all on-site personnel. All applicable standard protection measures will be complied with.

Comment(s) or Concern(s)	Response
How will listed species (e.g., manatees, crocodiles, alligators, sea turtles, etc.) protection be ensured during project development or as a result of project development?	NPS will ensure that the awarded contractor adheres to all of the conditions of the environmental permits as well as Federal and State wildlife regulations, (including, but not limited to manatee, sea turtle and smalltooth sawfish), including no wake zones and monitoring during construction. Construction activities occurring near sensitive habitats would be scheduled to minimize potential impacts during periods of breeding, nesting, and rearing of young (especially noting the American crocodile nesting season). Construction would occur only during daylight hours to reduce effects on nocturnal foraging or rest. Pre-construction surveys would be conducted to identify any Federal- and State-listed species occurring in the area. Should individuals or nest sites be identified, additional measures would be taken to avoid impacts (e.g., fencing nest sites, providing information to contractors about the species). Additionally, the contractor will be required to conduct environmental training for identification of threatened and endangered species for all on-site personnel.
Alternatives D and G propose the removal of the existing sheetpile wall. Please identify the methods proposed for the removal and replacement of the sheetpile walls.	With Alternative D, the existing sheetpile wall will be pulled (removed) and reused with the use of heavy equipment. Exact methods will be determined during the final design/permitting phase of the project. Alternative G was not selected for implementation.

Comment(s) or Concern(s)	Response
According to the EA, Alternative G for the Cape Sable Canals Dam Restoration project and Alternative G1 for the East Cape Canal will have the least long-term environmental impacts and the most benefits to wildlife. FFWCC recommends these two alternatives be used to restore/replace the dams in the Cape Sable area.	The Selected Alternative for the East Cape Extension canal dam is Alternative D. Under this scenario, the dam structure would function for a 50-year life-cycle, the natural and cultural resources would be protected and the safety hazards from the existing dam structure would be removed resulting in a positive visitor experience. The advantages of Alternative D, compared to the other action alternatives, would be similar with the exception that the construction costs greatly vary between the alternatives due to different engineering techniques. The cost is lower for Alternative D and the advantages are higher; therefore, Alternative D would provide the most cost-effective solution for the park for the East Cape Extension canal dam. The original NPS Selected Alternative for the Homestead Canal was described as "Alternative D1, the Preferred Alternative" in Chapter 2 of Cape Sable Canals Dam Restoration Project EA. Since the completion of the NEPA process, new information was provided by two local specialty marine equipment contractors during the development of the design documents causing a revision to Alternative D1. The new information shows that the use of ultra light/specialized marine equipment with shallow drafts can be utilized to transport the necessary sheetpile equipment into the Homestead Canal without impacting the substrate of Lake Ingraham. The new NPS Selected Alternative for the Homestead Canal is Alternative D/D1-Hybrid (the "Preferred Alternative"). This alternative combines the sheetpile design alternative evaluated in the EA (Alternative D) with the hydraulic pipeline material transportation method developed for Alternative D1. Under this scenario, the dam structure would function for a 50-year life-cycle, the natural and cultural resources would be protected and the safety hazards from the existing dam structure would be removed resulting in a positive visitor experience. The advantages of Alternative D/D1-Hybrid, compared to the other action alternatives, would be similar with the exception that the construction costs greatly vary between the alternatives due to different engineering techniques. The cost is lower for Alternative D/D1-Hybrid and the advantages are higher; therefore, Alternative D/D1-Hybrid would provide the most cost-effective solution for the park for the Homestead canal dam.

Comment(s) or Concern(s)	Response
A secondary wetland impact analysis will be required that addresses secondary impacts related to mangrove and other vegetation trimming and all other secondary impacts associated with project development. A restoration and monitoring plan will be required that addresses secondary impacts associated with vegetative trimming/removal. Additional secondary impacts include, as identified in Section 1.4.3.2.1 of the EA, the potential for flow increases through other, existing channels.	A secondary impacts analysis was provided in the EA. The project impacts will be refined during the final design/permitting phase of the project. Impacts will be avoided and/or minimized to the greatest extent practicable. A Restoration and Monitoring Plan will also be developed during the environmental permitting phase of the project. The monitoring plan will detail the areas to be monitored, methodology to be used, and time frames for reporting; and schematics, grading and planting details of any mitigation to be performed for the project.

Comment(s) or Concern(s)	Response
I thought I would share with you my experience with geotubes. They sounded like a good idea at the time, they are cheap and the material to fill the tubes can simply be removed from the immediate area. However, it has been my experience they are not stable. They rely solely on the stability of the underlying substrate. If that fails, the tubes move and crevasses occur behind them. Scouring from either side caused by excess flow, tide or surge will create a problem. Once placed, there is no way move them. They are not structurally sound enough to pick up with a machine. We have actually had to cut them open, dredge the fill material and remove the geotextile fabric. Then we had to start over. I would strongly recommend against their use.	The geotubes, in this application, are primarily intended for the temporary containment of the plug area during filling and will become secondary containment once the end riprap systems are constructed (Geotubes will be covered with riprap). If the tubes lose their integrity after the plug fill is placed, this will not be a critical concern as any gaps that may develop would be infilled with the plug area sand material and protected by the outer riprap system. According to limited site borings performed to date, the foundation base of the geotube will be on a thin layer of marl which is underlain by incompressible limestone (side slopes will be in contact with the softer marl material). The vertical settlement of the geotube foundation base should not be an issue of concern since the thin layer of marl that exists above the limestone would be squished out from under the weight of the geotubes during filling. There is more of a potential for small gaps to occur along the edges of the canal at the contact of the geotubes with the sidewall marl material. The design of the end riprap section will call for a free draining sand to be placed over the geotubes and in the contact corner and along the near side slopes of the canal 50 feet up and downstream. The purposes of this fill are to; a) to provide a flattened slope on which to place a geotextile fabric and to construct the protective riprap section and b) provide a more permeable seepage collection drain/outlet for any seepage working its way past the geotubes in the side slope area as well as the bottom area of the channel. The geotube and granular cover sands are to be covered with a non woven geotextile fabric over which the riprap bedding layer and riprap will be placed. The granular sand fill and fabric will collect and dissipate seepage into the riprap and prevent the internal erosion loss of material from the plug area - once the riprap section is completed. Thereafter, the geotube material is of little functional benefit unless the riprap should somehow be washed away during a severe tropical or hurricane storm event. Given the remoteness of the Homestead dam site and difficulty of access in getting major equipment and materials into and down the canal to the to the dam site area, the geotube concept, was deemed to have the least environmental impact on the park. However, note that the new NPS Selected Alternative for the Homestead Canal is Alternative D/D1-Hybrid. This alternative utilizes the sheetpile design.

Comment(s) or Concern(s)	Response
The following concerns relate to the proposal for barge utilization during project development: *• Staging of construction materials and activities are proposed on barges. How many barges are proposed to be utilized and where will they be located?* *• How long will barges be moored in anyone location?* *• What resources are present in the location of barge placement?* *• How will barges be held in place?* *• Please provide a nautical chart indicating how the barge(s) will be transported to the project site. Please indicate the draft of the fully loaded barge(s) and indicate that a minimum of 1-foot clearance exists between the fully loaded barge and the bottom, at mean low tide.*	Up to 3 spud barges will be utilized at any one time. Spud barges are flat-decked floating structures that have devices similar to legs, called spuds, which are lowered from underneath the barges and pushed into the waterway floor to anchor the structures in place. The barges will be staged at the eastern mouth of Lake Ingraham for the Homestead canal dam site and within the East Cape Extension canal for the East Cape Extension dam site. The barges will typically be moored for a period of 30 days at any one location. No protected resources exist within the staging areas as addressed in the EA document. However, mangrove trimming and/or selective clearing may need to occur in order to access the staging areas. Impacts associated with these activities have been addressed in the EA document. A nautical chart showing the preferred barge access route will be provided once an upland staging area has been determined. The upland staging area will be determined during the final design/permitting phase of the project. The draft of the fully loaded barge(s) is anticipated to be 3-4 feet. However, the awarded contractor will be encouraged to utilize specialty barges with lower drafts (e.g., pontoons, etc.). More specific details will be provided during the permitting process.
Heavy machinery is proposed to be used in several of the alternatives being considered. Please indicate how this equipment will be transported to the site, where it will be stored, how oils and greases will be contained, how refueling will occur. A plan should be developed and provided to the District indicating the limits of heavy equipment use during project development.	A spill containment and countermeasures plan will be prepared during the final design and permitting phase of the project. The plan will contain all of the details to control the use of hazardous materials onsite.

Comment(s) or Concern(s)	Response
District staff has concerns with alternate designs that will require the dredging of an access channel (52-ft by 8,320-ft). These concerns include the following: *• The proposal to store dredged materials in open water adjacent to the dredged channel. A benthic assessment of the area where material was to be placed would be required. This analysis would have to demonstrate that no adverse impacts to resources would result from the placement of materials.* *• How long would the materials be stored adjacent to the channel?* *• How would the silty, fine materials be stabilized?* *• How would turbidity, erosion be controlled in both the short term and long-term?* *• Would placement of the dredged materials result in any flow pattern alteration?* *• What is the proposal to restore the dredged areas?* *• Alternative sites for storage of materials were mentioned in the Environmental Assessment. Have these areas been identified?*	The original NPS Selected Alternative for the Homestead Canal was described as "Alternative D1, the Preferred Alternative" in Chapter 2 of Cape Sable Canals Dam Restoration Project EA. Alternative D1 will not require dredging an access channel in Lake Ingraham. Since the completion of the NEPA process, new information was provided by two local specialty marine equipment contractors during the development of the design documents causing a revision to Alternative D1. The new information shows that the use of ultra light/specialized marine equipment with shallow drafts can be utilized to transport the necessary sheetpile equipment into the Homestead Canal without impacting the substrate of Lake Ingraham. The new NPS Selected Alternative for the Homestead Canal is Alternative D/D1-Hybrid (the "Preferred Alternative"). This alternative combines the sheetpile design alternative evaluated in the EA (Alternative D) with the hydraulic pipeline material transportation method developed for Alternative D1. Alternative D/D1 Hybrid will also not require dredging an access channel in Lake Ingraham. Therefore, the concerns stated about alternate designs are not applicable to the Selected Alternatives.
Alternatives D1 and G1 propose the removal of the sheetpile walls. Please indicate how these walls will be disposed of. Additionally, both of these alternatives include a proposal to construct a 1.5 to 2.0 mile pipeline for the transport of sand to fill geotubes. Please indicate how navigation will be maintained with the pipe in place. Also, how will this proposed pipe be marked to ensure visibility? Where will the material proposed for use in the geotubes come from and how will it be transported to the site?	With Alternatives D1 and G1, the existing sheetpile wall will be cut at the sediment surface. Exact methods of cutting will be determined during the final design/permitting phase of the project. Navigation will not be adversely impacted as a result of using the temporary conveyance pipeline. The pipe will be anchored to the northern limits of the channel and marked with signage, lighting and buoys to ensure visibility. The material needed to fill the geotubes will be purchased from an upland source (to be determined during the final design phase of the project). The material will be trucked to the upland staging area, loaded onto a waiting barge and transported to the Lake Ingraham staging area and pumped to the dam site.

Comment(s) or Concern(s)	Response
Staging in the Florida Keys is proposed. This area(s) will need to be identified and the barge route established. Please ensure a revised plan sheet is provided that identifies the proposed barge route from the staging area to the navigable waters. Please provide a nautical chart to demonstrate that a minimum of one-foot of water between the bottom of the fully loaded barge and the sea floor exists at mean low water from the staging area to the project site. Also, please provide an assurance that existing roadways to the staging area are structurally sound enough to address the increase in truck traffic necessary to complete the proposed project.	The upland staging area will be determined during the final design/permitting phase of the project. A nautical chart showing the preferred barge access route will be provided once an upland staging area has been determined. Equipment/materials will be transported to the staging via existing overland ravel routes (to be determined during the final design/permitting phase of the project).
Alternate C includes an option to modify the existing dam. As erosive action has widened the East Cape Channel from 20-ft wide to 300-ft wide, what assurances will the applicant provide to indicate that future erosive action will not extend beyond the proposed wing-walls?	Alternative C was not selected. The intent of the dam is to minimize erosional forces (energy forces). The wing walls will minimize the erosion of the dam. In the Selected Alternatives rip rap will be used to anchor and protect the dam structures and minimize the potential for erosion and failure. Frequent monitoring and maintenance are part of this project for the Selected Alternatives and will be implemented to correct any problems that may arise over time.
Bank stabilization is proposed. Please ensure that impacts associated with bank stabilization have been quantified. Will listed species utilization of the area be adversely impacted as a result of the proposed stabilization?	Canal bank and wildlife impacts were analyzed and quantified in the EA. The project impacts will be refined during the final design/permitting phase of the project. Impacts will be avoided and/or minimized to the greatest extent practicable.

Comment(s) or Concern(s)	Response
The EA provided states that "agencies have stated that backfilling of the dredged channel will mitigate for temporary impacts." The SFWMD has not agreed with this proposal at this time. Direct and secondary wetland impacts associated with project development need to be addressedand offset. A preliminary, draft UMAM analysis was provided. However, a review of UMAM scores and any required mitigation will take place during ERP application review.	The original NPS Selected Alternative for the Homestead Canal was described as "Alternative D1, the Preferred Alternative" in Chapter 2 of Cape Sable Canals Dam Restoration Project EA. Alternative D1 will not require dredging an access channel in Lake Ingraham. Since the completion of the NEPA process, new information was provided by two local specialty marine equipment contractors during the development of the design documents causing a revision to Alternative D1. The new information shows that the use of ultra light/specialized marine equipment with shallow drafts can be utilized to transport the necessary sheetpile equipment into the Homestead Canal without impacting the substrate of Lake Ingraham. The new NPS Selected Alternative for the Homestead Canal is Alternative D/D1-Hybrid (the "Preferred Alternative"). This alternative combines the sheetpile design alternative evaluated in the EA (Alternative D) with the hydraulic pipeline material transportation method developed for Alternative D1. Alternative D/D1 Hybrid will also not require dredging an access channel in Lake Ingraham. Secondary impacts associated with hydraulic pipeline and other project elements will be assed during the permitting phase of the project.

ATTACHMENT B: ERRATA SHEETS

EVERGLADES NATIONAL PARK

CAPE SABLE CANALS DAM RESTORATION PROJECT/ENVIRONMENTAL ASSESSMENT

AUGUST 2009

Corrections and revisions to the Cape Sable Canals Dam Restoration Project/ Environmental Assessment (EA) are listed in this section. Revisions were made in response to comments from public and agency reviews of the EA. These revisions have not resulted in substantial modification of the selected alternative. It has been determined that the revisions do not require additional environmental analysis. Additions to the text are shown in bold and text removed is shown with strikeout. The page numbers referenced are from the *Cape Sable Canals Dam Restoration Project/Environmental Assessment* issued in June 2009.

Page E-5 - Under "Executive Summary"

~~Elevated dock structure(s) (approximately 10-ft by 10-ft) would be constructed in the center of each dam with ladder(s) to allow for access.~~ **A floating dock structure (less than 250 square feet) would be constructed near the center of each dam entrance. Canoe ramps would be placed on the riprap slope at each end of the dams.**

Page E-6 - Under "Executive Summary"

Floating mooring buoys **and/or free-standing piles** would be installed downstream (towards Lake Ingraham) of the dam structures for motorized vessel anchoring. ~~Marine anchors~~ **Mooring buoy anchors and/or piles** would ~~be utilized to secure the mooring buoys to the canal bottom to~~ minimize potential substrate disturbance ~~with installation~~.

page 42 – Under "Floating Mooring Buoys"

Floating mooring buoys **and/or free-standing piles** would also be installed downstream (towards Lake Ingraham) of the dam structures for motorized vessel anchoring. ~~Marine anchors~~ **Mooring buoy anchors and/or piles** would ~~be utilized to secure the mooring buoys to the canal bottom to~~ minimize potential substrate disturbance ~~with installation~~.

Page 43 – Under "Canoe/Kayak Portage"

Also, the repair of the existing dam would include an engineering component to provide safe passage over the restored dam for non-motorized boaters (canoeists/kayakers). To provide safe passage, a floating dock structure **(less than 250 square feet**~~approximately 10-ft by 10-ft~~**)** would be constructed ~~in~~**near** the center of each dam entrance~~. The dock would be constructed using a wood-plastic composite lumber composed of wood and recycled plastic. The dock would be constructed so that a portion of the structure would extend over the water. A ladder would be placed on each dock to allow for access~~. **A canoe ramp would be placed on the riprap slope adjacent to the floating dock footprint, to allow for canoes to be safely pulled out of, and placed into the water. A canoe/kayak ramp would be placed at each end of each dam.**

Page 67 – Under Table 2.2, "Alt. D", "Recreational Access/Portage", bullet 6

~~An elevated floating dock structure (10'x10') would be constructed.~~ **A floating dock, and mooring buoys or piles will be provided for motorized boats to tie-up.**

Page 67 – Under Table 2.2, "Alt. D", "Recreational Access/Portage", bullet 8

~~Floating mooring buoys would be installed along the access channel to provide safe boat docking.~~

Page 71 – Under Table 2.3, "Alt D", "Recreational Access/Portage", bullet 6

~~To provide safe portage, an elevated floating dock structure (approximately 10 ft by 10 ft) would be constructed.~~ **A floating dock, and mooring buoys or piles will be provided for motorized boats to tie-up.**

Page 71 – Under Table 2.3, "Alt D", "Recreational Access/Portage", bullet 7

~~A ladder would be placed on each dock to allow for in-water access.~~

Page 71 – Under Table 2.3, "Alt D", "Recreational Access/Portage", bullet 9

~~Floating mooring buoys would be installed along the access channel to provide safe boat docking.~~

Page 148 – Under "Vegetation and Wetlands" and "Action Alternative C…."

In addition to the above, ~~approximately 0.002~~less than 0.006 acres (~~90~~**250** square feet) of permanent shading impacts to **both** the East Cape Extension and Homestead canals would occur as a result of the proposed non-motorized boat (canoe/kayak) portage system. However, since no submerged resources are known to exist within these waterways, this new shading impact is negligible. Also, floating mooring buoys **and/or free-standing piles** would be installed downstream (towards Lake Ingraham) of the dam structure for motorized vessel anchoring. ~~Marine anchors~~ **Mooring buoy anchors and/or piles** would ~~be utilized to secure the mooring buoys to the canal bottom to~~ minimize potential substrate disturbance ~~with installation~~.

Page 158 – Under "Vegetation and Wetlands" and "Action Alternatives D…and G…."

In addition to the above, ~~approximately 0.002~~**less than 0.006** acres (~~90~~**250** square feet) of permanent shading impacts to **both** the East Cape Extension and Homestead canals would occur as a result of the proposed non-motorized boat (canoe/kayak) portage system with the implementation of either Alternative D or G. However, since no submerged resources are known to exist within these waterways, this new shading impact is negligible. Also, floating mooring buoys **and/or free-standing piles** would be installed downstream (towards Lake Ingraham) of the dam structure for motorized vessel anchoring. ~~Marine anchors~~ **Mooring buoy anchors and/or piles** would ~~be utilized to secure the mooring buoys to the canal bottom to~~ minimize potential substrate disturbance ~~with installation~~.

Page 168 – Under "Vegetation and Wetlands" and "Action Alternatives D1…and G1…."

Also, floating mooring buoys **and/or free-standing piles** would be installed downstream (towards Lake Ingraham) of the dam structure for motorized vessel anchoring. ~~Marine anchors~~ **Mooring buoy anchors and/or piles** would ~~be utilized to secure the mooring buoys to the canal bottom to~~ minimize potential substrate disturbance ~~with installation~~.

Page 186 - - Under "Marine Resources and Essential Fish Habitat" and "Action Alternative C...."

In addition to the above, ~~approximately 0.002~~**less than 0.006** acres (~~90~~**250** square feet) of permanent shading impacts to **both** the East Cape Extension and Homestead canals would occur as a result of the proposed non-motorized boat (canoe/kayak) portage system. However, since no submerged resources are known to exist within these waterways, this new shading impact is negligible. Also, floating mooring buoys **and/or free-standing piles** would be installed downstream (towards Lake Ingraham) of the dam structure for motorized vessel anchoring. ~~Marine anchors~~ **Mooring buoy anchors and/or piles** would ~~be utilized to secure the mooring buoys to the canal bottom to~~ minimize potential substrate disturbance ~~with installation~~.

Page 188-189- Under "Marine Resources and Essential Fish Habitat" and "Action Alternatives D...and G...."

In addition to the above, ~~approximately 0.002~~**less than 0.006** acres (~~90~~**250** square feet) of permanent shading impacts to **both** the East Cape Extension and Homestead canals would occur as a result of the proposed non-motorized boat (canoe/kayak) portage system. However, since no submerged resources are known to exist within these waterways, this new shading impact is negligible. Also, floating mooring buoys **and/or free-standing piles** would be installed downstream (towards Lake Ingraham) of the dam structure for motorized vessel anchoring. ~~Marine anchors~~ **Mooring buoy anchors and/or piles** would ~~be utilized to secure the mooring buoys to the canal bottom to~~ minimize potential substrate disturbance ~~with installation~~.

Page 190 - - Under "Marine Resources and Essential Fish Habitat" and "Action Alternatives D1...and G1...."

In addition to the above, ~~approximately 0.002~~less **than 0.006** acres (~~90~~**250** square feet) of permanent shading impacts to **both** the East Cape Extension and Homestead canals would occur as a result of the proposed non-motorized boat (canoe/kayak) portage system. However, since no submerged resources are known to exist within these waterways, this new shading impact is negligible. Also, floating mooring buoys **and/or free-standing piles** would be installed downstream (towards Lake Ingraham) of the dam structure for motorized vessel anchoring. ~~Marine anchors~~ **Mooring buoy anchors and/or piles** would ~~be utilized to secure the mooring buoys to the canal bottom to~~ minimize potential substrate disturbance ~~with installation~~.

Page 234-235 – Under "Visitor Use and Experience / Public Safety" and "Action Alternative C...."

As an added safety precaution for boaters, **appropriate** warning signs ~~stating "Warning – No Motorized Access – Submerged Structure"~~ would be posted ~~on both the ends of each of~~**at** the proposed dam structures. ~~Signs would be anchored to marine piles and installed in the center access channel of each dam site. Signs would constructed of reflected material and posted a minimum of 5 ft above MHL.~~

Floating mooring buoys **and/or free-standing piles** would also be installed downstream (towards Lake Ingraham) of the dam structures for motorized vessel anchoring. ~~Marine anchors~~ **Mooring buoy anchors and/or piles** would ~~be utilized to secure the mooring buoys to the canal bottom to~~ minimize potential substrate disturbance ~~with installation~~.

Page 236-235 – Under "Visitor Use and Experience / Public Safety" and "Action Alternative D... and D1...."

Additionally, like Alternative C, as an added safety precaution for boaters, warning signs ~~stating "Warning – No Motorized Access – Submerged Structure"~~ would be posted ~~on both the ends of each of~~ **at** the proposed dam structures.

Page 237-238 – Under "Visitor Use and Experience / Public Safety" and "Action Alternative G... and G1...."

Like Alternatives C and D/D1, as an added safety precaution for boaters, **appropriate** warning signs ~~stating "Warning – No Motorized Access – Submerged Structure"~~ would be posted ~~on both the ends of each of~~ **at** the proposed dam structures. ~~Signs would be anchored to marine piles and installed in the center access channel of each dam site. Signs would constructed of reflected material and posted a minimum of 5 ft above MHL.~~

Floating mooring buoys **and/or free-standing piles** would also be installed downstream (towards Lake Ingraham) of the dam structures for motorized vessel anchoring. ~~Marine anchors~~ **Mooring buoy anchors and/or piles** would ~~be utilized to secure the mooring buoys to the canal bottom to~~ minimize potential substrate disturbance ~~with installation~~.

Page 207 – Under "American Crocodile"

Construction activities for the proposed project would be limited to the months of October through ~~February~~ **March**, during which no American crocodile nesting occurs.

Page 249 – Under "Schedule"

- No work would take place during crocodile nesting season from ~~March~~ **April** to September, therefore the project schedule should be accelerated as to meet the scheduling constraints of the crocodile nesting season.
- The timeline goal for the project is to begin construction by October 1, 2010 (subsequent to crocodile nesting season) and complete construction by ~~February~~ **March 31,** 2011 (prior to the crocodile nesting season).

ATTACHMENT C: STATEMENT OF FINDINGS FOR WETLANDS

STATEMENT OF FINDINGS FOR EXECUTIVE ORDER 11990

(PROTECTION OF WETLANDS)

CAPE SABLE CANALS DAM RESTORATION PROJECT

EVERGLADES NATIONAL PARK

August 2009

Recommended:

Dan B. Kimball, Superintendent, Everglades National Park — Date: 7-22-2009

Certified for Technical Accuracy and Servicewide Consistency:

for BILL JACKSON

Bill Jackson, Chief, NPS Water Resources Division — Date: 7-27-2009

Approved:

David Vela, Southeast Regional Director — Date: 8-14-09

1.0 INTRODUCTION

The National Park Service (NPS) has prepared and made available for public review, an Environmental Assessment (EA) for the Cape Sable Canals Dam Restoration Project. This project is intended to provide sustainable solutions to issues associated with saltwater intrusion into and degradation of freshwater and brackish marshes north of the marl ridge; illegal motorized boat access into the Marjory Stoneman Douglas Wilderness area; and unsafe conditions for motorized and non-motorized boaters at the dam sites. The EA and this Statement of Findings (SOF) would provide decision-makers with sufficient information to decide whether restoration/construction of the dams at the East Cape Extension and Homestead canals in the Cape Sable area of Everglades National Park is worth the financial cost and potential environmental effects associated with construction. The NPS is the lead agency for preparation of this SOF.

The National Park Service (NPS) has long recognized the importance of addressing impacts from the Cape Sable canals. Stopping tidal flow into the cape's interior marshes is the key to revitalizing the function of these freshwater marshes. While this landscape is naturally dynamic, slowing the rate of change on this landscape may also bring about greater resilience to the cape in the face of predicted sea level rise and the possibility of more frequent and intense hurricanes.

The NPS plugged several of the canals at the marl ridge with earthen dams in the late 1950s and early 1960s. Over time, natural forces compromised two of these early structures and, by 1992, they had failed. The earthen dams were replaced in 1997 with sheet-piling dams, though these also failed after a few years, possibly due in part to vandalism, which increased erosion of the canal banks. Openings at the failed plugs continue to widen, due to erosional processes, and transport marine waters eastward along the Homestead Canal as far as Bear Lake. These structures are located along the East Cape Extension and Homestead canals (see Figure 1.1 for the locations of the failed dam sites and Figures 1.2 and 1.3 for aerial views of the East Cape Extension and Homestead canals' dam site).

Due to the need to minimize or stop tidal flow to the interior marshes of the cape, the NPS retained URS Corporation to conduct a Preliminary Engineering Analysis in 2007 to identify and develop preliminary engineering design concepts for the restoration of the failed dams on the East Cape Extension and Homestead canals. Upon completion of the preliminary study, the no action (represents the current condition) and viable action (build) alternatives for each canal were carried forward in the EA and SOF to analyze the impacts that would potentially result from implementation of these alternatives, in accordance with all applicable laws and policies. The remoteness of both dam sites and the difficulty in accessing the dam areas on the East Cape Extension and Homestead canals would have significant impact on the repair alternatives that have been developed as well as the associated costs.

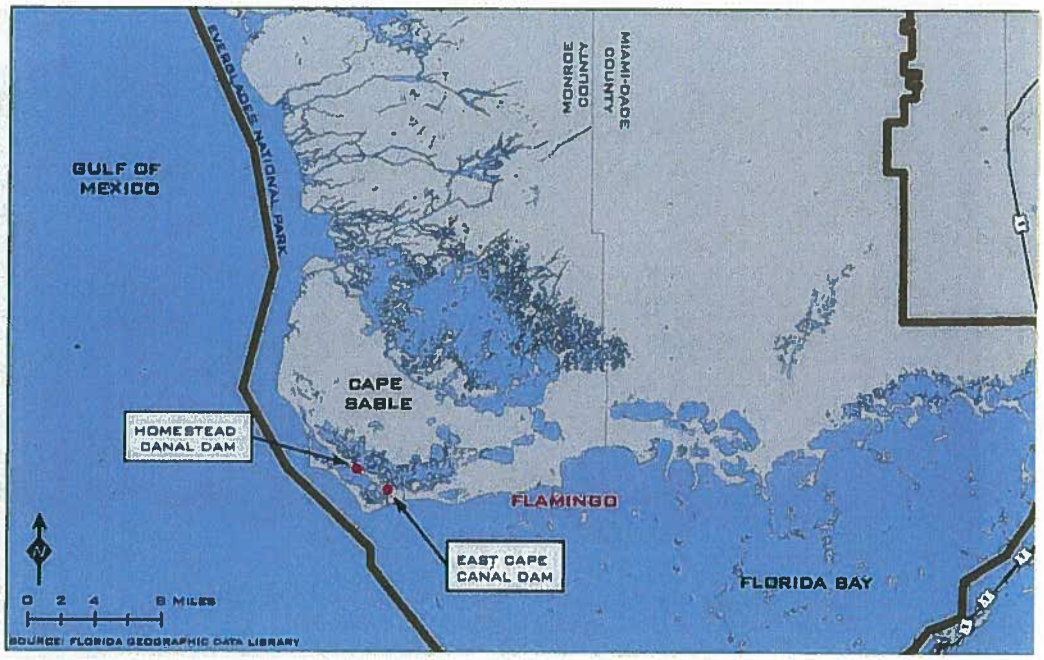

Figure 1.1 - Failed Dam Locations

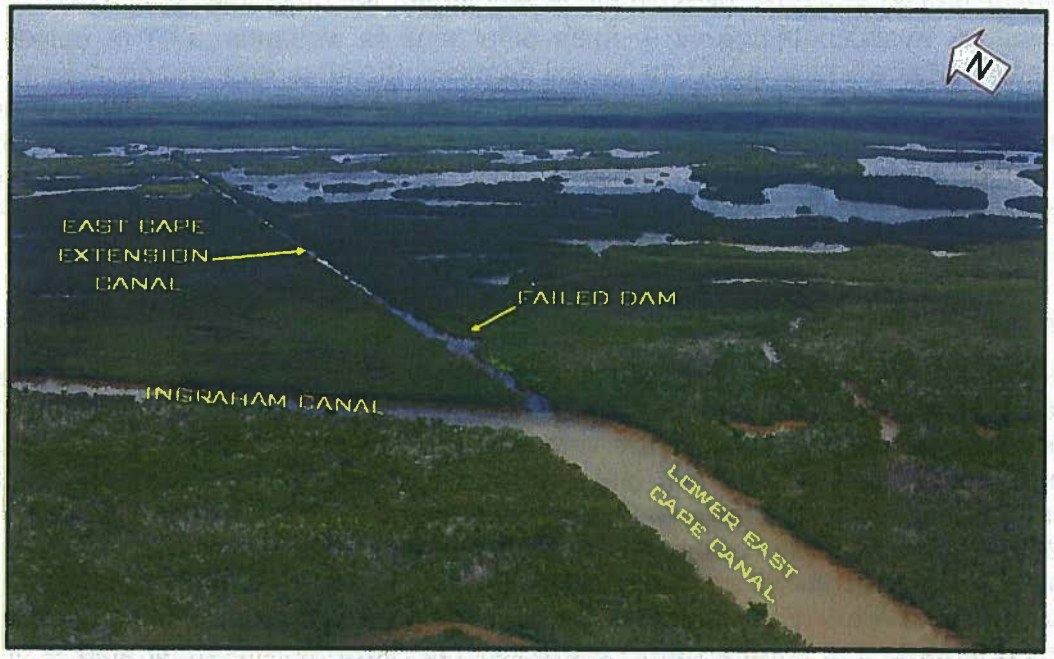

Figure 1.2 – Aerial View of East Cape Extension Canal Failed Dam

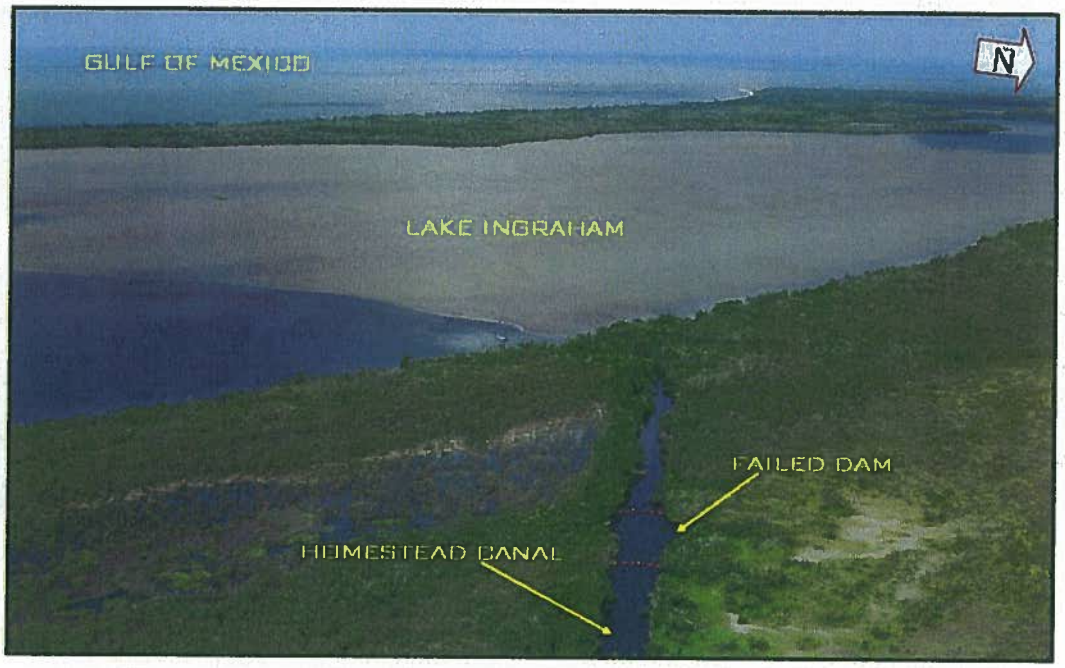

Figure 1.3 – Aerial View of Homestead Canal Failed Dam

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

2.0 WETLANDS OF THE CAPE SABLE AREA

Cape Sable is located at the southwest corner of the Florida mainland. It is bordered by Florida Bay to the south, the Gulf of Mexico to the west and Whitewater Bay to the northeast. It is connected to the mainland by an easterly-trending marl ridge, at the southernmost end of the "river of grass" that makes up the Everglades ecosystem. It is located between the outlets of two major watersheds of the Everglades National Park: Shark River Slough and Taylor Slough. Shark River Slough flows from its origin in the northeast portion of the park and empties into the Gulf of Mexico to the west of Cape Sable, while Taylor Slough drains a smaller watershed along the eastern portion of the park and flows into northeastern Florida Bay (NPS 2003). The study area is at elevations near sea level and, given its location in relation to the sloughs, is subject to the overland flow that defines the park's regional water system. Surface waters located within the Cape Sable study area include several manmade canals, natural tidal creeks and Lake Ingraham.

The majority of the land in the Cape Sable area is classified as wetland habitat, an integral component of the Everglades National Park landscape. Wetlands of the greater Everglades ecosystem include a mosaic of vegetation types, including tree-islands, mangrove forests, cypress swamps, marl prairies, sawgrass marshes, and sloughs (USGS 2007). Figure 2.1 shows the approximate limits and wetland classifications of each distinct wetland type within the Cape Sable study area, based on available National Wetland Inventory (NWI) Geographic Information System (GIS) data layers (USFWS 2007). The "E2" wetlands are estuarine intertidal wetlands. The "SS3" wetlands are broad-leaved evergreen scrub-shrub wetlands, consisting mainly of mangrove vegetation that has had stunted growth due to the effect of hurricanes. The "EM" wetlands consist of emergent coastal prairie and salt marsh vegetation such as saltwort and other salt-tolerant plants and marsh grasses, primarily *Spartina* species. The adjacent Florida Bay, where access to Cape Sable would originate under any alternative, is classified as an estuarine subtidal habitat with aquatic beds of unknown substrate characteristics.

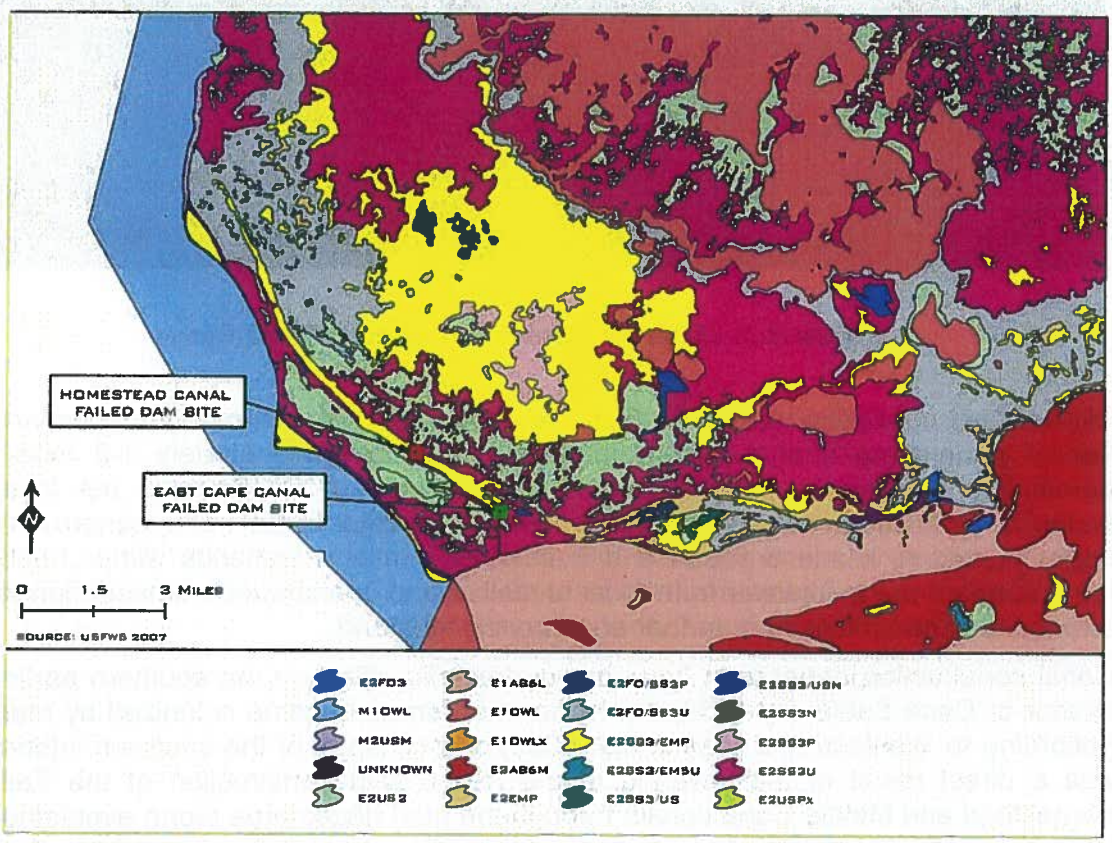

Figure 2.1 – NWI Classifications of Wetlands in Cape Sable Study Area

Prior to canal construction, the interior of Cape Sable consisted predominantly of freshwater marsh intermixed with brackish marsh. The marl ridge (shown in Figure 2.2, below) provided a continuous boundary between Florida Bay/Gulf of Mexico and the interior areas of Cape Sable from Flamingo west to Clubhouse Beach where the marl ridge turned northwestward and continued north of Lake Ingraham and emerged at the coast north of North Cape and Little Sable Creek.

Figure 2.2 – Approximate Location of Marl Ridge

Along the Gulf of Mexico, the Cape Sable coast consists of a mangrove wetland with a series of penetrating tidal creeks running inland for approximately 1-2 miles. These penetrating tidal creeks extend along the north side of Cape Sable but fade as the shoreline turns southeastward along the shore of Whitewater Bay. The mangrove coastline typically yielded to inland brackish and freshwater marsh wetlands within 1,000 feet at most. It appears the freshwater from local rainfall and overland flow limited mangrove and other marine communities from further encroaching inland.

Canal construction appears to have had a dramatic effect on the southern portion of the interior of Cape Sable. By 1953, the higher marl areas became colonized by mangroves. According to Wanless and Vlaswinkel (2005), the collapse of the southern interior marsh was a direct result of the lowering of the marsh with construction of the East Cape, Homestead and Middle Cape canals through the marl ridge; large storm events/hurricanes (e.g., the 1935 Labor Day Hurricane was described as sending a six-foot storm surge across Cape Sable eliminating forested wetlands adjacent to Lake Ingraham, Hurricane Donna was described as lifting up whole areas of mangrove forest and moving those, creating instant new islands, Hurricane Andrew described as crumpling and rolling up large areas of marsh); and saline intrusion through the constructed canals. Since 1953, the areas of open water have continued to gradually expand northward and the areas colonized by mangroves have progressed. In addition, the central and northern interior freshwater marsh communities of Cape Sable are interspersed with mangroves and other marine community vegetation. Peat soil is lost and fresh water marsh communities are

being replaced by open water saline communities. This process has been accelerated on Cape Sable by saltwater moving through the Homestead and East Cape Extension canals where the dams have failed. The open canals and at least one "natural" tributary, East Side Creek, transport sediment and organic material from interior marshes to Lake Ingraham where much of this material has been deposited. Sediment, and probably nutrients, from the collapsed marsh also make their way to Florida Bay and the Gulf of Mexico.

Detailed characterizations of wetland/surface water areas located within and adjacent to the Cape Sable study area are as follows:

Lake Ingraham – Embayment opening directly into Gulf of Mexico / Tidal Flats (FLUCFCS – 541 / 651)

USFWS – E2USM/N (Estuarine, Intertidal, Unconsolidated Shore, Irregularly Exposed / Regularly Flooded)

Lake Ingraham is a shallow, intertidal embayment approximately 5 miles in length by 0.5 mile in width with the long axis trending northwest/southeast. This shallow embayment (3-5 feet in water depth) is separated from the marine waters of the Gulf of Mexico and Florida Bay by a narrow carbonate sand beach ridge and barrier beach, and from the interior Cape Sable complex of mangrove wetlands and numerous shallow subtidal open water areas by an emergent calcium carbonate marl ridge. Several manmade canals and natural tidal creeks provide access to the lake and function as tidal inlets enhancing tidal flow into and out of the lake. The expansion of the East Cape and Homestead canals has exacerbated sediment deposition in the interior marshes and is converting Lake Ingraham into a tidal mud flat. Today, the flood tidal delta in Lake Ingraham forms a sediment body over 2.5 miles over the entire width of the lake and is 2-3 feet thick resembling an emergent system at low tide (Wanless and Vlaswinkel 2005). The sedimentation allows for the growth of abundant surface algal and cyanobacterial mats on the substrate as well as providing suitable habitat for the colonization of red mangrove (*Rhizophora mangle*) seedlings.

Homestead Canal Dam – Mangrove Swamp / Saltwater Marsh (FLUCFCS – 612 / 642 / 512)

USFWS – E2SS3P (Estuarine, Intertidal, Scrub-Shrub, Broad-Leaved Evergreen, Irregularly Flooded), E2EMP (Estuarine, Intertidal, Emergent, Irregularly Flooded) and E1UBLx (Estuarine, Subtidal, Unconsolidated Bottom, Subtidal, Excavated)

The Homestead canal was constructed in the 1920's and cuts across the marl ridge in a low area entering Lake Ingraham on its northeast shore. The permanently flooded canal was originally excavated for development purposes and as a borrow area for fill material needed for the construction of the old Ingraham Highway. The substrate of the excavated canal is comprised of an approximate 13-foot layer of marl underlain by approximately one foot or less of peat followed by limestone bedrock. No submerged vegetation exists within the waterway itself possibly due to strong tidal currents. The canal banks are comprised primarily of regularly flooded mangrove wetlands dominated by red mangrove (*Rhizophora mangle*), black mangrove (*Avicennia germinans*), and white mangrove (*Laguncularia racemosa*) with a sparse to dense groundcover dominated by saltwort (*Batis maritima*) and bushy seaside oxeye (*Borrichia frutescens*) adjacent to Lake Ingraham transitioning northward to a more elevated, irregularly flooded buttonwood (*Conocarpus erectus*) and

saltwort (*Batis maritima*) dominated wetland in the vicinity of the Homestead Canal failed dam. The buttonwood-saltwort community dominating the marl ridge consists of a mosaic of dense to open canopy buttonwood and open areas with a sparse to dense groundcover of saltwort.

A slightly elevated relict spoil bank persisting from the construction of the canal extends eastward along the south bank of the canal from Lake Ingraham. The plant community inhabiting the spoil bank is comprised of a mosaic of estuarine wetland species, halophytic species, and plants that require less hydric conditions that those found in the surrounding mangrove and buttonwood-saltwort communities. In addition to buttonwood, saltwort, and bushy seaside oxeye, common species inhabiting the spoil bank include gray nicker (*Caesalpinia bonduc*), Portia tree (*Thespesia populnea*), white stopper (*Eugenia axillaris*), white indigoberry (*Randia aculeata*), common wireweed (*Sida ulmifolia*), moonflowers (*Ipomoea alba*), pricklypear (*Opuntia humifusa*), and triangle cactus (*Acanthocereus tetragonus*).

East Cape Extension Canal Dam – Mangrove Swamp / Saltwater Marsh (FLUCFCS – 612 / 642 / 512)

USFWS – E2SS3P (Estuarine, Intertidal, Scrub-Shrub, Broad-Leaved Evergreen, Irregularly Flooded), E2EMP (Estuarine, Intertidal, Emergent, Irregularly Flooded) and E1UBLx (Estuarine, Subtidal, Unconsolidated Bottom, Subtidal, Excavated)

The East Cape canal was constructed in the 1920's as a narrow canal crossing the marl ridge in a low area extending south to Florida Bay. The permanently flooded canal was originally excavated to assist with draining the southern Everglades region for agricultural purposes. The substrate of the excavated canal is comprised of an approximate 14-foot layer of marl underlain by approximately one foot or less of peat followed by limestone bedrock. No submerged vegetation exists within the waterway itself possibly due to strong tidal currents. The canal banks are comprised primarily of regularly flooded mangrove wetlands dominated by red mangrove, black mangrove, and white mangrove. This community has a groundcover dominated by saltwort and bushy seaside oxeye varying in density from sparse to dense. As the gradient increases northward toward the East Cape Extension canal failed dam site, the mangrove wetland transitions to an irregularly flooded community dominated by buttonwood and saltwort with a lesser component of white mangrove and black mangrove. This community is an open shrub canopy intermixed dense stands of saltwort.

Southern Interior – Embayment not opening directly into Gulf of Mexico / Mangrove Swamp (FLUCFCS – 542 / 612)

USFWS – E2SS3U (Estuarine, Intertidal, Scrub-Shrub, Broad-Leaved Evergreen, Unknown Tidal) and E2USM (Estuarine, Intertidal, Unconsolidated Shore, Irregularly Exposed)

The habitats on the mainland side of the marl ridge are comprised primarily of a mosaic of mangrove wetland and numerous shallow bottom subtidal areas of open water. The southern interior of Cape Sable was a continuous marsh with isolated round lakes prior to the construction of the Homestead and East Cape Extension canals which increased saltwater intrusion to the interior (Wanless, 2005). These formerly freshwater southern interior marshes are separated from the intertidal habitats of Lake Ingraham by the marl

ridge. In addition to periodic overtopping of the marl ridge, the interior marsh area receives saltwater input via the failed sheet piling dam in the Homestead and East Cape Extension Canals. Further north, the central and northern interior areas contain a mosaic of freshwater, brackish, marine, and hyper-saline flora although most of the interior is dominated by red mangrove interspersed with open water (Wanless, 2005). In addition to mangroves, common flora in the central and northern interior areas includes cordgrass (*Spartina* spp.) and sawgrass (*Cladium jamaicense*).

Florida Bay – Embayment opening directly into Gulf of Mexico (FLUCFCS – 541)

USFWS – E1UBL (Estuarine, Subtidal, Unconsolidated Bottom, Subtidal) and E1ABL (Estuarine, Subtidal, Aquatic Bed, Subtidal)

Florida Bay is located at the southernmost tip of the Florida Peninsula between the mainland and the Florida Keys, most of which lies within the boundaries of Everglades National Park. The bay is characterized by many shallow interconnected basins, with an average depth of only three feet. It is an area where freshwater from the everglades mixes with the salty waters from the Gulf of Mexico to form an estuary with interconnected basins, grassy mud banks, seagrass flats, and mangrove islands that serve as nesting, nursery, and/or feeding grounds for a host of marine animals.

3.0 PURPOSE OF AND NEED FOR ACTION AND PROJECT OBJECTIVES

As mentioned in Section 1.0, above, the NPS has long recognized the importance of addressing impacts from the Cape Sable canals. Stopping tidal flow into the cape's interior marshes is the key to revitalizing the function of these freshwater marshes. While this landscape is naturally dynamic, slowing the rate of change on this landscape may also bring about greater resilience to the cape in the face of predicted sea level rise and the possibility of more frequent and intense hurricanes. Thus, the NPS has developed preliminary engineering design concepts for the restoration of the failed dams on the East Cape Extension and Homestead canals.

3.1 Purpose of the Project

"Purpose" is an overarching statement of what the project must do to be considered a success. The purpose of this project is to restore the failed dams on the Homestead and East Cape canals in the Cape Sable area of Everglades National Park. This project is intended to provide sustainable solutions to issues associated with saltwater intrusion into and degradation of freshwater and brackish marshes north of the marl ridge; illegal motorized boat access into the Marjory Stoneman Douglas Wilderness area; and unsafe conditions for motorized and non-motorized boaters at the dam sites.

3.2 Need for Action

"Need for Action" describes why action is required. It summarizes the most important points of the planning issues and provides the reasons the project is needed at this time. Restoration of the failed dams is needed to …

- Control the canal-induced intrusion of saltwater into freshwater and brackish marshes north of the Cape Sable marl ridge

- Restore the existing dams, installed in the late 1950s and replaced in the 1980s and 1990s, which have failed, so they can function effectively
- Protect the freshwater and brackish interior marshes and surrounding areas, which serve as habitat for fish and wildlife
- Reduce illegal motorized boat entry into the Marjory Stoneman Douglas Wilderness Area
- Restore safe conditions at the dam sites, which are a safety hazard to motorized and non-motorized boaters

3.3 Project Objectives

Objectives are "what must be achieved to a large degree for the action to be considered a success" (*Director's Order 12*). All alternatives selected for detailed analysis must meet project objectives to a large degree and resolve the purpose and need for action. Objectives must be grounded in the park's enabling legislation, purpose, significance, and mission goals and be compatible with direction and guidance provided by the park's general management plan, strategic plan, and/or other management guidance. The following are the objectives related to the restoration of the failed dams in the Cape Sable area. The objectives are grouped by subject and are based on the needs previously presented.

3.3.1 Natural Resources

- Restrict the flow of saltwater into freshwater and brackish marshes north of the Cape Sable marl ridge through these canals, thereby restoring the natural hydrology of the area
- Reduce freshwater loss from freshwater and brackish interior marshes through the East Cape and Homestead canals
- Improve habitat for juvenile crocodiles, wading birds, forage fish and other wildlife within the freshwater and brackish marshes north of the marl ridge
- Slow the rate of marsh collapse and loss of sediment and nutrients from the interior freshwater and brackish marshes
- Reduce/eliminate adverse impacts to marine resources

3.3.2 Cultural Resources

- Avoid adverse impacts to the Homestead and East Cape canals, which are historic structures, through project design or mitigation measures

3.3.3 Replacement Structure Longevity

- Replacement dams or geotubes should be designed to prevent vandals from breaching a dam by trenching around or through it, or damaging the geotubes
- Replacement structures should be designed to last at least 50 years (barring severe damage by catastrophic hurricane events) with annual/bi-annual maintenance

3.3.4 Visitor Use and Experience

- Provide safe passage over restored dams for canoeists/kayakers
- Resolve safety issues associated with the existing failed sheetpile structures
- Improve the wilderness visitor experience by eliminating/reducing illegal motorized boat entry into the Marjory Stoneman Douglas Wilderness Area

4.0 ALTERNATIVES CONSIDERED

Based on the preliminary analysis, internal scoping with the NPS, and the public input related to the proposed project, the following alternatives were carried forward for analysis in the EA. Alternative drawings have been provided for review at the end of this document.

4.1 East Cape Extension Canal and Homestead Canal Alternatives

Prior to finalizing the location of each of the proposed alternatives, a Digital Terrain Model (DTM) based on aerial photography was recently created in March of 2009 for each of the failed dam sites. The purpose of the DTM was to determine the topographic features for each of the proposed restoration alternatives. The DTM was developed by contouring lands above the lowest possible tidal water line for the East Cape Extension and Homestead canal dam sites to determine the most suitable location along each canal that coincides with the highest elevation points of the adjacent low relief marl ridges. Each site was over-flown obtaining new high-resolution black and white aerial photography for photogrammetric compilation by stereo plotting methods. A survey crew using Real-Time Kinematic (RTK) – Geographic Positioning System (GPS) survey equipment surveyed (on the ground) the 3-dimensional locations of specific photo-identifiable (PID's) topographic features present in the aerial photography to 3-dimensional scale and rectified the photography.

Modeling technologies were used to develop the 3-dimensional spot elevations from the water line and above on any lands present within the prescribed area for both canal dam sites. The spot elevations peppered about the prescribed site were processed to create an AutoCAD 3-D triangular irregular network (TIN), a 3-D mesh of triangular lines connecting the 3-dimensional spot elevation points. From the TIN, contours were generated which graphically display relative elevation differences land formations above the water line. Please refer to Figures 4.1 and 4.2 below for details. Due to the remoteness of the sites, these elevation differences have not yet been correlated to NAVD 88 elevation datum. NAVD 88 datum and vertical control for the site will be completed in the near future in support of future design related activities.

The results of the DTM are represented in Figures 4.1 and 4.2 below. Figure 4.1 shows the approximate location of the preferred alternative for the East Cape Extension canal with respect to these DTM (highest) elevations. Comparative elevations in the vicinity of the existing and proposed dams are comparatively small and tend more to be sloping gently away from the canal. Such elevation changes are more indicative of the placement and spreading of excavated material away from the canal excavation during the original canal construction. There appears to be minimal topographic relief which can be associated with a low lying Marl ridge paralleling the Lake Ingram shoreline in the vicinity of the existing dam.

Figure 4.2 shows the approximate location of the preferred alternative for the Homestead canal with respect to these (highest) elevations. The results of the DTM survey also identified a low lying area along the Homestead Canal just south of the existing failed sheetpile structure. This low lying area is approximately 40 feet by 150 feet and would require approximately one foot of fill to mitigate the potential for short-circuiting the proposed restoration alternatives. Additional filling of the canal bank area should be performed in this area to re-establish the elevated fill berm along the edge of the canal. Such filling is recommended so that flow around and south of the proposed plug area maintains a slow overland sheetflow course and does not short circuit such overland flow by discharge into the canal. These filling activities are addressed in each of the proposed alternatives presented below, except for Alternative C, since this low lying area is located in the immediate vicinity of the failed dam and the area will be filled as part of Alternative C.

The DTM survey is available for review from the National Park Service upon request.

4.1.1 Alternative A: No Action - Continue Current Management[1]

The No-Action alternative involves leaving the existing sheetpile in the East Cape Extension and Homestead canals where it is today and allowing the channel to continue to widen through natural erosional processes. This alternative would fail to accomplish the goals of the NPS and the U.S. Fish and Wildlife Service (USFWS), which are to meet the project objectives of improving fish and wildlife habitat, correct safety hazards associated with the failed structures, and preventing motorized vessel entry into Cape Sable wilderness. In addition, no action will also require NPS personnel to continue their routine inspection and maintenance program of the failed dam structures in perpetuity to prevent access to unsafe and dangerous areas. Since the failed dam structures create strong white water currents during tide changes, NPS has been using floating buoys and cables to prevent unauthorized access. Unfortunately, due to the remote location of these failed structures and the desire for people to access the interior marshes for fishing, vandalism has become an on-going maintenance issue for NPS personnel to prevent unauthorized access.

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1 Current Management includes, but is not limited to, public education about wilderness restrictions and safety hazards; maintenance of cables, floats and signs warning boaters of hazards; enforcement of regulations prohibiting motorized boats from entering wilderness area above the dams; monitoring of resource conditions and safety hazards.

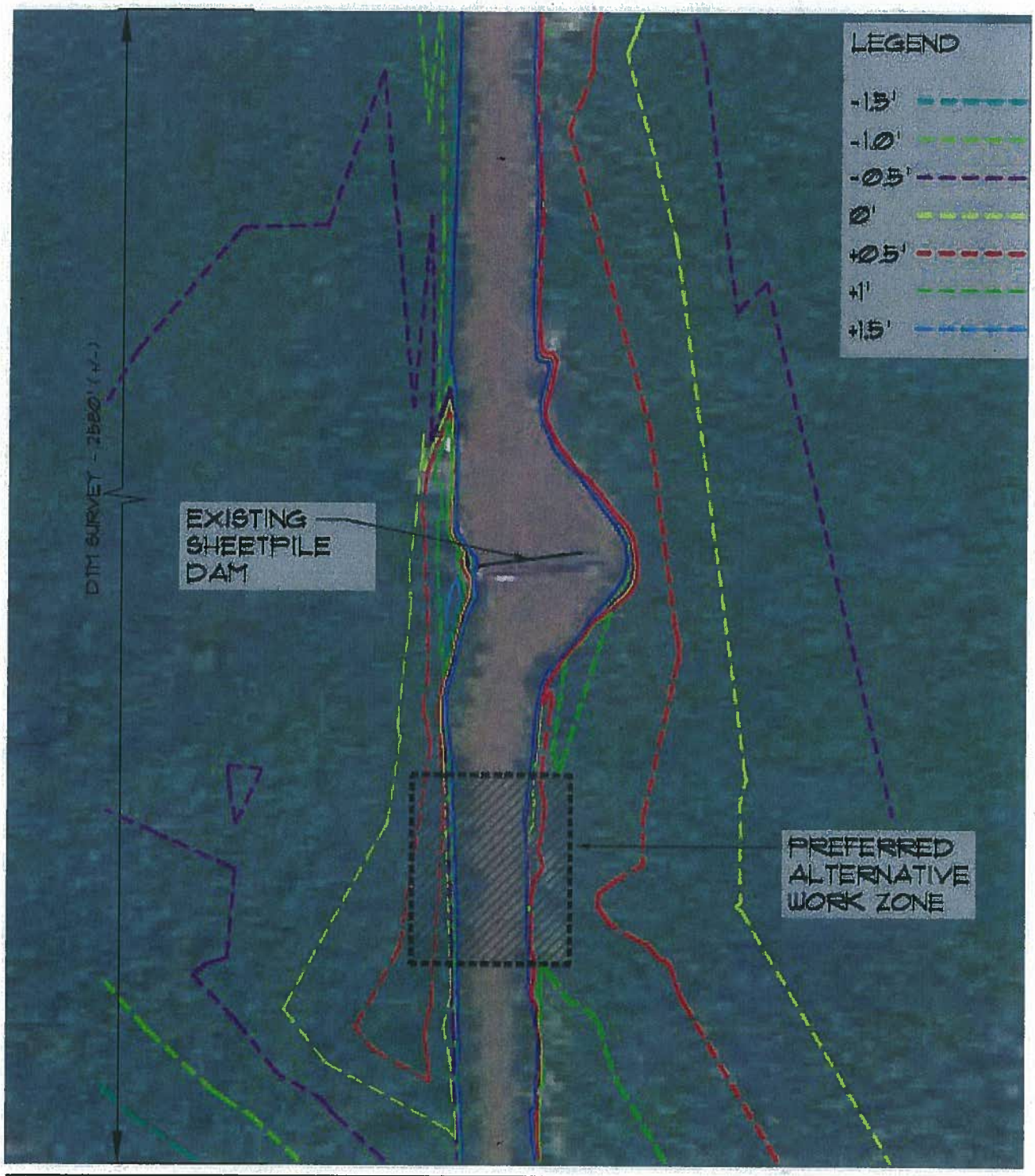

FIG. 4.1 - LOCATION OF PREFERRED ALTERNATIVE
EAST CAPE EXTENSION CANAL

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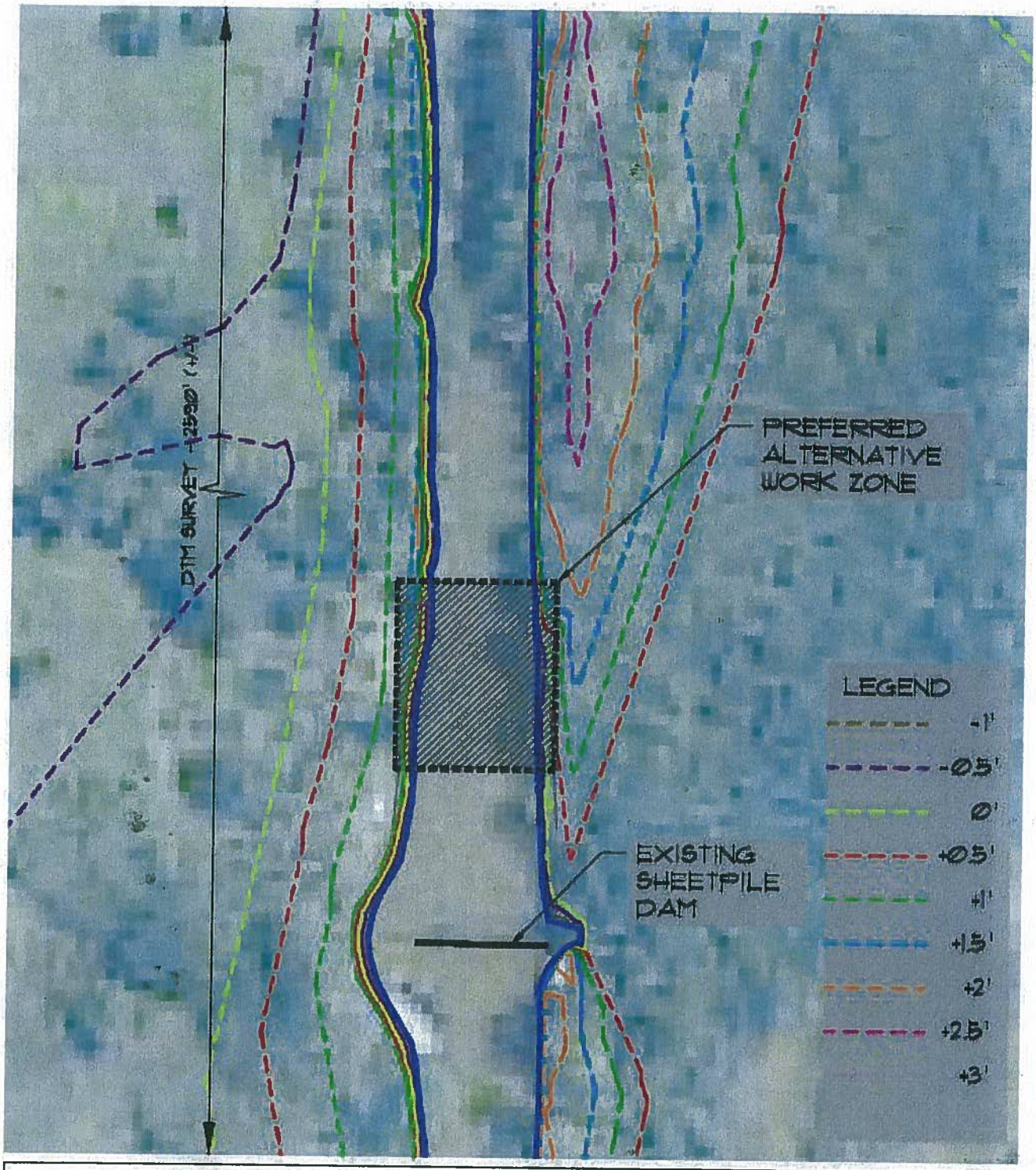

FIG. 4.2 - LOCATION OF PREFERRED ALTERNATIVE HOMESTEAD CANAL

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4.1.2 Elements Common to all Action Alternatives

Several of the elements proposed as a part of this project would be common to all the alternatives considered, excluding the no action alternative. This is due to the purpose of and needs for the project, as well as the desire to incorporate sustainable design concepts in any new construction. These elements are described below.

• Signage

To ensure safety, warning signs would be posted at each of the proposed dam structures. Signs would constructed of reflective material and posted a minimum of 5-ft above mean high water.

• Floating Mooring Buoys

Floating mooring buoys and/or free-standing piles would also be installed downstream (towards Lake Ingraham) of the dam structures for motorized vessel anchoring. Mooring buoy anchors and/or piles would be minimize potential substrate disturbance.

• Florida Keys Staging Area

All the necessary equipment and fill (earthen fill and riprap) would be mobilized to a suitable water transportation staging area in the Florida Keys (e.g., Sugarloaf Key or Marathon) by conventional dump trucks due to a lack of a suitable staging area in Everglades National Park and to further meet the criteria for avoidance and minimization of impacts to wetland resources. The exact location of the staging area in the Florida Keys would be determined by the awarded contractor; however, the area would be located entirely in previously disturbed uplands (i.e., parking lot, paved area, previously filled area, etc.). Construction materials would be transported to the East Cape canal via barges and tugs to the respective construction staging/work areas. The barges are anticipated to access the East Cape canal through existing navigational channels and/or deep water areas of the Gulf of Mexico and Florida Bay originating from the designated staging area in the Florida Keys. A potential barge route is depicted in Figure 4.3. The barge route was determined using available Geographic Information System (GIS) data layers obtained from the National Oceanic and Atmospheric Administration (NOAA) Coastal Services Center documenting bathymetric contours for the state of Florida and surrounding areas (NOAA CSC, 2000). The exact route would be determined by the awarded contractor; however, the route would be restricted to existing navigational channels and/or deep water areas of the Gulf of Mexico and western Florida Bay to avoid potential adverse impacts to the submerged resources.

• Woody Vegetation Clearing and Trimming

Clearing of woody vegetation would be performed where necessary, along the banks of the canal for equipment access and construction within the limits of a designated safe work zone. Trimming of overhanging mangrove trees may also need to occur within the western portion of the Homestead canal and the southern portion of the East Cape Extension canal for barge access to the designated work zone (dam site). Trimming would be conducted per the requirements of the Florida Department of Environmental Protection's (FDEP) Mangrove Trimming Permit (to be acquired prior to commencement of construction).

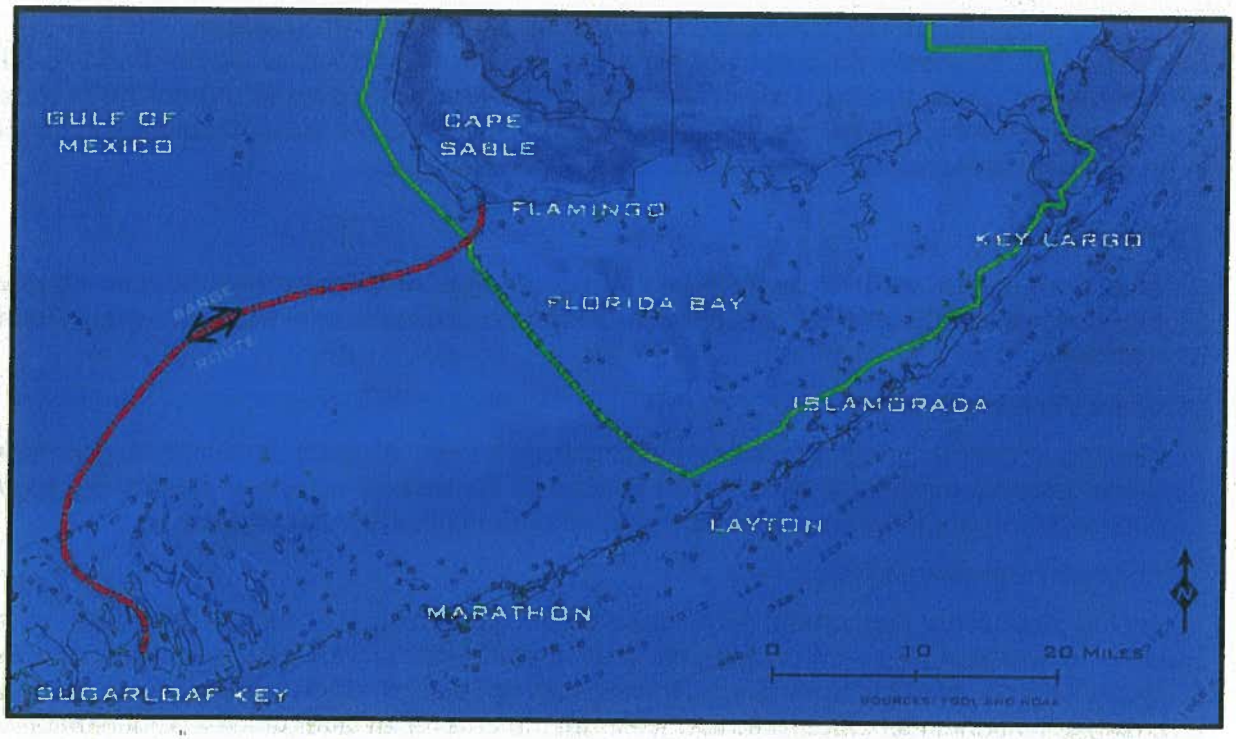

Figure 4.3 – Potential Barge Route

• Restoration of Disturbed Areas

Areas located within the designated work area that are disturbed but not permanently filled as part of the construction would be restored. The exact type of restoration would depend on the size and location of the area, but would generally include removal of any construction materials and incidental fill material, followed by regrading to the historic contours. Any non-native vegetation observed within or directly adjacent to the work area would be removed concurrent with the regrading activities. Regrading would facilitate natural recruitment of native hydrophytic vegetation. To expedite the stabilization of the area, native vegetation will be planted in the area. A monitoring program would be initiated by the NPS in order to monitor the re-growth of native vegetation in the work zone areas for a period of up to five years.

• Waste Management

Waste is primarily expected to be generated from servicing and maintenance of equipment. This waste is expected to be maintained on the barge. Portable toilets would be arranged and placed at the dam site. The waste from the portable toilets would be pumped out, removed from park and disposed at an appropriate disposal facility.

• Turbidity Control

Construction procedures would include the use of turbidity curtains to contain disturbed sediments and reduce water quality impacts. A turbidity monitoring plan would be

implemented during construction to ensure continued compliance with State water quality criteria.

• Monitoring

Anticipated monitoring during construction would include water quality/turbidity monitoring and monitoring for protected wildlife species. Standard USFWS and FFWCC guidelines for the protection of protected species that have the potential to occur within the project area (including but not limited to manatees, turtles, crocodiles, and smalltooth sawfish) would be implemented during construction activities to prevent injury. Anticipated long term monitoring/maintenance would include periodical riprap monitoring/maintenance. The structural aspects of the dam would also be monitored on a quarterly basis and after each major storm event. The construction phase of the project would be conducted outside of crocodile nesting season to avoid adverse impacts to this protected species.

• Canoe/Kayak Portage

Repair of the existing breached dam would prevent illegal motorized boat entry into the wilderness area. However, the potential exists for vandals to attempt to alter the banks of the canal beyond the outer edges of the dam, enabling access for illegal motorized boats. Installation of the deflector wingwalls and/or riprap would mitigate this type of activity. Also, the repair of the existing dam would include an engineering component to provide safe passage over the restored dam for non-motorized boaters (canoeists/kayakers). To provide safe portage, a floating dock structure (less than 250 square feet) would be constructed near the center of each dam entrance. A canoe/ kayak ramp would be placed on the riprap slope adjacent to the floating dock footprint, to allow for canoes to be safely pulled out of, and placed into the water. A ramp would be placed at each end of each dam. For Alternatives D/D1 and G/G1, a hardened path would be installed across the proposed plug/dam using articulated block riprap (interlocking mats) to provide safe and sustainable passage across the plug/dam (see Alternative Drawings at the end of this SOF for portage details).

• Bank Stabilization

Banks would be stabilized within the limits of the work area to prevent internal piping and erosion of the marl into and through the riprap. This is accomplished by first placing a layer of fine sand fill over the existing sub-grade to establish a 2.5:1 side slope, which would act as both a graded filter and drainage exit for water seeping around the ends of the sheetpile and would prevent internal piping movement of the lime silts. The fine sands would be covered by a layer of non-woven geotextile fabric to prevent movement of the fine sands into the riprap. The fabric would be covered by a riprap system consisting of a coarse bedding sand/small gravel layer overlain by a coarse riprap surface cover.

4.1.3 Action Alternative C – Repair in Place

Repairing the existing steel sheetpile walls includes extending them further inland. This alternative strengthens the existing dams by adding additional sheetpile landward on both sides of the dams. The landward sheetpile would be installed to form a flow deflector wingwall to prevent seepage and tunneling through the marl. The deflector wingwalls would also help to prevent illegal motorized boat entry into the wilderness area minimizing opportunities for vandals to alter the banks beyond the edge of the sheetpile walls.

Subsequent to sheetpile installation, fill material would be placed adjacent to the sheetpile walls (2.5:1 slope from the sheetpile to the ground) to substantially increase the lateral support for the dams. Additionally, graded riprap would be placed on top of the fill material and along the deflector wingwalls to provide erosion resistance. The repair of the existing dams would also include an engineering component to provide safe passage over the restored dam for non-motorized boaters (canoeists/kayakers).

In addition to the above, Action Alternative C for the Homestead canal dam site would require dredging a 52-foot wide by approximately 8,320 feet long temporary access channel within Lake Ingraham from the western terminus of the Ingraham canal to the Homestead canal due to the shallow water depths of Lake Ingraham. Per NPS staff, the current water elevations at high tide in Lake Ingraham are up to two feet above existing substrate with portions becoming exposed at low tide due to accelerated sediment deposition. According to Wanless and Vlaswinkel (2005), portions of the lake have transitioned from an open water system to a mud flat system in recent years. The channel would be dredged to a depth of approximately six feet below the mean low water elevation. To minimize impacts caused by dredging, a mechanical (bucket) dredge would be used. While both hydraulic and mechanical dredging methods can successfully remove the accumulated sediments within the channel, mechanically dredged sediment can be placed along the sides of the channel (less impact), versus hydraulic dredging which would require an off-site dewatering area and possible treatment equipment to allow dredge water effluent to be returned back to Lake Ingraham. For mechanical dredging operations within Lake Ingraham, accumulated sediments in the channel could be removed with a conventional barge-mounted long-reach excavator (40 to 60-ft reach). The width of the base of the dredged channel would not exceed 40 feet with anticipated 3:1 side slopes for a total top cross-sectional channel width of approximately 52 feet. The dredged material (approximately 40,000 cubic yards) would be temporarily stockpiled in areas adjacent to the dredged channel or other suitable area. Some of the dredged material would disperse through natural wave energy and erosional processes. However, construction procedures would include the use of turbidity curtains to contain disturbed sediments and reduce water quality impacts. A turbidity monitoring plan would be implemented during construction to ensure continued compliance with State water quality criteria. Upon completion of construction, the remaining material would be pulled back into the channel via a barge and heavy equipment (e.g., clam shell, backhoe, etc.). Over time, the dredged channel would be returned to pre-construction condition via natural processes.

4.1.4 Action Alternatives D (New 100' Plug - Marl Ridge Location) and G (New 370'/430' Plug – Marl Ridge Location)

This alternative includes the extraction and relocation of the existing free-standing sheetpile walls (previous dam structures) to narrower more suitable locations that are in better alignment with the marl ridge. It is anticipated that 80% of the extracted steel sheetpile could be reused. Additionally, earthen plugs would be constructed by installing a second sheetpile wall upstream or downstream of the first wall within the canals. For Alternative D, the two sheetpile walls would be placed a distance of approximately 100 feet apart, and for Alternative G, the two sheetpile walls would be placed a distance of approximately 370 feet (for the East Cape Extension canal dam site) or 430 feet (for the Homestead canal dam site) apart. The area between the two walls would be filled and planted with wetland vegetation to reduce the potential for erosion. The fill material would

originate from an off-site location. Landward sheetpile would be installed in all four quadrants of the plugs to form flow deflector wingwalls to promote surface sheetflow away from the dam structures and thus prevent seepage and tunneling through the marl. Additionally, fill material would be placed adjacent to each sheetpile wall (2.5:1 slope from the sheetpile to the ground on the waterward side) to substantially increase the lateral support for the dams. Graded riprap would be placed on top of the fill material along the outside face of the sheetpile walls and along the deflector wingwalls and canal banks to provide erosion resistance. These alternatives would also include an engineering component to provide safe passage over the restored dams for non-motorized boaters (canoeists/kayakers).

NPS developed a digital terrain model (DTM) by contouring lands above the lowest possible tidal water line for the East Cape Extension and Homestead Canal Dam sites in order to determine the most appropriate location along each canal that coincides with the highest elevation points of the marl ridge. Each site was over-flown obtaining new high-resolution black & white aerial photography for photogrammetric compilation by stereo plotting methods. Subsequently, a Real-Time Kinematic (RTK) Geographic Positioning System (GPS) survey field crew surveyed (on the ground) the 3-dimensional locations of specific photo-identifiable (PID's) topographic features present in the aerial photography to 3-dimensional scale and rectified the photography. The field work was conducted in March, 2009. Modeling technologies were used to develop the 3-dimensional spot elevations from the water line and above on any lands present within the prescribed area for both the East Cape Extension and Homestead canal dam sites. The spot elevations peppered about the prescribed site were processed to create an AutoCAD 3-D triangular irregular network (TIN), a 3-D mesh of triangular lines connecting the 3-dimensional spot elevation points. From the TIN, contours were generated which graphically display land formations above the water line.

To restore the low lying area identified in the DTM survey, additional fill will be added along the southern bank just east of the failed dam structure to raise the elevation along the bank approximately one foot. It is estimated that approximately 500 cubic yards of fill will be required. Since an access channel will be provided, a shallow draft barge will be used to transport the fill material to the site. Once positioned at the site, a long reach excavator will be used to transport the fill from the barge to the low lying area. A small front end loader will than be used to grade the fill placed in the low lying area to match the existing adjacent topographic elevation. Since the resulting elevation would match existing adjacent grades, regrowth of wetland vegetation is expected within two years and the area is expected to return to full functionality within five years. As a precaution, a monitoring program would be initiated by the NPS in order to monitor the re-growth of native vegetation in this area for a period of up to five years. If after two years, sufficient coverage of desirable species is not observed, supplemental plantings may be conducted to facilitate the process.

In addition to the above, Action Alternative D or G for the Homestead canal dam site would require dredging a 52-foot wide by approximately 8,320 feet long temporary access channel as described in Alternative C.

4.1.5 Homestead Canal Modified Alternatives

Impact minimization efforts have been considered during this study to reduce impacts to the adjacent wetland/surface water systems to the maximum extent possible while maintaining safe and sound engineering and construction practices. Therefore, modified alternatives of the above described Action Alternative D (New 100' Plug – Marl Ridge Location) and Action Alternative G (New 430' Plug – Marl Ridge Location) were developed and carried forward in the EA for further analysis for the Homestead canal only. These modified alternatives provide a construction option for the Homestead canal dam site (only) that allows for further avoidance and minimization of impacts to natural resources through eliminating the need to dredge the 52-foot wide by approximately 8,320 feet long navigational channel through Lake Ingraham as described above for Alternatives D and G for dam site access.

4.1.5.1 Action Alternatives D1 (New 100' Plug - Geotubes) and G1 (New 430' Plug - Geotubes)

Dredging of an access channel in Lake Ingraham would not be required with these modified alternatives of Alternatives D and G. Geotubes would supplant the proposed sheetpile walls associated with Alternatives D and G. Geotubes are large tubular sand bags that are filled in place by pumping sand or slurry through a pipe from a barge. They are typically used to build structures such as breakwaters, shoreline protection or island creation. For these modified alternatives, fill material would be transported to the Homestead canal work area through a constructed floating pipeline. The 6 to 8 inch pipeline would be constructed using a shallow draft barge and would run from the work area to a larger barge located at a designated staging area at the western terminus of the Ingraham canal (eastern mouth of Lake Ingraham) for a distance of approximately 1.5 to 2 miles. The constructed floating pipeline would be anchored to the northern edge of the existing channel in Lake Ingraham and the eastern edge of the approach channel to the Homestead canal. The water depths within the Ingraham canal are sufficient and would not require dredging. Fill material would be transported to the staging area at the Ingraham canal and conveyed through the pipe via hydraulic pumping to the work area in order to avoid potential adverse impacts to the lake from dredging activities. In addition, the existing sheetpile dam would be cut off at a suitable level using a torch in place of extracting the sheetpile with heavy equipment as with Alternatives D and G. The sheetpile would be removed for safety. Please reference Figure 4.4 for an aerial-view schematic of the proposed pump/pipeline system.

To restore the low lying area identified in the DTM survey, additional fill will be added along the southern bank just east of the failed dam structure to raise the elevation along the bank approximately one foot. It is estimated that approximately 500 cubic yards of fill will be required. Since an access channel will not be available to allow for a shallow draft barge to enter the work area, a helicopter will be used to transport fill material to the site and place the fill material in the low lying area. Due to the difficulty in transporting heavy equipment to the work site, manual labor will be used to grade the fill to match the existing topographic elevation. Since the resulting elevation would match existing adjacent grades, regrowth of wetland vegetation is expected within two years and the area is expected to return to full functionality within five years. As a precaution, a monitoring program would be

initiated by the NPS in order to monitor the re-growth of native vegetation in this area for a period of up to five years.

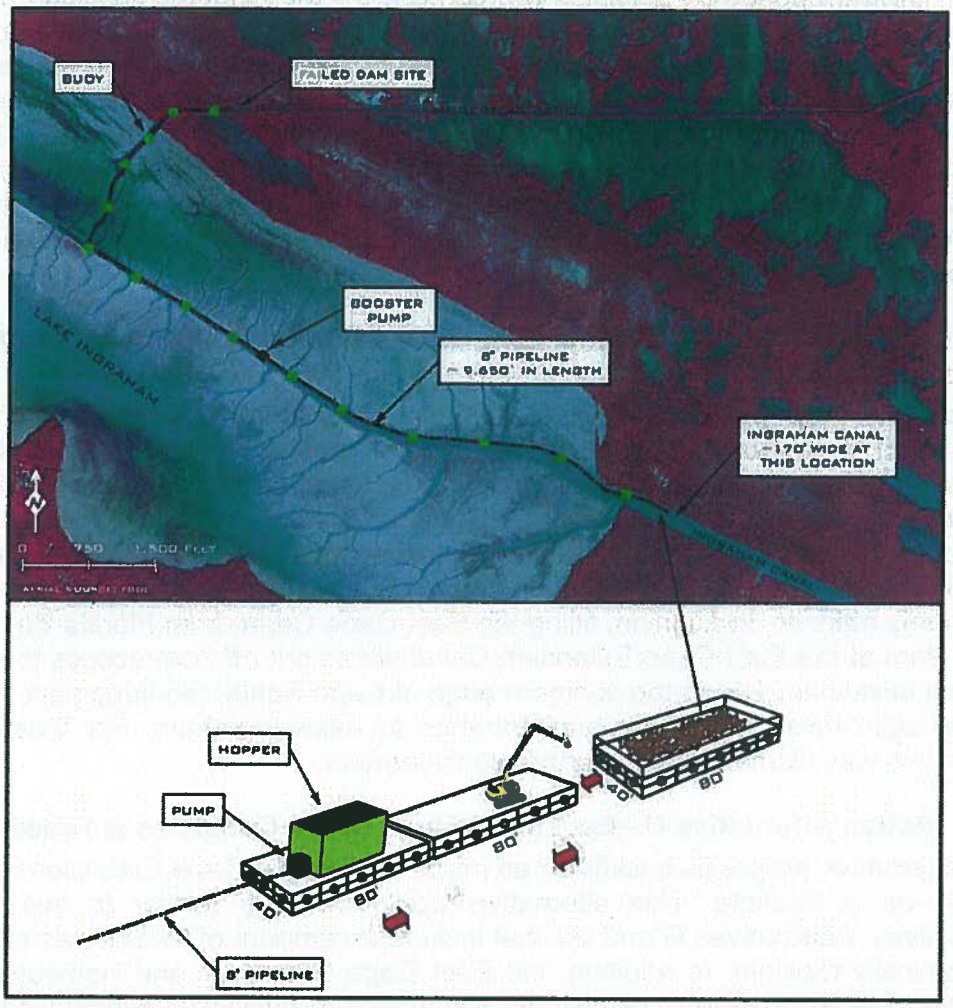

Figure 4.4 – Aerial View Schematic of Proposed Pump/Pipeline System

4.2.1 Action Alternative B - Relocate the Existing Failed Sheetpile Dams to Narrower Location

This alternative would relocate the existing failed sheetpile dams to a narrower location upstream in the canals. The relocated dams would be strengthened by adding sheetpile wingwalls landward on both sides of the dams. The wingwalls would deflect surface flows away from the dams, help prevent illegal motorized boat entry into designated wilderness and reduce opportunities for vandals to alter the banks beyond the edge of the sheetpile walls. This alternative was considered but dismissed because it is similar to retained alternative C, it would require extracting and moving the existing sheetpile to currently undisturbed areas, and because a more sustainable solution, such as a plug configuration, would be preferable.

4.2.2 Action Alternative E - Plug from Mouths of Canals Downstream to the Existing Dams

This alternative proposes plugging the two canals from their mouths upstream to the site of the existing dams to reduce tidal inflow up to the repaired dams. A sheetpile or geotube dam would be installed at the mouths of the canals which would be filled up to the existing dams or a reasonable distance beyond the highest elevation point of the marl ridge (based on the digital terrain model described in Section 4.1.4 of this document). This alternative was considered but dismissed because it is similar to retained Alternatives G and G1 and would not be optimally cited along the high topographical point at the marl ridge. Furthermore, it was deemed economically infeasible due to the increased costs of filling longer reaches of the canals.

4.2.3 Action Alternative F - Backfill East Cape Canal from Florida Bay to the Existing Dam

This alternative proposes backfilling the East Cape Canal from Florida Bay to the existing failed dam or a reasonable distance across the marl ridge at the East Cape Canal Extension. It would also consist of plugging the Homestead Canal across the width of the marl ridge. This stretch of the East Cape Canal is approximately one mile long, 250 feet wide and ten feet deep. Due to the extensive size and volume of fill required for East Cape Canal, this alternative was deemed economically infeasible and could not be implemented in a timely manner. In addition, filling the East Cape Canal from Florida Bay to the existing failed dam at the East Cape Extension Canal would cut off boat access to Lake Ingraham and the backcountry from the southern edge of Cape Sable, requiring park visitors to travel almost eight miles to the western entrance to Lake Ingraham. For these reasons, this alternative was dismissed from further consideration.

4.2.4 Action Alternative H - Backfill as Much of the Canals as is Feasible

This alternative proposes backfilling as much of the East Cape Extension and Homestead Canals as is feasible. This alternative would be very similar to two other retained alternatives, Alternatives G and G1 that include an amount of fill that was considered to be economically feasible. In addition, the East Cape Extension and Homestead Canals are both National Register-eligible historic resources and backfilling substantial portions of the canal could substantially affect the historic character of the resources. Filling the East Cape Extension and Homestead Canals would also cut off non-motorized boat access into the designated wilderness from Lake Ingraham and the East Cape Canal. This change would likely be controversial and potentially result in a moderate to major adverse effect on visitor use and experience. For these reasons, this alternative was dismissed from further consideration.

4.2.5 Action Alternative I - Plug Canals in Several Places with Geotubes or Fill

This alternative would plug the East Cape Extension and Homestead Canals in several places rather than the current configuration of only one dam at each canal. One of the objectives of the dam restoration project is 50-year sustainability of the replacement structure. This alternative would be less likely to fail than Alternatives B or C but probably would not be substantially more reliable that Alternatives D or G. Therefore, the alternative of multiple plugs in each canal was determined to be unnecessarily redundant since other alternatives put forward with only one dam location are being designed to meet the 50-year

sustainability objective. Therefore, this alternative was dismissed from further consideration.

4.2.6 Action Alternative J - Completely Fill in the Canals

This alternative proposes backfilling the entire length of the East Cape Extension and Homestead Canals. The extensive size and volume of fill required for this alternative makes it economically infeasible and it could not be implemented in a timely manner. In addition, the East Cape Extension and Homestead Canals are both National Register-eligible historic resources and backfilling substantial portions of the canal could substantially affect the historic character of the resources. Filling the East Cape Extension and Homestead Canals would also cut off non-motorized boat access into the designated wilderness from Lake Ingraham and the East Cape Canal. This change would likely be controversial and potentially result in a moderate to major adverse effect on visitor use and experience. For these reasons, this alternative was dismissed from further consideration.

4.2.7 Action Alternative K - Repairing Middle Cape Canal at Gulf of Mexico and East Cape Canal at Florida Bay

This alternative proposes repairing the Middle Cape Canal at the Gulf of Mexico and the East Cape Canal at Florida Bay. Blocking these larger canals at the coast may substantially limit spring tide incursions into the interior marshes; however, due to the extensive size and volume of fill required for this alternative, it was found to economically infeasible and could not be implemented in a timely manner. In addition, filling of the Middle Cape Canal and East Cape Canal would entirely sever boat access to Lake Ingraham and the backcountry, prohibiting park visitors from traveling into these areas. This change would likely be controversial and potentially result in a moderate to major adverse effect on visitor use and experience. For these reasons, this alternative was dismissed from further consideration.

5.0 WETLANDS AND WETLAND FUNCTIONS

Most of Everglades National Park is prone to frequent and continual flooding due to low elevation, lack of extensive physical relief, and saline and freshwater hydrologic inputs (rainfall, overland sheet flow, tidal fluxes, and direct surface water discharges). The Cape Sable area is multifaceted, encompassing marine, estuarine and freshwater systems. Saltwater from Florida Bay and the Gulf of Mexico enters the Cape Sable region through a series of canals constructed in the early 20th century for agriculture and development purposes, as well as through natural watercourses such as Hidden and East Side creeks. Saltwater also enters the interior of Cape Sable through Whitewater Bay via Ponce De Leon Bay to the north. In addition, during moderate to high tides, the marl ridge is overtopped and substantial amounts of saltwater from the Gulf of Mexico enter the Cape Sable area.

For the East Cape Extension and Homestead canal dams, the areas to be affected by the physical footprint of the action alternatives (including the preferred alternatives) are a mixture of regularly flooded mangrove wetlands and irregularly flooded shrub-scrub buttonwood/saltwort/mangrove wetlands as well as the open water area of the canals. Figures 5.1 and 5.2 show the footprint of the preferred alternative overlain on a wetland map for the East Cape Extension canal dam site and the Homestead canal dam site,

respectively. The wetlands are part of and contiguous with the estuarine wetland system of the greater Cape Sable area in the vicinity of the existing marl ridge. The primary functions of these wetlands include surface and subsurface water storage, support of the biogeochemical processes (nutrient cycling, peat accretion, etc.), support of characteristic plant community, and providing suitable habitat for native fish and wildlife. These functions appear to be retained, although degraded, following the excavation of the canals in the early 20th century.

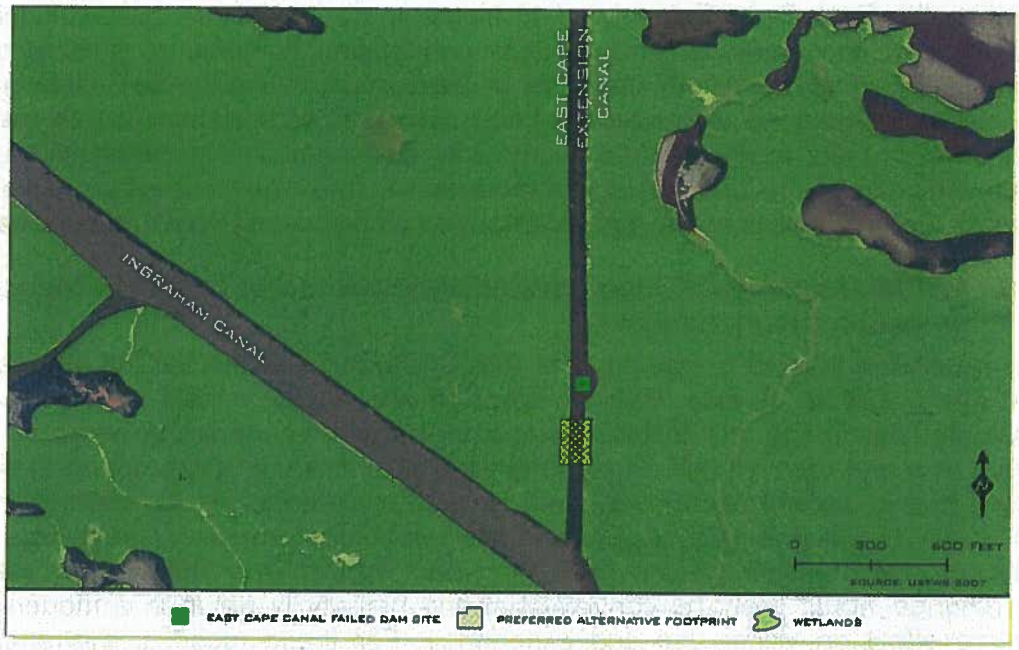

Figure 5.1 – East Cape Canal Preferred Alternative Footprint

Figure 5.2 – Homestead Canal Preferred Alternative Footprint

5.1 Special Status Species

Eleven federally listed animal species have the potential to occur in the vicinity of the project area. These species, and their status, are listed in Table 5.1, below:

Table 5.1 – Federally Listed Endangered, Threatened and Candidate Animal Species with Potential to Occur in the Cape Sable Area

Common Name	Scientific Name	Federal Status
Florida panther	*Felis concolor coryi*	Endangered
West Indian manatee	*Trichechus manatus*	Endangered
Smalltooth sawfish	*Pristis pectinata*	Endangered
Atlantic hawksbill turtle	*Eretmochelys imbricata*	Endangered
Green turtle	*Chelonia mydas*	Endangered
Kemp's Ridley turtle	*Lepidochelys kempii*	Endangered
Atlantic leatherback turtle	*Dermochelys coriacea*	Endangered
Loggerhead turtle	*Caretta caretta*	Threatened
American crocodile	*Crocodylus acutus*	Threatened
Eastern indigo snake	*Drymarchon corais couperi*	Threatened
Wood stork	*Mycteria Americana*	Endangered

Sources: NPS, IRC 2009, Glassberg 2000.

The Florida panther lives in upper dry land habitats such as hardwood hammocks, pine flatwoods, and thicket swamps near wetlands. Although it does not like extremely wet places, it would wade across waterways if necessary to find food and drier land. The USFWS developed a Standard Local Operating Procedures for Endangered Species (SLOPES) for the Florida panther (April 18, 2000). According to that SLOPES, the USFWS designated a Panther Consultation Area in south Florida that extends from Monroe and Miami-Dade Counties north to Charlotte and Glades Counties, including portions of Collier, Broward, Palm Beach, Lee and Hendry Counties. Within the designated Panther Consultation Area (PCA) are Panther Preservation Areas (PPA) ranked as Priority 1 and 2. Also included are areas otherwise designated as Conservation Lands, such as national preserves (Big Cypress), national parks (Everglades National Park), state parks (Collier-Seminole), SFWMD Water Conservations Areas (WCA-1, -2, -3), etc. The East Cape Extension canal and the Homestead canal project areas are located outside of the Panther Preservation Areas and the Panther Conservation Area. In addition, wetlands are not particularly suitable panther habitat, but only serve as refuge from loss of suitable habitat. Therefore, since it has been determined that the proposed project is not located within the PCA, and no evidence was found of panthers inhabiting the wetlands of the Cape Sable area, the proposed project is anticipated to have no effect on the Florida panther.

The West Indian manatee is typically found in coastal or estuarine waters, bays, rivers, and lakes, but may be found in inland canals during winter months. Manatees are grazers and require sheltered coves for feeding, resting, and calving. The potential for manatees exists within the East Cape Extension and Homestead canals, which are tidally connected to the waters of Florida Bay and the Gulf of Mexico. Although portions of these canals would be disturbed by all of the proposed action alternatives, the Florida Fish and Wildlife Conservation Commission's (FFWCC) standard protection measures would be utilized prior to and during all in-water construction activities to ensure that no adverse impacts to

the West Indian manatee would result. As a result of these precaution measures, the proposed project may affect but is not likely to adversely affect the West Indian manatee.

The smalltooth sawfish can exist both in saltwater and freshwater, tending to prefer fairly shallow water with muddy or sandy bottoms such as rivers, streams, lakes, creeks, bays, lagoons, and estuaries. The potential exists for the smalltooth sawfish to occur within the project area and construction activities could affect the sawfish's behavior, causing them to avoid the affected area. However, these impacts would be minimal (affecting a relatively small area), temporary (lasting only for the duration of construction), and are not expected to jeopardize the continued existence of the smalltooth sawfish within the greater Cape Sable area. No measurable long-term effects are anticipated during operation of these facilities. Furthermore, care would be taken to ensure that no smalltooth sawfish are harmed during project construction activities. Also, smalltooth sawfish protection measures established by the FFWCC would be employed during all in-water construction activities to ensure that no adverse impacts to this species would occur. As a result of these precaution measures, the proposed project may affect but is not likely to adversely affect the smalltooth sawfish.

The Atlantic hawksbill turtle inhabits coastal reefs, bays, rocky areas, estuaries, and lagoons and are generally found at depths of 70 feet or less. Hatchlings may be found in the open sea floating on masses of marine plants. Juveniles, subadults, and adults typically forage on coral reefs, although hawksbills may also occupy other hard-bottom communities and occasionally mangrove-fringed bays. This species comes to land to nest and prefers undisturbed, deep sand beaches. No suitable nesting habitat exists within the project limits (NOAA Fisheries 2007a). Construction activities could affect the hawksbill sea turtles' behavior, causing them to avoid the affected area. However, such impacts would be minimal (affecting a relatively small area), temporary (lasting only for the duration of construction), and are not expected to jeopardize the continued existence of the hawksbill sea turtle within the greater Cape Sable area. No measurable long-term effects are anticipated during operation of these facilities. Also, sea turtle protection measures established by the FFWCC would be employed during all in-water construction activities to ensure that no adverse impacts to this species would occur. As a result of these precaution measures, the proposed project may affect but is not likely to adversely affect the Atlantic hawksbill turtle.

The green turtle is dependent upon three basic habitat types: high energy beaches for nesting; convergence zones in pelagic (open sea) habitats as juveniles, and benthic feeding grounds (namely seagrass meadows) as subadults and adults. Green sea turtle foraging areas in the southeastern United States include shallow coastal and estuarine waters with an abundance of macroalgae or seagrass. This species also occurs in non-vegetated areas near mainland coastlines, islands, reefs, or shelves, and has been observed in open-ocean surface waters, especially where wind and currents concentrate pelagic organisms (NMFS and USFWS 1991a) (NOAA Fisheries 2007a). Construction activities could affect the green sea turtles' behavior, causing them to avoid the affected area. However, such impacts would be minimal (affecting a relatively small area), temporary (lasting only for the duration of construction), and are not expected to jeopardize the continued existence of the green sea turtle within the greater Cape Sable area. No measurable long-term effects are anticipated during operation of these facilities. Also, sea turtle protection measures established by the FFWCC would be employed during all in-

water construction activities to ensure that no adverse impacts to this species would occur. As a result of these precaution measures, the proposed project may affect but is not likely to adversely affect the green turtle.

The Kemp's Ridley turtle inhabit shallow coastal and estuarine waters over sand or mud bottoms. Juveniles feed on sargassum, while adults are largely shallow-water benthic feeders whose food items include shrimp, snails, bivalves, jellyfish, and marine plants (NOAA Fisheries 2007a). Adults are restricted to the Gulf of Mexico; however, the pelagic juveniles also occur in the Atlantic Ocean (presumably dispersed by major oceanic currents). Kemp's Ridley sea turtles might temporarily forage in the open water areas in the vicinity of the proposed project; however, no suitable nesting habitat exists within the project limits. Construction activities could affect the Kemp's Ridley sea turtles' behavior, causing them to avoid the affected area. However, such impacts would be minimal (affecting a relatively small area), temporary (lasting only for the duration of construction), and are not expected to jeopardize the continued existence of the Kemp's Ridley sea turtle within the greater Cape Sable area. No measurable long-term effects are anticipated during operation of these facilities. Also, sea turtle protection measures established by the FFWCC would be employed during all in-water construction activities to ensure that no adverse impacts to this species would occur. As a result of these precaution measures, the proposed project may affect but is not likely to adversely affect the Kemp's Ridley turtle.

Atlantic leatherback sea turtles spend most of their time in the open sea, entering coastal waters only when nesting and/or in pursuit of jellyfish aggregations. Critical habitat for the leatherback includes a strip of land at, and the waters adjacent to, Sandy Point on the western end of St. Croix, U.S. Virgin Islands (NOAA Fisheries 2007a). Nesting occurs from February to July with sites located from Georgia to the U.S. Virgin Islands. During the summer, leatherbacks tend to be found along the east coast of the United States from the Gulf of Maine south to the central coast of Florida (NOAA Fisheries 2007a). Leatherbacks might temporarily forage in the open water areas in the vicinity of the proposed project; however, no suitable nesting habitat exists within the project limits. Construction activities could affect the leatherback sea turtles' behavior, causing them to avoid the affected area. However, such impacts would be minimal (affecting a relatively small area), temporary (lasting only for the duration of construction), and are not expected to jeopardize the continued existence of the leatherback sea turtle within the greater Cape Sable area. No measurable long-term effects are anticipated during operation of these facilities. Also, sea turtle protection measures established by the FFWCC would be employed during all in-water construction activities to ensure that no adverse impacts to this species would occur. As a result of these precaution measures, the proposed project may affect but is not likely to adversely affect the Atlantic leatherback turtle.

Loggerhead turtles typically occur over the continental shelf and in bays, estuaries, lagoons, creeks, and mouths of rivers, but have been found as far as 500 miles offshore (NMFS and USFWS 1991b). Nesting primarily occurs on barrier islands adjacent to continental landmasses in warm-temperate and sub-tropical waters (NMFS and USFWS 1991b). In the continental United States, loggerheads nest along the Atlantic coast and sporadically along the Gulf coast (NMFS and USFWS, 1991b). Nest sites are typically located on high-energy, open sandy beaches above the mean high tide and seaward of well-developed dunes; however, no suitable nesting habitat exists within the project limits. After hatching, juvenile loggerheads move directly to sea and often float in masses of

sargassum (NMFS and USFWS, 1991b) (NOAA Fisheries 2007b). Construction activities could affect the loggerhead sea turtles' behavior, causing them to avoid the affected area. However, such impacts would be minimal (affecting a relatively small area), temporary (lasting only for the duration of construction), and are not expected to jeopardize the continued existence of the loggerhead sea turtle within the greater Cape Sable area. No measurable long-term effects are anticipated during operation of these facilities. Also, sea turtle protection measures established by the FFWCC would be employed during all in-water construction activities to ensure that no adverse impacts to this species would occur. As a result of these precaution measures, the proposed project may affect but is not likely to adversely affect the loggerhead turtle.

The American crocodile is distributed along a broad range of coastal and estuarine shores in parts of Mexico, Central and South America, the Caribbean, and the extreme tip of southern Florida (Gaby et al. 1985; Kushlan and Mazzotti 1989a; Kushlan and Mazzotti 1989b; Van Meter 1992; Hamilton 1999; Mazzotti 1999; Mazzotti and Cherkiss 2003). Historically in Florida, the American crocodile ranged from Lake Worth on the east coast, south through the upper keys and west through Florida Bay, and north to Charlotte Harbor (Kushlan and Mazzotti 1989a; Van Meter 1992). The recent distribution of the American crocodile in Florida is much more restricted, with documented populations across the southern tip of Florida from Cape Sable to southern Biscayne Bay, including Key Largo (Kushlan and Mazzotti 1989a; Hamilton 1999). American crocodile habitat in Florida Bay is defined as mangrove lined ponds, creeks, and shorelines, and man-made ponds and canals associated with them (Kushlan and Mazzotti 1989b; Van Meter 1992). American crocodile nesting habitat consists of mounds and holes built and dug in elevated substrate along the coast (Kushlan and Mazzotti 1989b; Van Meter 1992; Mazzotti and Cherkiss 2003). American crocodile nesting in Florida Bay occurs between the months of March and September (Kuslan and Mazzotti 1989b). Nesting and hatchling success has been linked to several factors, including salinity, fertility, predation, temperature extremes, moisture conditions, erosion of nest sites, and human disturbance (Mazzotti 1989). The American crocodile was designated as endangered on 25 September 1975 under the Federal Endangered Species Act (Federal Register 40:44149) (Van Meter 1992; Hamilton 1999; Mazzotti 1999; Mazzotti and Cherkiss 2003). Critical habitat for the American crocodile was designated in December of 1979 (Federal Register 45:10350-10355) (Hamilton 1999; Mazzotti and Cherkiss 2003). The federal status of the American crocodile was downlisted from Endangered to Threatened in May 2008 due to a recovery of the population, a large portion of which is location in the Cape Sable area. Seventy-five nests were located along the banks of the East Cape Extension and Homestead canals in 2007 and 2008 combined (M. Parry, NPS, personal communication, 2008). Construction activities for the proposed project would be limited to the months of October through February, during which no American crocodile nesting occurs. Therefore, due to the limiting timeframe of nesting activities and construction, the proposed project may affect but is not likely to adversely affect the American crocodile.

The Eastern indigo snake is found in a variety of habitats and would readily utilize disturbed areas and populated residential areas; however, their preferred habitat is dry pineland bordered by water. The project area consists of large expanses of wetland, which are not particularly attractive as habitat to this snake. Because the project location lacks the preferred snake habitat, there is a relatively low potential for this project to impact the Eastern indigo snake. In addition, project construction may be temporarily disruptive to

individual snakes; therefore, it is predicted that any individual snake would migrate away from the construction work zone during construction activities. Also, Eastern indigo snake protection measures established by the USFWS would be employed during all construction activities. Therefore, based on the minimal potential for this snake to be present, and the implementation of these protection measures, it has been determined that this project may affect, but is not likely to adversely affect the Eastern indigo snake.

The wood stork is usually found nesting colonially in a variety of inundated forested wetlands, mixed hardwood swamps, sloughs, and mangroves. The wood stork forages mainly in shallow water in freshwater marshes, swamps, lagoons, ponds, tidal creeks, flooded pastures and ditches, where they are attracted to falling water levels that concentrate food sources (mainly fish). USFWS database records (USFWS 2009) indicate the existence of one active nesting colony located near the project area. This colony is located approximately 14.2 miles northeast of the project corridor. Therefore, the project is located in the CFA (within 18.6 miles) of this nesting colony. To minimize adverse effects to the wood stork due to any loss of wetlands, the USFWS recommends that any lost foraging habitat resulting from the project be replaced within the CFA of the affected nesting colony. However, based on the wetland functional benefits derived from the proposed project versus the minor impacts to wetlands and the fact that no suitable foraging habitat for the wood stork exists within the project limits, it has been determined that this project may affect, but is not likely to adversely affect the wood stork.

5.2 Wetland Impacts, Functional Assessment and Mitigation Analysis

Alternative A (No-Action)

1) Analysis. Under Alternative A, no construction would take place and current conditions/processes would continue. There would be no direct adverse effect from construction on existing wetland vegetation communities within the project area.

However, taking no action to address the issues associated with the failed sheetpile dams on the East Cape Extension and Homestead canals would sustain the anthropomorphic impacts on erosional processes within these canals and the greater Cape Sable area. As mentioned earlier, according to Wanless and Vlaswinkel (2005), the collapse of the southern interior marsh is a direct result of the lowering of the marsh with construction of the canals through the marl ridge, as well as large storm events/hurricanes and saline intrusion. The areas of open water have continued to gradually expand northward and the areas colonized by mangroves have progressed. Peat soil is lost and freshwater marsh communities are being replaced by open water saline communities. Thus, the characteristics and functions of large portions of the interior marsh wetlands are transitioning at increased rates from brackish ecosystems to marine ecosystems adversely impacting existing wildlife utilizing these areas (see the Wildlife and Wildlife Habitat section of this EA for further details). This process is accelerated with the substantial amount of saltwater moving through the Homestead and East Cape Extension canals where the dams have failed. These processes would continue to act at current or potentially increasing rates. Related erosion and channel widening could also be expected to continue resulting in long-term degradation and permanent loss of portions of adjacent and downstream vegetated wetlands. Therefore, with Alternative A, long-term moderate to major adverse impacts to existing wetland resources could be expected.

Long-term, indirect, negligible to minor adverse impacts to the wetland areas directly adjacent to the existing dams are also anticipated to continue to occur as a result of canoe/kayak portage around the failed dam sites due to the dangerous conditions (i.e., strong currents, eddies, etc.) of trying to paddle through the waterway past the failed dam sites. This off-trail use by visitors has the potential to trample and possibly eliminate desirable wetland vegetation through continual usage of the trail. This impact, although minor, has the potential to introduce opportunities for the growth of nuisance, opportunistic and/or exotic vegetation within areas of higher elevation (i.e., areas with minimal/infrequent inundation allowing for the growth of exotic species). Furthermore, without the existence of a deterrent from entering the wilderness area or upstream marshes of Cape Sable, use of this area by motorized boats is likely to continue further degrading these interior marshes through disturbance and pollution from fuels, greases and oils.

While all the environmental impacts of climate change would affect South Florida and Everglades National Park within the next century, the key concern for the lowlying Cape Sable area would be rising sea level, "with a very high likelihood" that the sea level would rise an additional 1.5 feet in the next 50 years and a cumulative total of three to five feet within a century (CCATF, 2008). Vegetation and wetlands would be impacted by the increasing amount and duration of saltwater in the interior freshwater and brackish marshes of Cape Sable.

2) Cumulative Impacts. No cumulative impacts to vegetation and wetlands would occur as a result of combining the cumulative projects with the actions contained in Alternative A because the effects of the cumulative projects would be negligible. Impacts to vegetation and wetlands would be limited only to those direct and indirect impacts resulting from Alternative A. For more information on the cumulative projects and the determinations of negligible impacts see Section 1.4.5 and Section 3.2.3 of the EA document, respectively.

3) Conclusion. No direct impacts to wetland/surface water areas would result with Alternative A. There would be moderate to major adverse effects to the wetland systems of the greater Cape Sable area. There would also be long-term, negligible to minor adverse impacts resulting from ongoing visitor use in and around the existing dam sites. No beneficial effects to wetlands are anticipated as a result of Alternative A. Alternative A would produce moderate to major adverse impacts on wetlands. Consequently, there would be no impairment of wetlands as a result of Alternative A.

Action Alternative C (Repair in Place)

1) Analysis. Under Alternative C, the existing dam sites would be repaired along the East Cape Extension and Homestead canals. Wetland and surface water impacts would be largely restricted to the immediate banks of the canal. Impact minimization efforts have been considered during this study to reduce impacts to the adjacent wetland/surface water systems to the maximum extent possible while maintaining safe and sound engineering and construction practices. Unavoidable wetland impacts would occur since the project is wetland dependent and constructed entirely within wetlands/surface waters. Unavoidable direct impacts (permanent and temporary) were quantified for Alternative C based on the aerial extent of wetlands/surface waters within the proposed construction limits. The resulting quantities are depicted in Table 5.2, below:

Table 5.2 – Direct Impacts to Wetlands/Surface Waters for Alternative C

Wetland/Surface Water ID[2]	Type of Impact/ Perm or Temp	Description	Direct Wetland Impacts (ft^2)	Direct Wetland Impacts (acres)
E1UBLx	Fill and Riprap - Permanent	East Cape Extension Canal	2,732.54	0.063
E1UBLx	New Sheetpile - Permanent	East Cape Extension Canal	67.77	0.001
E2SS3P/E2EMP	Riprap - Permanent	Banks of East Cape Extension Canal	3,522.52	0.081
E2SS3P/E2EMP	Mangrove Trimming - Temporary	Banks of East Cape Extension Canal	18,081.08	0.415
E2SS3P/E2EMP	New Sheetpile - Permanent	Banks of East Cape Extension Canal	499.82	0.011
E2SS3P/E2EMP	Temp. Work Zone Clearing - Temporary	Banks of East Cape Extension Canal	6,652.73	0.153
E1UBLx	Fill and Riprap - Permanent	Homestead Canal	2,848.15	0.065
E1UBLx	New Sheetpile - Permanent	Homestead Canal	122.05	0.003
E2SS3P/E2EMP	Riprap - Permanent	Banks of Homestead Canal	4,112.58	0.095
E2SS3P/E2EMP	New Sheetpile - Permanent	Banks of Homestead Canal	469.66	0.011
E2SS3P/E2EMP	Temp. Work Zone Clearing - Temporary	Banks of Homestead Canal	7,917.63	0.182
E2SS3P/E2EMP	Mangrove Trimming - Temporary	Banks of Homestead Canal	38,798.32	0.891
E2USM/N	Access Dredging - Temporary	Substrate of Lake Ingraham	1,431,040.00	32.852

Direct permanent impacts of 0.064 acres and 0.068 acres within surface waters of the East Cape Extension and Homestead canals, respectively, would occur as result of implementing Alternative C. These filling impacts are a direct result of the placement of the additional sheetpile needed to extend the existing dam to the banks of the canal as well as the placement of earthen fill and riprap for stabilization and armoring. Direct permanent impacts of 0.092 and 0.106 acres within wetlands along the banks of the East Cape Extension and Homestead canals, respectively, would also occur. These filling impacts are associated with the placement of the additional sheetpile needed for the wingwalls as well as the placement of riprap for support and armoring. In addition to the above, less than 0.006 acres (250 square feet) of permanent shading impacts to both the East Cape Extension and Homestead canals would occur as a result of the proposed non-motorized boat (canoe/kayak) portage system. However, since no submerged aquatic vegetation are known to exist within these waterways, this new shading impact is negligible. Also, floating mooring buoys and/or free-standing piles would be installed downstream (towards Lake

[2] Wetland/Surface Water identification codes define the type and characteristics of the wetland/surface water area. These codes are defined in detail in Section 2.0 of this document.

Ingraham) of the dam structure for motorized vessel anchoring. Mooring buoy anchors and/or piles would minimize potential substrate disturbance. As a result, the moorings would minimize potential secondary impacts to the canal bottom from the use of standard boat anchors. As stated above, since no submerged aquatic vegetation are known to exist within these waterways, the impacts associated with installation of the moorings are negligible.

To minimize wetland resource impacts, BMPs would be implemented during construction. These practices would include employment of staked silt fence and turbidity barriers. Silt fence would be employed prior to commencement of construction around the outer perimeter of each work zone to minimize the potential for impacts to adjacent undisturbed wetlands. Turbidity barriers would be employed in the canals prior to commencement of construction at a sufficient distance (approximately 500 feet if conditions allow) from the work zone to create a temporary mixing zone upstream and downstream of the dam location in order to allow for settling of any turbidity generated during construction since the project is located in OFWs (see Water Resources section of EA for details on OFWs), which has restrictive requirements pertaining to water quality (i.e., restricted to zero NTUs above ambient). The barriers would remain in place and be regularly inspected throughout the construction phase of the project. To ensure compliance with water quality standards in OFWs, a turbidity monitoring plan would be employed during construction. If monitoring reveals that turbidity levels exceed the standards, construction activities shall cease immediately and shall not resume until corrective measures are employed (e.g., the use of additional barriers, timing construction activities with tidal cycles, modifications to equipment, etc.). After construction is completed, temporarily disturbed areas would be restored to pre-existing conditions (e.g., regraded, compacted, etc.) and possibly replanted with native coastal wetland vegetation if regrowth does not occur naturally. The turbidity barriers and silt fence would be removed at the work areas in the canals once turbidity has subsided following construction completion of the dams.

Due to the space limitations in the work area, designated work zones have been established along the canal banks in which equipment would be staged for use during construction. Additional staging is anticipated to occur on floating barge(s) along the East Cape canal at the approximate location where the Ingraham canal branches off to the west and along the Homestead canal just west of the work zone. The barge(s) are anticipated to access the East Cape Extension canal through existing navigational channels and/or deep water areas of Florida Bay, and Lake Ingraham and the Homestead canal through the Ingraham canal, Lower East Cape canal, and existing navigational channels and/or deep water areas of western Florida Bay. The barge(s) would originate from a designated staging area in the Florida Keys (e.g., Sugarloaf Key or Marathon) due to a lack of a suitable staging area in Everglades National Park and to further meet the criteria for avoidance and minimization of impacts to wetland resources (see Figure 4.3 for the potential barge route). The exact location of the staging area in the Florida Keys would be determined by the awarded contractor; however, the area would be located entirely in previously disturbed uplands (i.e., parking lot, paved area, previously filled area, etc.). No adverse impacts to protected wetland resources are anticipated to occur as a result of utilizing the proposed accessways.

For the Homestead canal (only), barge(s) are anticipated to access the work zone with the dredging of a 52-foot wide by approximately 8,320 feet long temporary access channel

through the shallow water depths within Lake Ingraham. Per NPS staff, the current water elevations at high tide in Lake Ingraham are up to 2 feet above existing substrate with portions becoming exposed at low tide due to accelerated sediment deposition. Portions of the lake have transitioned from an open water system to a mud flat system in recent years (Wanless and Vlaswinkel, 2005). The channel would be dredged to a depth of approximately six feet below the mean low water elevation. To minimize impacts caused by dredging, a mechanical (bucket) dredge would be used. While both hydraulic and mechanical dredging methods can successfully remove the accumulated sediments within the channel, mechanically dredged sediment can be placed along the sides of the channel (less impact), versus hydraulic dredging which would require an off-site dewatering area and possible treatment equipment to allow dredge water effluent to be returned back to Lake Ingraham, which has the potential to result in moderate to major adverse impacts to the water quality of Lake Ingraham. For mechanical dredging operations within Lake Ingraham, accumulated sediments in the channel could be removed with a conventional barge-mounted long-reach excavator (40 to 60-ft reach). The width of the base of the dredged channel would not exceed 40 feet with anticipated 3:1 side slopes for a total top cross sectional channel width of approximately 52 feet. The dredged material (approximately 40,000 cubic yards) would be temporarily stockpiled in areas adjacent to the dredged channel outward to a maximum distance of approximately 60 feet on both sides [for a total temporary impact footprint of approximately 172 feet wide by 8,320 feet long (32.852 acres)]. Turbidity resulting from the dredging operation would be contained within the construction footprint using staked and/or floating turbidity curtains or other suitable barriers to minimize the potential for turbidity beyond the limits of construction. The barriers would be employed prior to commencement of construction activities and remain in place and regularly inspected throughout the construction phase of the project. To ensure compliance with water quality standards in OFW (see Water Resources section of EA for details on OFWs), a turbidity monitoring plan would be employed during construction. If monitoring reveals that turbidity levels exceed the standards, construction activities shall cease immediately and shall not resume until corrective measures are employed (e.g., the use of additional barriers, timing construction activities with tidal cycles, modifications to equipment, etc.). Upon completion of construction at the Homestead canal dam site, the dredged material in Lake Ingraham would be pulled back into the channel via mechanical means and the turbidity barriers would be removed once turbidity has subsided. Some of the dredged material would disperse beyond the turbidity barriers via tidal currents and wave energy; however, due to the lack of submerged aquatic vegetation in Lake Ingraham, the effect would be considered minor to negligible. The channel would be returned to pre-construction condition upon completion of construction. Per discussions with the regulatory agencies, since no protected submerged aquatic vegetation exists in the area to be dredged, the backfilling of the channel would serve as mitigation for dredging impacts to Lake Ingraham. Additionally, any resulting temporal functional losses due to this temporary impact would be mitigated with the upstream and downstream benefits to existing wetland functions within Lake Ingraham and the interior marshes of Cape Sable (see below for details).

In addition to dredging, trimming of overhanging mangrove trees may need to occur within the canals for barge access. Trimming would be conducted per the requirements of the FDEP's Mangrove Trimming Permit (to be acquired prior to commencement of construction). Approximately 0.415 acres (18,081.08 s.f.) along the East Cape Extension

canal and 0.891 acres (38,798.32 s.f.) along the Homestead canal may require trimming (areas based on aerial coverage of vegetation over each waterway between the mouth of each canal at Lake Ingraham and the existing dam site that would need to be trimmed to allow for barge access). Following construction completion, regrowth of the mangroves over the waterway would be left unrestricted and the area is expected to return to full functionality within five years.

The 0.153-acre temporary work zone along the East Cape Extension canal and the 0.182-acre temporary work zone along the Homestead canal would be temporarily cleared of woody vegetation above the existing substrate prior to construction. Following completion of construction activities, the work zone would be restored (e.g., regraded, compacted, etc.) to pre-existing conditions to facilitate natural recruitment of native hydrophytic vegetation. To expedite the stabilization of the area, native vegetation will be planted in the area. A monitoring program would be initiated by the NPS in order to monitor the re-growth of native vegetation in the work zone areas for a period of up to five years.

The areas to be affected by the physical footprint of the alternative are a mixture of regularly flooded mangrove wetlands and irregularly flooded shrub-scrub buttonwood/saltwort/mangrove wetlands as well as the open water area of the canal. The wetlands are part of and contiguous with the estuarine wetland system of the greater Cape Sable area in the vicinity of the existing marl ridge. The primary functions of these wetlands include surface and subsurface water storage, support of the biogeochemical processes (nutrient cycling, peat accretion, etc.), support of characteristic plant community, and providing suitable habitat for native fish and wildlife. These functions appear to be retained, although degraded, following excavation of the canals.

Per Chapter 62-345 Florida Administrative Code (F.A.C.), a functional analysis of the wetland areas to be impacted (permanent and temporary impacts) was conducted using the Florida Department of Environmental Protection's (FDEP) Uniform Wetland Mitigation Assessment Method (UMAM) (FDEP, 2004) which has been adopted by the South Florida Water Management District (SFWMD) on February 2, 2004 and, as of August 1, 2005, has also been adopted by the U.S. Army Corps of Engineers (USACE). The UMAM provides a standardized procedure for assessing the functions provided by wetlands and other surface waters; the amount that those functions are reduced by a proposed impact; and the amount of mitigation necessary to compensate for that loss in terms of current condition; hydrologic connection; uniqueness; location; fish and wildlife utilization; time lag; and mitigation risk. Impacts to surface water areas with no protected submerged aquatic vegetation typically do not require mitigation; thus, a UMAM analysis was not performed for impacts to the waterway itself. A summary of the results of the assessment on the area to be permanently and temporarily impacted is provided in Table 5.3 below. In Table 5.3, "Current" indicates the functional value of the assessment area based on existing conditions per the three categories of indicators of wetland function (location and landscape support, water environment and community structure) scored to the extent that they affect the ecological value of the assessment area. Scores per each category range from ten to zero based on reasonable scientific judgment. A score of ten indicates an optimal level whereas a score of zero indicates a severely diminished or negligible level. The "Current" score is determined by summing the scores for each of the indicators and dividing that value by 30 to yield a number between zero and one. The "Current" assessment score is calculated twice, providing a functional assessment score without

construction (existing conditions) and a functional assessment score with construction (proposed conditions). The "Delta" indicates the functional value difference between the existing conditions (without construction) and the proposed conditions (with construction). For example, a negative delta would indicate that a loss in functional value would occur with construction. "Functional Loss" indicates the total calculated loss based on the size of the wetland being impacted and the loss in functional value that would occur (impact area x "Delta"). For further details of the functional assessments, the UMAM assessment forms have been provided at the end of this Wetland SOF for review.

Table 5.3 – UMAM Functional Assessment – Impacted Areas - Alternative C

	Impact Area ID	Perm or Temp	Assess. Area Size	Current (Without)	Current (With)	Delta	Functional Loss
East Cape Extension Canal	Canal Banks – Filling	Perm	0.092 acres	0.667	0.500	-0.167	-0.015
	Canal Banks – Mangrove Trimming	Temp	0.415 acres	0.667	0.600	-0.067	-0.028
	Canal Banks – Work Zone Clearing	Temp	0.153 acres	0.700	0.533	-0.167	-0.026
Homestead Canal	Canal Banks – Filling	Perm	0.106 acres	0.667	0.500	-0.167	-0.018
	Canal Banks – Mangrove Trimming	Temp	0.891 acres	0.667	0.600	-0.067	-0.059
	Canal Banks – Work Zone Clearing	Temp	0.182 acres	0.700	0.533	-0.167	-0.030
	Lake Ingraham - Access Channel Dredging	Temp	32.852 acres	0.667	0.433	-0.233	-8.761

The UMAM analysis indicates that the banks of the East Cape Extension and Homestead canals have an existing functional assessment score ranging from 0.667 to 0.700, which falls within the moderate quality range, between 0.50 and 0.79. Wetlands assigned UMAM scores less than 0.50 are typically highly disturbed and have limited wetland functions. Wetlands assigned UMAM scores greater than 0.79 are typically high quality wetlands with pristine wetland functions.

As shown in Table 5.3, the functional loss for 0.092 acres and 0.106 acres of permanent filling impacts to wetlands along the East Cape Extension and Homestead canals was determined to be -0.015 and -0.018, respectively; the functional loss for 0.415 acres and 0.891 acres of temporary impacts to mangroves as a result of trimming activities along the East Cape Extension and Homestead canals was determined to be -0.028 and -0.059, respectively; the functional loss for 0.153 acres and 0.182 acres of temporary impacts to

wetlands as a result of vegetation clearing activities along the East Cape Extension and Homestead canals was determined to be -0.026 and -0.030, respectively; and the functional loss for 32.852 acres of temporary impacts to Lake Ingraham as a result of dredging a temporary access channel was determined to be -8.761. Thus, the total functional loss for 0.092 acres of permanent impacts and 0.568 acres of temporary impacts to wetlands with implementing Alternative C for the East Cape Extension canal is -0.069. In addition, the total functional loss for 0.106 acres of permanent impacts and 33.925 acres of temporary impacts to wetlands with implementing Alternative C for the Homestead canal is -8.868.

All BMPs typically associated with NPS construction projects would be properly implemented and maintained throughout all construction activities minimizing short-term secondary impacts to adjacent and downstream wetland areas. Water quality impacts resulting from erosion and sedimentation during construction activities would be controlled through the use of BMPs, including temporary erosion control measures. Temporary erosion control measures would consist of staked silt fence and turbidity barriers. No substantial impacts due to sedimentation or water quality degradation are anticipated to occur during construction activities; however, the project would require a temporary mixing zone upstream and downstream of the dam location in order to allow for settling of any turbidity generated during construction since the project is located in OFWs, which has restrictive requirements pertaining to water quality (i.e., zero NTUs above ambient). If turbid conditions persist outside of the temporary mixing zone, the awarded contractor would be required to take all necessary measures to control turbidity. These measures may include timing construction activities with tidal cycles, modifications to equipment, or temporarily ceasing operations completely, if necessary. Permanent erosion control measures would consist of restoring disturbed areas (e.g., regrading, compacting, planting, etc.) and placement of riprap on disturbed banks for stability.

The potential for long-term secondary impacts resulting from the project were also analyzed due to the lack of a vegetative buffer between the proposed dam sites and the adjacent wetlands. However, since the area is located in the backcountry of Everglades National Park and no active roadways or trails lead to this area, continued long-term disturbance at the dam sites is not anticipated. In addition, the potential for long-term, indirect, negligible to minor adverse impacts to the wetland areas directly adjacent to the existing dams would be remedied through the construction of canoe/kayak portages over the new dams. Details of the portage are discussed in Section 4.0 of this document. Thus, this observed activity is not anticipated to continue following dam construction, which provides a net benefit in relation to indirect/secondary impacts.

Furthermore, no adverse impacts are anticipated to occur to the watershed as a result of the proposed project due to the derived benefits. Although a small area of existing wetland vegetation would be permanently impacted with construction of this alternative, the upstream and downstream benefits to existing wetland functions for Lake Ingraham (approximately 1,863 acres) and the interior marshes of Cape Sable (approximately 55,894 acres based on the aerial extent of this area from just north of the marl ridge to the southern edge of Whitewater Bay) outweighs the wetland functional loss derived from the implementation of Alternative C (see above). This is evidenced through the use of the UMAM functional analysis, which was used to assess the potential benefits to the interior marsh and Lake Ingraham (see Figure 5.3 for locations of the proposed offsite mitigation

areas) derived as a result of the proposed project. Since the Cape Sable area interior marsh wetlands are contiguous and retain similar wetland functions, it was appropriate to conduct one UMAM functional assessment for the entire area. In addition, the temporary impacts would be mitigated through onsite restoration activities as discussed above; however, a mitigation UMAM functional analysis was also performed for these temporary impacts to show that any resulting temporal functional losses would be mitigated with the upstream and downstream benefits to existing wetland functions within Lake Ingraham and the interior marshes of Cape Sable. The resulting UMAM assessment scores are provided in Table 5.4, below. Copies of the UMAM scores for the mitigation areas have been enclosed for review at the end of this SOF.

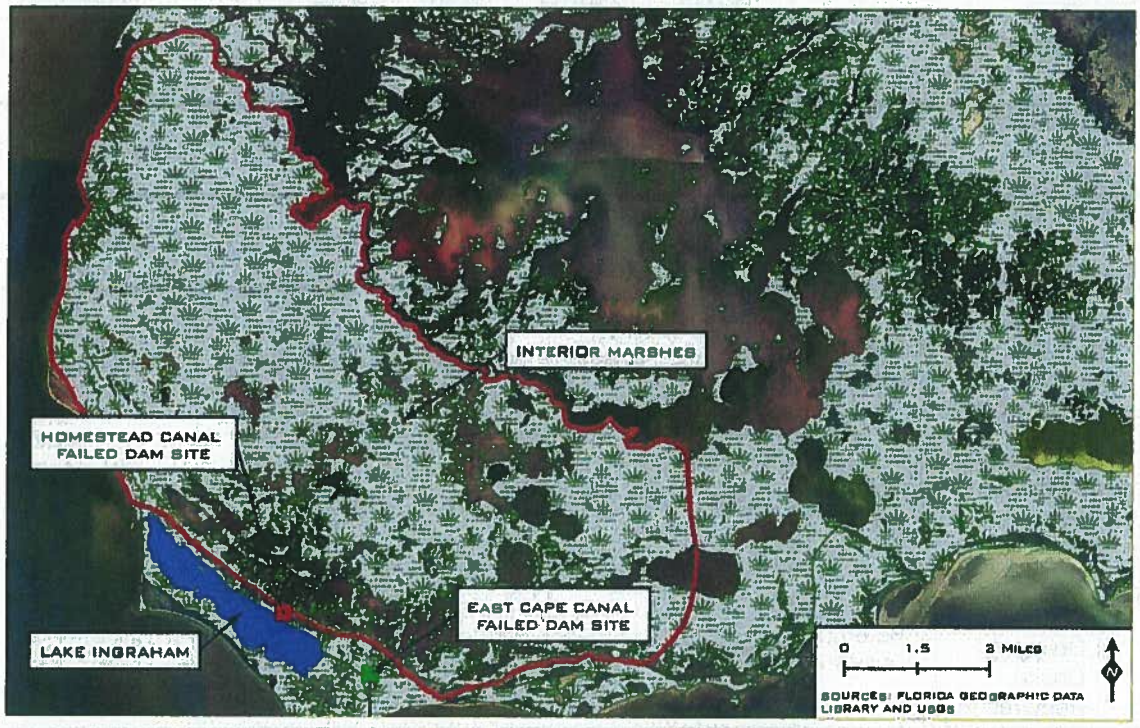

Figure 5.3 – Offsite Wetland Mitigation Areas

Table 5.4 – UMAM Functional Assessment for Mitigation Areas – Alternative C

Mitigation Area ID		Assess. Area Size	Current (Without)	Current (With)	Delta	Time Lag	Risk	Relative Functional Gain	Functional Gain (Mitigation Credits)
East Cape Extension Canal	Mangrove Trimming Onsite Restoration	0.415 acres	0.600	0.667	0.067	1.14	1.25	0.047	0.019
	Temporary Work Zone Onsite Restoration	0.153 acres	0.533	0.700	0.167	1.14	1.25	0.117	0.018
Lake Ingraham Offsite Enhancement		1,863 acres	0.700	0.767	0.100	1.0	1.25	0.080	149.040
Interior Marshes Offsite Enhancement		55,894 acres	0.667	0.767	0.067	1.0	1.25	0.053	2,962.382
Homestead Canal	Mangrove Trimming Onsite Restoration	0.891 acres	0.600	0.667	0.067	1.14	1.25	.047	0.042
	Temporary Work Zone Onsite Restoration	0.182 acres	0.533	0.700	0.167	1.14	1.25	0.117	0.021
	Access Channel Dredging Onsite Restoration	32.852 acres	0.433	0.667	0.233	1.03	1.25	0.181	5.946

The time lag (the period of time between when the functions are lost at the impact site and when the functions are achieved at the mitigation site) and risk (the degree of uncertainty that the proposed conditions would be achieved resulting in a reduction in the ecological value of the mitigation sites) scores for the mitigation areas listed in Table 3.3, above, were determined as follows:

Mangrove Trimming Restoration (East Cape Extension and Homestead canals): The time lag was determined to be five years resulting in a T-factor score of 1.14 to allow for regrowth of trimmed mangroves and attain comparable pre-impact conditions. The risk was determined to have a score of 1.25 since vulnerability is low with a high probability of success (hydrological conditions, water quality, adjacent land uses not a factor; vulnerability to colonization of undesirable invasive exotics is low; vulnerability to undesirable plant communities is low).

Temporary Work Zone Restoration (East Cape Extension and Homestead canals): The time lag was determined to be five years resulting in a T-factor score of 1.14 to allow for regrowth of the mangrove/saltwort-dominated vegetation and attain comparable pre-impact conditions. The risk was determined to have a score of 1.25 since vulnerability is low with a high probability of success (hydrological conditions, water quality, adjacent land uses not a factor; vulnerability to colonization of undesirable invasive exotics is low; vulnerability to undesirable plant communities is low).

Access Channel Restoration (Lake Ingraham - Homestead canal): The time lag was determined to be two years resulting in a T-factor score of 1.03 to attain comparable pre-impact conditions as a regularly to periodically exposed mud flat with algal and cyanobacterial mats on the substrate. The risk was determined to have a score of 1.25 since vulnerability is low with high probability of success.

Lake Ingraham and the Interior Marshes: The time lag (the period of time between when the functions are lost at the impact site and when the functions are achieved at the mitigation sites) was determined to be immediate (less than one year) resulting in a T-factor score of 1.0 due to the following immediately derived benefits:

- Lake Ingraham
    - The dams would slow the rate of sediment deposition in Lake Ingraham as a result of marsh collapse and loss of sediment and nutrients from the interior freshwater and brackish marshes
    - The dams would improve habitat for wading birds, forage and game fish and other wildlife within Lake Ingraham due to the decrease in sediment deposition rates
- Interior Marshes
    - The dams would restrict the unnatural flow of saltwater into freshwater and brackish marshes north of the Cape Sable marl ridge through these canals
    - The dams would reduce freshwater loss from freshwater and brackish interior marshes through the East Cape Extension and Homestead canals
    - The dams would slow the rate of marsh collapse and loss of sediment and nutrients from the interior freshwater and brackish marshes
    - The dams would improve nesting and juvenile habitat for crocodiles, wading birds, forage and game fish and other wildlife within the freshwater and brackish marshes north of the marl ridge

The risk (the degree of uncertainty that the proposed conditions would be achieved resulting in a reduction in the ecological value of the mitigation sites) was determined to have a score of 1.25. The risk factor was determined based on the potential for scour during high tidal fluxes overtopping the marl ridge to erode new channels around the permanent riprap armor.

The mitigation functional gain was calculated as follows:

- A relative functional gain [mitigation Delta / (risk x time lag)] of 0.019 and 0.042 for mangrove trimming onsite restoration for the East Cape Extension and Homestead canals, respectively. The actual mitigation functional gain (gain in functions

provided by that mitigation assessment area = mitigation acres x relative functional gain) provided by this onsite restoration (allowing for unrestricted regrowth of mangroves over the waterway) is 0.008 and 0.037 for the East Cape Extension and Homestead canals, respectively.

- A relative functional gain of 0.018 and 0.021 for the restoration of the temporary work zones for the East Cape Extension and Homestead canals, respectively. The actual mitigation functional gain provided by this onsite restoration is 0.003 and 0.004 for the East Cape Extension and Homestead canals, respectively.
- A relative functional gain of 5.946 for the restoration of the temporary access channel in Lake Ingraham dredged to access the Homestead canal. The actual mitigation functional gain provided by this onsite restoration is 195.338.
- A relative functional gain of 0.053 for the interior marshes and 0.080 for Lake Ingraham. The actual mitigation functional gain provided by the mitigation sites was determined to be approximately 2,962.38 for the enhancement of approximately 55,894 acres of interior marsh and approximately 149.04 for the enhancement of approximately 1,863 acres of Lake Ingraham.

Thus, for the East Cape Extension canal, the total calculated functional gain for onsite restoration of 0.568 acres and offsite enhancement of 57,757 acres of wetlands is 3,111.459; whereas, the total calculated functional loss for 0.092 acres of permanent impacts and 0.568 acres of temporary impacts to wetlands with implementing Alternative C is -0.069 showing that the overall benefit to local and regional wetlands in the greater Cape Sable area as a result of the construction of this alternative far outweighs the total calculated functional loss to wetlands associated with construction. Thus, no additional mitigation is warranted for proposed permanent and temporary impacts to onsite wetlands as a result of implementing Alternative C for the East Cape Extension canal.

Similarly, for the Homestead canal, the total calculated functional gain for onsite restoration of 33.925 acres and offsite enhancement of 57,757 acres of wetlands is 3,117.431; whereas, the total calculated functional loss for 0.106 acres of permanent impacts and 33.925 acres of temporary impacts to wetlands with implementing Alternative C is -8.868 showing that the overall benefit to local and regional wetlands in the greater Cape Sable area as a result of the construction of this alternative far outweighs the total calculated functional loss to wetlands associated with construction. Thus, no additional mitigation is warranted for proposed permanent and temporary impacts to onsite wetlands as a result of implementing Alternative C for the Homestead canal.

While all the environmental impacts of climate change would affect South Florida and Everglades National Park within the next century, the key concern for the lowlying Cape Sable area would be rising sea level, "with a very high likelihood" that the sea level would rise an additional 1.5 feet in the next 50 years and a cumulative total of three to five feet within a century (CCATF, 2008). Vegetation and wetlands would be impacted by the increasing amount and duration of saltwater in the interior freshwater and brackish marshes of Cape Sable. While slowing the rate of sea level rise is beyond the resources of the park, these impacts would be mitigated in the short-term to intermediate-term time frame by the construction of the proposed dam structure. The dams would reduce the intensity and duration of saltwater entering the interior freshwater and brackish Cape Sable marshes via the East Cape Extension and Homestead canals. The slowing or

postponement of impacts by the construction of a dam structure would allow time for the interior marshes of Cape Sable to restabilize and recover from the current impacts caused by the breached dams and allow more time for the system and resources to adjust to the changes caused by climate change and sea level rise.

2) Cumulative Impacts. No cumulative impacts to vegetation and wetlands would occur as a result of combining the cumulative projects with the actions contained in Alternative C because the effects of the cumulative projects would be negligible. Impacts to vegetation and wetlands would be limited only to those direct and indirect impacts resulting from implementation of Alternative C. For more information on the cumulative projects and the determinations of negligible impacts see Section 1.4.5 and Section 3.2.3 of the EA, respectively.

3) Conclusion. For Alternative C, construction activities would result in minor adverse, localized, direct effects on vegetation. However, this action alternative would provide an overall benefit to local and regional wetlands in the greater Cape Sable area, which far outweighs the minor direct impacts associated with construction. The conservation of the local and regional wetlands receiving the benefits derived from the project is (1) necessary to fulfill specific purposes identified in the establishing legislation of the park, (2) key to the natural or cultural integrity of the park or opportunities for enjoyment of the park, or (3) identified as a goal in the park's master plan or other NPS planning documents. Alternative C would result in short-term, minor, adverse, and localized impacts as well as long-term beneficial effects. Thus, there would be no impairment of vegetation and wetlands as a result of the implementation of Alternative C.

Action Alternatives D (New 100' Plug – Marl Ridge Location) and G (New 370'/430' Plug - Marl Ridge Location)

1) Analysis. Under Alternative D, the existing dams would be removed and replaced with 100-foot plugs centered on the highest elevation point of the marl ridge along the East Cape Extension and Homestead canals (see Figures 4.1 and 4.2 in Section 4.1.4 of this document depicting the location of the preferred alternatives along the highest elevation points of the marl ridge for each of the canals). Under Alternative G, the existing dams would be removed and replaced with plugs the length of the approximate marl ridge along the East Cape Extension (370') and Homestead (430') canals. Wetland and surface water impacts are largely restricted to the immediate banks of the canals. Impact minimization efforts have been considered during this study to reduce impacts to the adjacent wetland/surface water systems to the maximum extent possible while maintaining safe and sound engineering and construction practices. Unavoidable wetland impacts would occur since the project is wetland dependent and constructed entirely within wetlands/surface waters. Unavoidable direct impacts (permanent and temporary) were quantified for Alternatives D and G based on the aerial extent of wetlands/surface waters within the proposed construction limits. The resulting quantities are depicted in Tables 5.5 and 5.6:

Table 5.5 – Direct Impacts to Wetlands/Surface Waters for Alternative D

	Wetland/Surface Water ID[3]	Type of Impact/ Perm or Temp	Description	Direct Wetland Impacts (ft^2)	Direct Wetland Impacts (acres)
East Cape Extension Canal	*E1UBLx*	Fill and Riprap - Permanent	East Cape Extension Canal	1,664.18	0.038
	E1UBLx	New Sheetpile - Permanent	East Cape Extension Canal	607.78	0.014
	E1UBLx	Plug Fill - Permanent	East Cape Extension Canal	5,470.78	0.126
	E2SS3P/E2EMP	Riprap - Permanent	Banks of East Cape Extension Canal	3,970.57	0.091
	E2SS3P/E2EMP	New Sheetpile - Permanent	Banks of East Cape Extension Canal	499.90	0.011
	E2SS3P/E2EMP	Mangrove Trimming - Temporary	Banks of East Cape Extension Canal	18,081.08	0.415
	E2SS3P/E2EMP	Work Zone Clearing Temporary	Banks of East Cape Extension Canal	8,551.11	0.196
Homestead Canal	*E1UBLx*	Fill and Riprap - Permanent	Homestead Canal	2,107.32	0.048
	E1UBLx	New Sheetpile - Permanent	Homestead Canal	445.64	0.010
	E1UBLx	Plug Fill - Permanent	Homestead Canal	4,105.33	0.094
	E2SS3P/E2EMP	Riprap - Permanent	Banks of Homestead Canal	3,127.24	0.072
	E2SS3P/E2EMP	New Sheetpile - Permanent	Banks of Homestead Canal	563.75	0.013
	E2SS3P/E2EMP	Temp. Work Zone Clearing - Temporary	Banks of Homestead Canal	8,337.40	0.191
	E2SS3P/E2EMP	Mangrove Trimming - Temporary	Banks of Homestead Canal	38,798.32	0.891
	E2SS3P/E2EMP	Earthen Fill - Temporary	Southern Bank of Homestead Canal	1,077.88	0.025
	E2USM/N	Access Dredging - Temporary	Substrate of Lake Ingraham	1,431,040.00	32.852

[3] Wetland/Surface Water identification codes define the type and characteristics of the wetland/surface water area. These codes are defined in detail in Section 3.4.1.3 of this document.

Table 5.6 – Direct Impacts to Wetlands/Surface Waters for Alternative G

	Wetland/Surface Water ID[4]	Type of Impact/ Perm or Temp	Description	Direct Wetland Impacts (ft^2)	Direct Wetland Impacts (acres)
East Cape Extension Canal	*E1UBLx*	Fill and Riprap - Permanent	East Cape Extension Canal	1,664.18	0.038
	E1UBLx	New Sheetpile - Permanent	East Cape Extension Canal	607.78	0.014
	E1UBLx	Plug Fill - Permanent	East Cape Extension Canal	5,470.78	0.126
	E2SS3P/E2EMP	Riprap - Permanent	Banks of East Cape Extension Canal	3,970.57	0.091
	E2SS3P/E2EMP	New Sheetpile - Permanent	Banks of East Cape Extension Canal	499.90	0.011
	E2SS3P/E2EMP	Mangrove Trimming - Temporary	Banks of East Cape Extension Canal	18,081.08	0.415
	E2SS3P/E2EMP	Work Zone Clearing Temporary	Banks of East Cape Extension Canal	8,551.11	0.196
Homestead Canal	*E1UBLx*	Fill and Riprap - Permanent	Homestead Canal	2,107.32	0.048
	E1UBLx	New Sheetpile - Permanent	Homestead Canal	445.64	0.010
	E1UBLx	Plug Fill - Permanent	Homestead Canal	4,105.33	0.094
	E2SS3P/E2EMP	Riprap - Permanent	Banks of Homestead Canal	3,127.24	0.072
	E2SS3P/E2EMP	New Sheetpile - Permanent	Banks of Homestead Canal	563.75	0.013
	E2SS3P/E2EMP	Temp. Work Zone Clearing - Temporary	Banks of Homestead Canal	8,337.40	0.191
	E2SS3P/E2EMP	Mangrove Trimming - Temporary	Banks of Homestead Canal	38,798.32	0.891
	E2SS3P/E2EMP	Earthen Fill - Temporary	Southern Bank of Homestead Canal	1,077.88	0.025
	E2USM/N	Access Dredging - Temporary	Substrate of Lake Ingraham	1,431,040.00	32.852

Direct permanent impacts of 0.178 and 0.152 acres within surface waters of the East Cape Extension and Homestead canals, respectively, would occur as result of implementing Alternative D. Direct permanent impacts of 0.590 and 0.450 acres within surface waters of the East Cape Extension and Homestead canals, respectively, would occur as result of implementing Alternative G. These filling impacts are a direct result of the placement of the new sheetpile, earthen fill and riprap for the new plug, stabilization and armoring. Direct permanent impacts of 0.102 and 0.085 acres within wetlands along the banks of the East Cape Extension and Homestead canals, respectively, would also occur as a result of

[4] Wetland/Surface Water identification codes define the type and characteristics of the wetland/surface water area. These codes are defined in detail in Section 3.4.1.3 of this document.

Alternative D. Direct permanent impacts of 0.084 and 0.085 acres within wetlands along the banks of the East Cape Extension and Homestead canals, respectively, would also occur as a result of Alternative G. These filling impacts are associated with the placement of the additional sheetpile needed for the deflector wingwalls as well as the placement of riprap for support and armoring. In addition to the above, less than 0.006 acres (250 square feet) of permanent shading impacts to both the East Cape Extension and Homestead canals would occur as a result of the proposed non-motorized boat (canoe/kayak) portage system with the implementation of either Alternative D or G. However, since no submerged aquatic vegetation are known to exist within these waterways, this new shading impact would be negligible. Also, floating mooring buoys and/or free-standing piles would be installed downstream (towards Lake Ingraham) of the dam structure for motorized vessel anchoring. Mooring buoy anchors and/or piles would minimize potential substrate disturbance. As a result, the moorings would minimize potential secondary impacts to the canal bottom from the use of standard boat anchors. As stated above, since no submerged aquatic vegetation are known to exist within these waterways, the impacts associated with installation of the moorings are negligible.

To minimize wetland resource impacts, BMPs would be implemented during construction as discussed in the analysis for Alternative C, above. These practices would include employment of staked silt fence and turbidity barriers. The barriers would be employed in the canals prior to commencement of construction and maintained throughout the construction phase of the project. After construction is completed, temporarily disturbed areas would be restored to pre-existing conditions (e.g., regraded, compacted, etc.) and possibly replanted with native coastal wetland vegetation if regrowth does not occur naturally. The turbidity barriers and silt fence would be removed at the work areas in the canals once turbidity has subsided following construction completion of the dams.

Due to the space limitations in the work area, designated work zones have been established along the canal banks in which equipment would be staged for use during construction. Additional staging is anticipated to occur on floating barge(s) along the East Cape canal at the approximate location where the Ingraham canal branches off to the west and along the Homestead canal just west of the work zone. The barge(s) are anticipated to access the East Cape Extension canal through existing navigational channels and/or deep water areas of western Florida Bay, and Lake Ingraham and the Homestead canal through the Ingraham canal, Lower East Cape canal, and existing navigational channels and/or deep water areas of Florida Bay. The barge(s) would originate from a designated staging area in the Florida Keys (e.g., Sugarloaf Key or Marathon) due to a lack of a suitable staging area in Everglades National Park and to further meet the criteria for avoidance and minimization of impacts to wetland resources (see Figure 4.3 for the potential barge route). The exact location of the staging area in the Florida Keys would be determined by the awarded contractor; however, the area would be located entirely in previously disturbed uplands (i.e., parking lot, paved area, previously filled area, etc.). No adverse impacts to protected wetland resources are anticipated to occur as a result of utilizing the proposed accessways.

For the Homestead canal (only), barge(s) are anticipated to access the work zone with the dredging of a 52-foot wide by approximately 8,320 feet long temporary access channel through the shallow water depths within Lake Ingraham. Per NPS staff, the current water elevations at high tide in Lake Ingraham are up to two feet above existing substrate with

portions becoming exposed at low tide due to accelerated sediment deposition. Portions of the lake have transitioned from an open water system to a mud flat system in recent years (Wanless and Vlaswinkel, 2005). The channel would be dredged to a depth of approximately six feet below the mean low water elevation. To minimize impacts caused by dredging, a mechanical (bucket) dredge would be used. While both hydraulic and mechanical dredging methods can successfully remove the accumulated sediments within the channel, mechanically dredged sediment can be placed along the sides of the channel (less impact), versus hydraulic dredging which would require an off-site dewatering area and possible treatment equipment to allow dredge water effluent to be returned back to Lake Ingraham, which has the potential to result in moderate to major adverse impacts to the water quality of Lake Ingraham. For mechanical dredging operations within Lake Ingraham, accumulated sediments in the channel could be removed with a conventional barge-mounted long-reach excavator (40 to 60-ft reach). The width of the base of the dredged channel would not exceed 40 feet with anticipated 3:1 side slopes for a total top cross sectional channel width of approximately 52 feet. The dredged material (approximately 40,000 cubic yards) would be temporarily stockpiled in areas adjacent to the dredged channel outward to a maximum distance of approximately 60 feet on both sides [for a total temporary impact footprint of approximately 172 feet wide by 8,320 feet long (32.852 acres)]. Turbidity resulting from the dredging operation would be contained within the construction footprint using staked and/or floating turbidity curtains or other suitable barriers to minimize the potential for turbidity beyond the limits of construction. The barriers would be employed prior to commencement of construction activities and remain in place and regularly inspected throughout the construction phase of the project. To ensure compliance with water quality standards in OFWs (see Water Resources section of EA for details on OFWs), a turbidity monitoring plan would be employed during construction. If monitoring reveals that turbidity levels exceed the standards, construction activities shall cease immediately and shall not resume until corrective measures are employed (e.g., the use of additional barriers, timing construction activities with tidal cycles, modifications to equipment, etc.). Upon completion of construction at the Homestead canal dam site, the dredged material in Lake Ingraham would be pulled back into the channel via mechanical means and the turbidity barriers would be removed once turbidity has subsided. Some of the dredged material would disperse beyond the turbidity barriers via tidal currents and wave energy; however, due to the lack of submerged aquatic vegetation in Lake Ingraham, the effect would be considered minor to negligible. The channel would be returned to pre-construction condition upon completion of construction. Per discussions with the regulatory agencies, since no protected submerged aquatic vegetation exists in the area to be dredged, the backfilling of the channel would serve as mitigation for dredging impacts to Lake Ingraham. Additionally, any resulting temporal functional losses due to this temporary impact would be mitigated with the upstream and downstream benefits to existing wetland functions within Lake Ingraham and the interior marshes of Cape Sable (see below for details).

In addition to dredging, trimming of overhanging mangrove trees may need to occur within the canals for barge access. Trimming would be conducted per the requirements of the FDEP's Mangrove Trimming Permit (to be acquired prior to commencement of construction). Approximately 0.415 acres (18,081.08 s.f.) along the East Cape Extension canal and 0.891 acres (38,798.32 s.f.) along the Homestead canal may require trimming (areas based on aerial coverage of vegetation over each waterway between the mouth of

each canal at Lake Ingraham and the existing dam site that would need to be trimmed to allow for barge access). Following construction completion, regrowth of the mangroves over the waterway would be left unrestricted and the area is expected to return to full functionality within five years.

The 0.196-acre work zone along the East Cape Extension canal and the 0.191-acre work zone along the Homestead canal for Alternative D and the 0.326-acre work zone along the East Cape Extension canal and the 0.343 work zone along the Homestead canal for Alternative G would be temporarily cleared of woody vegetation prior to construction. Following completion of construction, the work zone would be restored (e.g., regraded, compacted, etc.) to pre-existing conditions to facilitate natural recruitment of native hydrophytic vegetation. To expedite the stabilization of the area, native vegetation will be planted in the area. A monitoring program would be initiated by the NPS in order to monitor the re-growth of native vegetation in the work zone areas for a period of up to five years.

Per the results of the digital terrain model, one foot of earthen fill would need to be placed at the approximate location of the existing dam site along the southern bank of the Homestead canal (only). The fill is needed to bring an apparent low elevation area up to a higher grade to prevent a potential failure of the canal bank at this location (due to erosional processes) following construction of the new dam (see Section 4.1.4 of this document for further details). This activity would result in the temporary loss of wetland vegetation within an area of approximately 0.025 acres (1,077.88 s.f.). The area would also be planted with native wetland vegetation to reduce the potential for erosion. Since the resulting elevation would match existing adjacent grades, the area is expected to return to full functionality within five years. As a precaution, a monitoring/maintenance program would be initiated by the NPS in order to monitor and maintain the planted wetland vegetation in this area for a period of up to five years.

The areas to be affected by the physical footprint of the alternative are a mixture of regularly flooded mangrove wetlands and irregularly flooded shrub-scrub buttonwood/saltwort/mangrove wetlands as well as the open water area of the canal. The wetlands are part of and contiguous with the estuarine wetland system of the greater Cape Sable area in the vicinity of the existing marl ridge. The primary functions of these wetlands include surface and subsurface water storage, support of the biogeochemical processes (nutrient cycling, peat accretion, etc.), support of characteristic plant community, and providing suitable habitat for native fish and wildlife. These functions appear to be retained, although degraded, following excavation of the canal.

A functional analysis of the wetland areas to be impacted (permanent and temporary impacts) was conducted using UMAM (see above for description under Alternative C). Impacts to surface water areas with no protected submerged aquatic vegetation typically do not require mitigation, thus, a UMAM analysis was not performed for impacts to the waterways. A summary of the results of the assessment on the area to be permanently and temporarily impacted is provided in Tables 5.7 and 5.8, below. UMAM assessment forms for the impact areas have been provided at the end of this Wetland SOF for review.

Table 5.7 – UMAM Functional Assessment – Impacted Area - Alternative D

	Impact Area ID	Perm or Temp	Assess. Area Size	Current (Without)	Current (With)	Delta	Functional Loss
East Cape Extension Canal	Canal Banks – Filling	Perm	0.102 acres	0.667	0.500	-0.167	-0.017
	Canal Banks – Mangrove Trimming	Temp	0.415 acres	0.667	0.600	-0.067	-0.028
	Canal Banks – Work Zone Clearing	Temp	0.196 acres	0.700	0.533	-0.167	-0.033
Homestead Canal	Canal Banks – Filling	Perm	0.085 acres	0.667	0.500	-0.167	-0.014
	Canal Banks – Mangrove Trimming	Temp	0.891 acres	0.667	0.600	-0.067	-0.059
	Canal Banks – Work Zone Clearing	Temp	0.191 acres	0.700	0.533	-0.167	-0.032
	Southern Canal Bank – Filling	Temp	0.025 acres	0.667	0.500	-0.167	-0.004
	Lake Ingraham - Access Channel Dredging	Temp	32.852 acres	0.667	0.433	-0.233	-8.761

As shown in Table 5.7, the functional loss for 0.102 acres and 0.085 acres of permanent filling impacts to wetlands along the East Cape Extension and Homestead canals, respectively, was determined to be -0.017 and -0.014; and the functional loss for 0.196 acres and 0.191 acres of temporary impacts to wetlands as a result of vegetation clearing activities along the East Cape Extension and Homestead canals, respectively, was determined to be -0.033 and -0.032; and the functional loss for 0.025 acres of temporary impacts to wetlands as a result of raising the existing grade of an area along the southern bank of the Homestead canal was determined to be -0.004. The functional loss for temporary impacts to mangroves as a result of trimming activities and temporary impacts to Lake Ingraham as a result of dredging a temporary access channel are the same as what was calculated under Alternative C, above. Thus, for the East Cape Extension canal, the total functional loss as a result of Alternative D for 0.102 acres of permanent impacts and 0.611 acres of temporary impacts to wetlands is -0.078. In addition, for the Homestead canal, the total functional loss as a result of Alternative D for 0.085 acres of permanent impacts and 33.959 acres of temporary impacts to wetlands is -8.856.

Table 5.8 – UMAM Functional Assessment – Impacted Area - Alternative G

	Impact Area ID	Perm or Temp	Assess. Area Size	Current (Without)	Current (With)	Delta	Functional Loss
East Cape Extension Canal	Canal Banks – Filling	Perm	0.084 acres	0.667	0.500	-0.167	-0.014
	Canal Banks – Mangrove Trimming	Temp	0.415 acres	0.667	0.600	-0.067	-0.028
	Canal Banks – Work Zone Clearing	Temp	0.326 acres	0.700	0.533	-0.167	-0.054
Homestead Canal	Canal Banks – Filling	Perm	0.085 acres	0.667	0.500	-0.167	-0.014
	Canal Banks – Mangrove Trimming	Temp	0.891 acres	0.667	0.600	-0.067	-0.059
	Canal Banks – Work Zone Clearing	Temp	0.343 acres	0.700	0.533	-0.167	-0.057
	Southern Canal Bank - Filling	Temp	0.025 acres	0.667	0.500	-0.167	-0.004
	Lake Ingraham - Access Channel Dredging	Temp	32.852 acres	0.667	0.433	-0.233	-8.761

As shown in Table 5.8, the functional loss for 0.084 acres and 0.085 acres of permanent filling impacts to wetlands along the East Cape Extension and Homestead canals was determined to be -0.014 and -0.014; the functional loss for 0.326 acres and 0.343 acres of temporary impacts to wetlands as a result of vegetation clearing activities along the East Cape Extension and Homestead canals, respectively, was determined to be -0.054 and -0.057; and the functional loss for 0.025 acres of temporary impacts to wetlands as a result of raising the existing grade of an area along the southern bank of the Homestead canal was determined to be -0.004. The functional loss for temporary impacts to mangroves as a result of trimming activities and temporary impacts to Lake Ingraham as a result of dredging a temporary access channel are the same as what was calculated under Alternative C, above. Thus, for the East Cape Extension canal, the total functional loss as a result of Alternative G for 0.084 acres of permanent impacts and 0.741 acres of temporary impacts to wetlands is -0.096. In addition, for the Homestead canal, the total functional loss as a result of Alternative G for 0.085 acres of permanent impacts and 34.111 acres of temporary impacts to wetlands is -8.895.

All BMPs typically associated with NPS construction projects would be properly implemented and maintained throughout all construction activities minimizing short-term secondary impacts to adjacent and downstream wetland areas. Water quality impacts resulting from erosion and sedimentation during construction activities would be controlled through the use of BMPs, including temporary erosion control measures. Temporary erosion control measures would consist of staked silt fence and turbidity barriers. No substantial impacts due to sedimentation or water quality degradation are anticipated to occur during construction activities; however, the project would require a temporary mixing

zone upstream and downstream of the dam location in order to allow for settling of any turbidity generated during construction since the project is located in OFWs, which has restrictive requirements pertaining to water quality (i.e., zero NTUs above ambient). If turbid conditions persist outside of the temporary mixing zone, the awarded contractor would be required to take all necessary measures to control turbidity. These measures may include timing construction activities with tidal cycles, modifications to equipment, or temporarily ceasing operations completely, if necessary. Permanent erosion control measures would consist of restoring disturbed areas (e.g., regrading, compacting, planting, etc.) and placement of riprap on disturbed banks for stability.

The potential for long-term secondary impacts resulting from the project were also analyzed due to the lack of a vegetative buffer between the proposed dam sites and the adjacent wetlands. However, since the area is located in the backcountry of Everglades National Park and no active roadways or trails lead to this area, continued long-term disturbance at the dam sites is not anticipated. In addition, the potential for long-term, indirect, negligible to minor adverse impacts to the wetland areas directly adjacent to the existing dams would be remedied through the construction of canoe/kayak portages over the new dams. Details of the portage are discussed in Section 4.0 of this document. Thus, this observed activity is not anticipated to continue following dam construction, which provides a net benefit in relation to indirect/secondary impacts.

Furthermore, no adverse impacts are anticipated to occur to the watershed as a result of the proposed project due to the derived benefits. Although a small area of existing wetland vegetation would be permanently impacted with construction of this alternative, the upstream and downstream benefits to existing wetland functions for Lake Ingraham (approximately 1,863 acres) and the interior marshes of Cape Sable (approximately 55,894 acres based on the aerial extent of this area from just north of the marl ridge to the southern edge of Whitewater Bay) outweighs the wetland functional loss derived from the implementation of Alternative D or Alternative G (see above). This is evidenced through the use of the UMAM functional analysis as shown above in the analysis for Alternative C (the UMAM analysis for Lake Ingraham and the interior marshes is the same for all alternatives), which was used to assess the potential benefits to the interior marshes and Lake Ingraham (mitigation sites) derived as a result of the proposed project. In addition, the temporary impacts would be mitigated through onsite restoration activities as discussed above and a mitigation UMAM functional analysis was also performed for these temporary impacts to show that any resulting temporal functional losses would be mitigated with the upstream and downstream benefits to existing wetland functions within Lake Ingraham and the interior marshes of Cape Sable. The results of this UMAM assessment is similar to the analysis for Alternative C; however, differ slightly due to the size of the temporary work zone per each alternative. The results of the UMAM analysis for the onsite restoration areas are shown below in Tables 5.9 and 5.10. UMAM assessment forms for the onsite restoration areas have been provided at the end of this Wetland SOF for review.

Table 5.9 – UMAM Functional Assess. for Onsite Restoration Areas – Alternative D

Mitigation Area ID		Assess. Area Size	Current (Without)	Current (With)	Delta	Time Lag	Risk	Relative Functional Gain	Functional Gain (Mitigation Credits)
East Cape Extension Canal	Mangrove Trimming Onsite Restoration	0.415 acres	0.600	0.667	0.067	1.14	1.25	0.047	0.019
	Temporary Work Zone Onsite Restoration	0.196 acres	0.533	0.700	0.167	1.14	1.25	0.117	0.023
Homestead Canal	Mangrove Trimming Onsite Restoration	0.891 acres	0.600	0.667	0.067	1.14	1.25	.047	0.042
	Temporary Work Zone Onsite Restoration	0.191 acres	0.533	0.700	0.167	1.14	1.25	0.117	0.022
	Southern Canal Bank Filling Area Restoration	0.025 acres	0.533	0.700	0.167	1.14	1.25	0.117	0.003
	Access Channel Dredging Onsite Restoration	32.852 acres	0.433	0.667	0.233	1.03	1.25	0.181	5.946

The time lag (the period of time between when the functions are lost at the impact site and when the functions are achieved at the mitigation site) and risk (the degree of uncertainty that the proposed conditions would be achieved resulting in a reduction in the ecological value of the mitigation sites) scores for the southern canal bank filling restoration area for the Homestead canal (only) listed in Table 5.9, above, were determined as follows:

Southern Canal Bank Filling Restoration Area (Homestead canal only): The time lag was determined to be five years resulting in a T-factor score of 1.14 to allow for growth of the mangrove/saltwort-dominated vegetation and to attain comparable pre-impact conditions. The risk was determined to have a score of 1.25 since vulnerability is low with a high probability of success (hydrological conditions, water quality, adjacent land uses not a factor; vulnerability to colonization of undesirable invasive exotics is low; vulnerability to undesirable plant communities is low).

The mitigation functional gain for the southern canal bank filling restoration area for the Homestead canal (only) was calculated as follows:

A relative functional gain [mitigation Delta / (risk x time lag)] for the restoration of the southern canal bank filling area (Homestead canal only) is 0.117. The actual mitigation functional gain (relative functional gain x acres) provided by this onsite restoration is 0.003.

Thus, for the East Cape Extension canal, the total calculated functional gain for onsite restoration of 0.611 acres and offsite enhancement of 57,757 acres of wetlands is 3,111.487; whereas, the total calculated functional loss for 0.102 acres of permanent impacts and 0.611 acres of temporary impacts to wetlands as a result of implementing Alternative D is -0.078 showing that the overall benefit to local and regional wetlands in the greater Cape Sable area as a result of the construction of this alternative far outweighs the total calculated functional loss to wetlands associated with construction. Thus, no additional mitigation is warranted for proposed permanent and temporary impacts to onsite wetlands as a result of implementing Alternative D for the East Cape Extension canal.

Similarly, for the Homestead canal, the total calculated functional gain for onsite restoration of 33.934 acres and offsite enhancement of 57,757 acres of wetlands is 3,117.435; whereas, the total calculated functional loss for 0.085 acres of permanent impacts and 33.959 acres of temporary impacts to wetlands as a result of implementing Alternative D is -8.856 showing that the overall benefit to local and regional wetlands in the greater Cape Sable area as a result of the construction of this alternative far outweighs the total calculated functional loss to wetlands associated with construction. Thus, no additional mitigation is warranted for proposed permanent and temporary impacts to onsite wetlands as a result of implementing Alternative D for the Homestead canal.

Table 5.10 – UMAM Functional Assess. for Onsite Restoration Areas – Alternative G

Mitigation Area ID		Assess. Area Size	Current (Without)	Current (With)	Delta	Time Lag	Risk	Relative Functional Gain	Functional Gain (Mitigation Credits)
East Cape Extension Canal	Mangrove Trimming Onsite Restoration	0.415 acres	0.600	0.667	0.067	1.14	1.25	0.047	0.019
	Temporary Work Zone Onsite Restoration	0.326 acres	0.533	0.700	0.167	1.14	1.25	0.117	0.038
Homestead Canal	Mangrove Trimming Onsite Restoration	0.891 acres	0.600	0.667	0.067	1.14	1.25	.047	0.042
	Temporary Work Zone Onsite Restoration	0.343 acres	0.533	0.700	0.167	1.14	1.25	0.117	0.040

Mitigation Area ID		Assess. Area Size	Current (Without)	Current (With)	Delta	Time Lag	Risk	Relative Functional Gain	Functional Gain (Mitigation Credits)
	Southern Canal Bank Filling Area Restoration	0.025 acres	0.533	0.700	0.167	1.14	1.25	0.117	0.003
	Access Channel Dredging Onsite Restoration	32.852 acres	0.433	0.667	0.233	1.03	1.25	0.181	5.946

Thus, for the East Cape Extension canal, the total calculated functional gain for onsite restoration of 0.741 acres and offsite enhancement of 57,757 acres of wetlands is 3,111.479; whereas, the total calculated functional loss for 0.084 acres of permanent impacts and 0.741 acres of temporary impacts to wetlands as a result of implementing Alternative G is -0.096 showing that the overall benefit to local and regional wetlands in the greater Cape Sable area as a result of the construction of this alternative far outweighs the total calculated functional loss to wetlands associated with construction. Thus, no additional mitigation is warranted for proposed permanent and temporary impacts to onsite wetlands as a result of implementing Alternative G.

Similarly, for the Homestead canal, the total calculated functional gain for onsite restoration of 34.111 acres and offsite enhancement of 57,757 acres of wetlands is 3,117.453; whereas, the total calculated functional loss for 0.085 acres of permanent impacts and 34.111 acres of temporary impacts to wetlands as a result of implementing Alternative G is -8.895 showing that the overall benefit to local and regional wetlands in the greater Cape Sable area as a result of the construction of this alternative far outweighs the total calculated functional loss to wetlands associated with construction. Thus, no additional mitigation is warranted for proposed permanent and temporary impacts to onsite wetlands as a result of implementing Alternative G.

While all the environmental impacts of climate change would affect South Florida and Everglades National Park within the next century, the key concern for the lowlying Cape Sable area would be rising sea level, "with a very high likelihood" that the sea level would rise an additional 1.5 feet in the next 50 years and a cumulative total of three to five feet within a century (CCATF, 2008). Vegetation and wetlands would be impacted by the increasing amount and duration of saltwater in the interior freshwater and brackish marshes of Cape Sable. While slowing the rate of sea level rise is beyond the resources of the park, these impacts would be mitigated in the short-term to intermediate-term time frame by the construction of the proposed dam structure. The dams would reduce the intensity and duration of saltwater entering the interior freshwater and brackish Cape Sable marshes via the East Cape Extension and Homestead canals. The slowing or postponement of impacts by the construction of a dam structure would allow time for the interior marshes of Cape Sable to restabilize and recover from the current impacts caused by the breached dams and allow more time for the system and resources to adjust to the changes caused by climate change and sea level rise.

2) Cumulative Impacts. No cumulative impacts to vegetation and wetlands would occur as a result of combining the cumulative projects with the actions contained in Alternative D or G because the effects of the cumulative projects would be negligible. Impacts to vegetation and wetlands would be limited only to those direct and indirect impacts resulting from implementation of Alternative D or G. For more information on the cumulative projects and the determinations of negligible impacts see Section 1.4.5 and Section 3.2.3 of the EA, respectively.

3) Conclusion. For Alternative D or G, construction activities would result in minor adverse, localized, direct effects on vegetation. However, this action alternative would provide an overall benefit to local and regional wetlands in the greater Cape Sable area, which far outweighs the minor direct impacts associated with construction. The conservation of the local and regional wetlands receiving the benefits derived from the project is (1) necessary to fulfill specific purposes identified in the establishing legislation of the park, (2) key to the natural or cultural integrity of the park or opportunities for enjoyment of the park, or (3) identified as a goal in the park's master plan or other NPS planning documents. Alternative D or G would result in short-term, minor, adverse, and localized impacts as well as long-term beneficial effects. Thus, there would be no impairment of vegetation and wetlands as a result of the implementation of Alternative D or G.

Action Alternatives D1 (New 100' Plug - Geotubes) and G1 (New 430' Plug - Geotubes)

These alternatives provide a construction option for the Homestead canal (only) that allows for further avoidance and minimization of impacts to wetland resources from Alternatives D and G through the avoidance of dredging a 52-foot wide by approximately 8,320 feet long navigational channel through Lake Ingraham. However, minor unavoidable wetland impacts would still occur since the project is wetland dependent and constructed entirely within wetlands/surface waters. Under Alternative D1, the existing dam would be removed and replaced with an approximate 100-foot plug centered on the highest elevation point of the marl ridge along the Homestead canal (see Figure 4.2 in Section 4.1.4 depicting the location of the preferred alternative along the highest elevation points of the marl ridge along the Homestead canal). Under Alternative G1, the existing dam would be removed and replaced with an approximate 430-foot plug filling the length of the approximate marl ridge along the Homestead canal. Wetland and surface water impacts are largely restricted to the immediate banks of the canal. Impact minimization efforts have been considered during this study to reduce impacts to the adjacent wetland/surface water systems to the maximum extent possible while maintaining safe and sound engineering and construction practices. Unavoidable direct impacts (permanent and temporary) were quantified for Alternative D1 and Alternative G1 based on the aerial extent of wetlands/surface waters within the proposed construction limits. The resulting quantities are depicted in Table 5.11, below:

Table 5.11 – Direct Impacts to Wetlands/Surface Waters for Alternatives D1 and G1

	Wetland/Surface Water ID[5]	Type of Impact/ Perm or Temp	Description	Direct Wetland Impacts (ft^2)	Direct Wetland Impacts (acres)
Alternative D1	E1UBLx	Fill and Riprap - Permanent	Homestead Canal	3,645.27	0.084
	E1UBLx	Geotubes - Permanent	Homestead Canal	2,262.73	0.052
	E1UBLx	Plug Fill - Permanent	Homestead Canal	4,505.56	0.103
	E2SS3P/E2EMP	Riprap - Permanent	Banks of Homestead Canal	1,394.25	0.032
	E2SS3P/E2EMP	Mangrove Trimming - Temporary	Banks of East Cape Extension Canal	18,081.08	0.415
	E2SS3P/E2EMP	Earthen Fill - Temporary	Southern Bank of Homestead Canal	1,077.88	0.025
	E2SS3P/E2EMP	Temp. Work Zone Clearing - Temporary	Banks of Homestead Canal	5,473.93	0.126
Alternative G1	E1UBLx	Fill and Riprap - Permanent	Homestead Canal	3,645.27	0.084
	E1UBLx	Geotubes - Permanent	Homestead Canal	2,262.73	0.052
	E1UBLx	Plug Fill - Permanent	Homestead Canal	17,705.56	0.406
	E2SS3P/E2EMP	Riprap - Permanent	Banks of Homestead Canal	1,394.25	0.032
	E2SS3P/E2EMP	Mangrove Trimming - Temporary	Banks of Homestead Canal	38,798.32	0.891
	E2SS3P/E2EMP	Earthen Fill - Temporary	Southern Bank of Homestead Canal	1,077.88	0.025
	E2SS3P/E2EMP	Temp. Work Zone Clearing - Temporary	Banks of Homestead Canal	23,600.81	0.542

Direct permanent impacts of 0.239 acres within surface waters of the canal would occur as result of implementing Alternative D1 and direct permanent impacts of 0.542 acres within surface waters of the canal would occur as result of implementing Alternative G1. These filling impacts are a direct result of the placement of the geotubes, earthen fill and riprap for the new plug, stabilization and armoring. Direct permanent impacts of 0.032 acres within wetlands along the banks of the canal would also occur as a result of implementing Alternative D1 and direct permanent impacts of 0.032 acres within wetlands along the

[5] Wetland/Surface Water identification codes define the type and characteristics of the wetland/surface water area. These codes are defined in detail in Section 3.4.1.3 of this document.

banks of the canal would also occur as a result of implement Alternative G1. These filling impacts are associated with the placement of riprap for slope support and armoring of the geotubes. Also, floating mooring buoys and/or free-standing piles would be installed downstream (towards Lake Ingraham) of the dam structure for motorized vessel anchoring. Mooring buoy anchors and/or piles would minimize potential substrate disturbance. As a result, the moorings would minimize potential secondary impacts to the canal bottom from the use of standard boat anchors. Since no submerged aquatic vegetation is known to exist within these waterways, the impacts associated with installation of the moorings are negligible.

To minimize wetland resource impacts, BMPs would be implemented during construction as discussed in the analysis for Alternative C, above. These practices would include employment of staked silt fence and turbidity barriers. The barriers would be employed in the Homestead canal prior to commencement of construction and maintained throughout the construction phase of the project. After construction is completed, temporarily disturbed areas would be restored to pre-existing conditions (e.g., regraded, compacted, etc.) and possibly replanted with native coastal wetland vegetation if regrowth does not occur naturally. The turbidity barriers and silt fence would be removed from the canal/work area once turbidity has subsided following construction completion of the dam.

Due to the space limitations in the work area, a designated work zone has been established along the canal banks in which small equipment and materials would be staged for use during construction. Additional staging is anticipated to occur on floating barge(s) at the western terminus of the Ingraham canal (eastern mouth of Lake Ingraham). This additional staging area is required due to access restrictions from this location to the work area along the Homestead canal (i.e., very shallow water depths within Lake Ingraham). Per NPS staff, the current water elevations at high tide in Lake Ingraham are up to two feet above existing substrate with portions becoming exposed at low tide due to accelerated sediment deposition. Portions of the lake have transitioned from an open water system to a mud flat system in recent years (Wanless and Vlaswinkel 2005). Therefore, in order to avoid dredging impacts to Lake Ingraham, fill material would be transported to the Homestead canal work area through a constructed floating pipeline. Since the pipeline would be floating on top of the lake waters, no adverse impacts to the lake are anticipated to occur from this activity. The 6-8 inch pipeline would be constructed using a shallow draft barge and would run from the work area to a larger barge located at the designated staging area at the western terminus of the Ingraham canal for a distance of approximately two miles. The use of the shallow draft barge is not anticipated to require dredging of the lake. Fill material would be transported to the staging area at the Ingraham canal and conveyed through the pipe via hydraulic pumping to the work area at the Homestead canal to fill the geotubes and plug. Riprap (armoring materials) would be transported to the work area using a helicopter (see Section 4.0 for further details regarding this alternative). The barge(s) are anticipated to access the Ingraham canal through the Lower east Cape canal and existing navigational channels and/or deep water areas of western Florida Bay originating from a designated staging area in the Florida Keys (e.g., Sugarloaf Key or Marathon) due to a lack of a suitable staging area in Everglades National Park and to further meet the criteria for avoidance and minimization of impacts to wetland resources (see Figure 4.3 for the potential barge route). The exact location of the staging area in the Florida Keys would be determined by the awarded contractor; however, the area would be located entirely in previously disturbed uplands

(i.e., parking lot, paved area, previously filled area, etc.). No adverse impacts to protected wetland resources are anticipated to occur as a result of utilizing the Ingraham canal as a staging area.

Trimming of overhanging mangrove trees may need to occur within the canals for barge access. Trimming would be conducted per the requirements of the FDEP's Mangrove Trimming Permit (to be acquired prior to commencement of construction). Approximately 0.415 acres (18,081.08 s.f.) along the East Cape Extension canal and 0.891 acres (38,798.32 s.f.) along the Homestead canal may require trimming (areas based on aerial coverage of vegetation over each waterway between the mouth of each canal at Lake Ingraham and the existing dam site that would need to be trimmed to allow for barge access). Following construction completion, regrowth of the mangroves over the waterway would be left unrestricted and the area is expected to return to full functionality within five years.

The 0.126-acre temporary work zone for Alternative D1 and the 0.542-acre temporary work zone for Alternative G1 along the Homestead canal would be temporarily cleared of woody vegetation prior to construction. Following completion of construction, the work zone would be restored (e.g., regraded, compacted, etc.) to pre-existing conditions to facilitate natural recruitment of native hydrophytic vegetation. To expedite the stabilization of the area, native vegetation will be planted in the area. A monitoring program would be initiated by the NPS in order to monitor the re-growth of native vegetation in the work zone areas for a period of up to five years.

Per the results of the digital terrain survey, one foot of earthen fill would need to be placed at the approximate location of the existing dam site along the southern bank of the Homestead canal (only). The fill is needed to bring an apparent low elevation area up to a higher grade to prevent a potential failure of the canal bank at this location (due to erosional processes) following construction of the new dam (see Section 4.1.4 of this document for further details). This activity would result in the temporary loss of wetland vegetation within an area of approximately 0.025 acres (1,077.88 s.f.). The area would also be planted with native wetland vegetation to reduce the potential for erosion. Since the resulting elevation would match existing adjacent grades, the area is expected to return to full functionality within five years. As a precaution, a monitoring/maintenance program would be initiated by the NPS in order to monitor and maintain the planted wetland vegetation in this area for a period of up to five years.

The area to be affected by the physical footprint of the alternative is a mixture of regularly flooded mangrove wetlands and irregularly flooded shrub-scrub buttonwood/saltwort/ mangrove wetlands as well as the open water area of the canal. The wetlands are part of and contiguous with the estuarine wetland system of the greater Cape Sable area in the vicinity of the existing marl ridge. The primary functions of these wetlands include surface and subsurface water storage, support of the biogeochemical processes (nutrient cycling, peat accretion, etc.), support of characteristic plant community, and providing suitable habitat for native fish and wildlife. These functions appear to be retained, although degraded, following excavation of the canal.

A functional analysis of the wetland areas to be impacted (permanent and temporary impacts) was conducted using UMAM (see above for description under Alternative C). Impacts to surface water areas with no protected submerged aquatic vegetation typically

do not require mitigation, thus, a UMAM analysis was not performed for impacts to the waterway itself. A summary of the results of the assessment on the areas to be permanently and temporarily impacted is provided in Table 5.12, below. UMAM assessment forms for the impact areas have been provided at the end of this Wetland SOF for review.

Table 5.12 – UMAM Functional Assess. – Impacted Area - Alternatives D1 and G1

	Impact Area ID	Perm or Temp	Assess. Area Size	Current (Without)	Current (With)	Delta	Functional Loss
Alternative D1	Canal Banks – Filling	Perm	0.032 acres	0.667	0.500	-0.167	-0.005
	Canal Banks – Mangrove Trimming	Temp	0.415 acres	0.667	0.600	-0.067	-0.028
	Southern Canal Bank – Filling	Temp	0.025 acres	0.667	0.500	-0.167	-0.004
	Canal Banks – Work Zone Clearing	Temp	0.126 acres	0.700	0.533	-0.167	-0.021
Alternative G1	Canal Banks – Filling	Perm	0.032 acres	0.667	0.500	-0.167	-0.005
	Canal Banks – Mangrove Trimming	Temp	0.891 acres	0.667	0.600	-0.067	-0.059
	Southern Canal Bank – Filling	Temp	0.025 acres	0.667	0.500	-0.167	-0.004
	Canal Banks – Work Zone Clearing	Temp	0.542 acres	0.700	0.533	-0.167	-0.091

As shown in Table 5.12, the functional loss for 0.032 acres of permanent filling impacts to wetlands along the Homestead canal for both alternatives was determined to be -0.005; and the functional loss for 0.126 acres and 0.542 acres of temporary impacts to wetlands as a result of vegetation clearing activities along the Homestead canal for Alternative D1 (NPS Preferred Alternative for the Homestead canal) and Alternative G1, respectively, was determined to be -0.021 and -0.091. The functional loss for temporary impacts to mangroves as a result of trimming activities and for temporary impacts resulting from the need to raise the existing grade of an area along the southern bank of the Homestead canal for both alternatives are the same as what was calculated under the analysis for Alternatives D and G, above. Thus, the total functional loss as a result of Alternative D1 (NPS Preferred Alternative for the Homestead canal) for 0.032 acres of permanent impacts and 0.566 acres of temporary impacts to wetlands is -0.058. In addition, the total functional

loss as a result of Alternative G1 for 0.032 acres of permanent impacts and 1.458 acres of temporary impacts to wetlands is -0.159.

The UMAM analysis indicates that the wetland areas have a score of 0.667, which falls within the moderate quality range, between 0.50 and 0.79. Wetlands assigned UMAM scores less than 0.50 are typically highly disturbed and have limited wetland functions. Wetlands assigned UMAM scores greater than 0.79 are typically high quality wetlands with sustained wetland functions.

All BMPs typically associated with NPS construction projects would be properly implemented and maintained throughout all construction activities minimizing short-term secondary impacts to adjacent and downstream wetland areas. Water quality impacts resulting from erosion and sedimentation during construction activities would be controlled through the use of BMPs, including temporary erosion control measures. Temporary erosion control measures would consist of staked silt fence and turbidity barriers. No substantial impacts due to sedimentation or water quality degradation are anticipated to occur during construction activities; however, the project would require a temporary mixing zone upstream and downstream of the dam locations in order to allow for settling of any turbidity generated during construction since the project is located in OFWs, which has restrictive requirements pertaining to water quality (i.e., zero NTUs above ambient). If turbid conditions persist outside of the temporary mixing zone, the awarded contractor would be required to take all necessary measures to control turbidity. These measures may include timing construction activities with tidal cycles, modifications to equipment, or temporarily ceasing operations completely, if necessary. Permanent erosion control measures would consist of restoring disturbed areas (e.g., regrading, compacting, planting, etc.) and placement of riprap on disturbed banks for stability.

The potential for long-term secondary impacts resulting from the project were also analyzed due to the lack of a vegetative buffer between the proposed dam site and the adjacent wetlands. However, since the area is located in the backcountry of Everglades National Park and no active roadways or trails lead to this area, continued long-term disturbance at the dam sites is not anticipated. In addition, the potential for long-term, indirect, negligible to minor adverse impacts to the wetland areas directly adjacent to the existing dams would be remedied through the construction of canoe/kayak portages over the new dams. Details of the portage are discussed in Section 4.0 of this document. Thus, this observed activity is not anticipated to continue following dam construction, which provides a net benefit in relation to indirect/secondary impacts.

Furthermore, no adverse impacts are anticipated to occur to the watershed as a result of the proposed project due to the derived benefits. Although a small area of existing wetland vegetation would be impacted with construction of this alternative, the upstream and downstream benefits to existing wetland functions for Lake Ingraham (approximately 1,863 acres) and the interior marshes of Cape Sable (approximately 55,894 acres based on the aerial extent of this area from just north of the marl ridge to the southern edge of Whitewater Bay) outweighs the wetland functional loss derived from the implementation of Alternative D1 or Alternative G1 (see above). This is evidenced through the use of the UMAM functional analysis as shown above in the analysis for Alternatives D and G (the UMAM analysis for Lake Ingraham and the interior marshes is the same for all alternatives), which was used to assess the potential benefits to the interior marshes and Lake Ingraham (mitigation sites) derived as a result of the proposed project. In addition,

the temporary impacts would be mitigated through onsite restoration activities as discussed above and a mitigation UMAM functional analysis was also performed for these temporary impacts to show that any resulting temporal functional losses would be mitigated with the upstream and downstream benefits to existing wetland functions within Lake Ingraham and the interior marshes of Cape Sable. The results of this UMAM assessment is similar to the analysis for Alternatives D and G; however, differ slightly due to the size of the temporary work zone per each alternative. The results of the UMAM analysis for the onsite restoration areas are shown below in Table 5.13. UMAM assessment forms for the onsite restoration areas have been provided at the end of this Wetland SOF for review.

Table 5.13 – UMAM Functional Assess. for Onsite Restoration Areas – Alternatives D1 and G1

Mitigation Area ID		Assess. Area Size	Current (Without)	Current (With)	Delta	Time Lag	Risk	Relative Functional Gain	Functional Gain (Mitigation Credits)
Alternative D1	Mangrove Trimming Onsite Restoration	0.415 acres	0.600	0.667	0.067	1.14	1.25	0.047	0.019
	Southern Canal Bank Filling Area Restoration	0.025 acres	0.533	0.700	0.167	1.14	1.25	0.117	0.003
	Temporary Work Zone Onsite Restoration	0.126 acres	0.533	0.700	0.167	1.14	1.25	0.117	0.015
Alternative G1	Mangrove Trimming Onsite Restoration	0.891 acres	0.600	0.667	0.067	1.14	1.25	.047	0.042
	Southern Canal Bank Filling Area Restoration	0.025 acres	0.533	0.700	0.167	1.14	1.25	0.117	0.003
	Temporary Work Zone Onsite Restoration	0.542 acres	0.533	0.700	0.167	1.14	1.25	0.117	0.063

Thus, for Alternative D1, the total calculated functional gain for onsite restoration of 0.566 acres and offsite enhancement of 57,757 acres of wetlands is 3,111.459; whereas, the total calculated functional loss for 0.032 acres of permanent impacts and 0.566 acres of

temporary impacts to wetlands is -0.058 showing that the overall benefit to local and regional wetlands in the greater Cape Sable area as a result of the construction of this alternative far outweighs the total calculated functional loss to wetlands associated with construction. Thus, no additional mitigation is warranted for proposed permanent and temporary impacts to onsite wetlands as a result of implementing Alternative D1.

Similarly, for Alternative G1, the total calculated functional gain for onsite restoration of 1.458 acres and offsite enhancement of 57,757 acres of wetlands is 3,117.530; whereas, the total calculated functional loss for 0.032 acres of permanent impacts and 1.458 acres of temporary impacts to wetlands is -0.159 showing that the overall benefit to local and regional wetlands in the greater Cape Sable area as a result of the construction of this alternative far outweighs the total calculated functional loss to wetlands associated with construction. Thus, no additional mitigation is warranted for proposed permanent and temporary impacts to onsite wetlands as a result of implementing Alternative G1.

While all the environmental impacts of climate change would affect South Florida and Everglades National Park within the next century, the key concern for the lowlying Cape Sable area would be rising sea level, "with a very high likelihood" that the sea level would rise an additional 1.5 feet in the next 50 years and a cumulative total of three to five feet within a century (CCATF, 2008). Vegetation and wetlands would be impacted by the increasing amount and duration of saltwater in the interior freshwater and brackish marshes of Cape Sable. While slowing the rate of sea level rise is beyond the resources of the park, these impacts would be mitigated in the short-term to intermediate-term time frame by the construction of the proposed dam structure. The dams would reduce the intensity and duration of saltwater entering the interior freshwater and brackish Cape Sable marshes via the East Cape Extension and Homestead canals. The slowing or postponement of impacts by the construction of a dam structure would allow time for the interior marshes of Cape Sable to restabilize and recover from the current impacts caused by the breached dams and allow more time for the system and resources to adjust to the changes caused by climate change and sea level rise.

2) Cumulative Impacts. No cumulative impacts to vegetation and wetlands would occur as a result of combining the cumulative projects with the actions contained in Alternative D1 or Alternative G1 because the effects of the cumulative projects would be negligible. Impacts to vegetation and wetlands would be limited only to those direct and indirect impacts resulting from implementation of Alternative D1 or Alternative G1. For more information on the cumulative projects and the determinations of negligible impacts see Section 1.4.5 and Section 3.2.3 of the EA, respectively.

3) Conclusion. For Alternative D1 or Alternative G1, construction activities would result in minor adverse, localized, direct effects on vegetation. However, these action alternatives would provide an overall benefit to local and regional wetlands in the greater Cape Sable area, which far outweighs the minor direct impacts associated with construction. The conservation of the local and regional wetlands receiving the benefits derived from the project is (1) necessary to fulfill specific purposes identified in the establishing legislation of the park, (2) key to the natural or cultural integrity of the park or opportunities for enjoyment of the park, or (3) identified as a goal in the park's master plan or other NPS planning documents. Alternative D1 or Alternative G1 would result in short-term, minor, adverse, and localized impacts as well as long-term beneficial effects. Thus, there would

be no impairment of vegetation and wetlands as a result of the implementation of Alternative D1 or Alternative G1.

5.3 Justification for Use of Wetlands

There are no practicable non-wetland alternatives for the construction component of the proposed action. The purpose of the project is to provide sustainable solutions to issues associated with saltwater intrusion into and degradation of freshwater and brackish marshes north of the marl ridge; illegal motorized boat access into the Marjory Stoneman Douglas Wilderness area; and unsafe conditions for motorized and non-motorized boaters at the dam sites. All areas within the study area are designated wetlands. No alternative non-wetland locations exist in the area of where the dams would function sufficiently.

6.0 COMPLIANCE

Clean Water Act Section 404

The proposed actions impact waters of the United States as defined by the Clean Water Act and are therefore subject to review by the U.S. Army Corps of Engineers. The Clean Water Act Section 404 regulates the discharge of dredged or fill material into waters of the United States. This review is conducted concurrent with the Section 10 Rivers and Harbors Act (see below) permitting process. Before moving forward with this project, NPS anticipates applying for a Section 404/Section 10 permit.

Before moving forward with this project, NPS anticipates applying for a Section 404 permit.

Rivers and Harbors Act Section 10

Section 10 of the Rivers and Harbors Act (33 U.S.C. 401 *et seq.*) requires authorization from the U.S. Army Corps of Engineers (USACE) for the construction of any structure in or over any navigable water of the United States, the excavation/dredging or deposition of material in these water or any obstruction or alteration in a "navigable water". The proposed actions include the construction of a structure within navigable waters of the United States as defined by the Rivers and Harbors Act and are therefore subject to review by the USACE. This review is conducted concurrent with the Section 404 Clean Water Act (see above) permitting process. Before moving forward with this project, NPS anticipates applying for a Section 404/Section 10 permit.

Coastal Zone Management Act

The proposed actions impact coastal resources as defined by the Coastal Zone Management Act (CZMA) (16 U.S.C. §§1451 et. seq.) and are therefore subject to review by the FDEP under the Florida Coastal Management Program (FCMP), the State of Florida's federally approved management program. The State of Florida's coastal zone includes the area encompassed by the state's 67 counties and its territorial seas. Therefore, federal actions occurring throughout the state are reviewed by the State for consistency with the FCMP. However, the State has limited its federal consistency review of federally licensed and permitted activities to the federal licenses or permits specified in Section 380.23(3)c, Florida Statutes. This review is conducted concurrent with the FDEP's Environmental Resource Permitting process. Before moving forward with this project, NPS anticipates applying for an Environmental Resources Permit from the State of Florida.

7.0 CONCLUSION

The NPS finds that there are no practicable alternatives to disturbing wetlands along the Cape Sable Extension and Homestead canals in the Cape Sable area. Wetlands have been avoided to the maximum practicable extent, and the wetland impacts that could not be avoided would be minimized. Unavoidable impacts to wetlands would be compensated for through the immediate and long-term wetland functional benefits associated with the proposed project. Table 7.1, below, summarizes the wetland impacts per each alternative. Alternative A (no action) is excluded from the summary table since this alternative would sustain the anthropomorphic impacts on erosional processes within these canals and the greater Cape Sable area and does not meet the objectives of the proposed project.

Table 7.1 – Summary of Wetland Impacts for Action Alternatives

Alternative ID		Permanent Impacts	Temporary Impacts	Total Impacts
East Cape Extension Canal	Alternative C	0.092 acres	0.568 acres	0.660 acres
	Alternative D	0.102 acres	0.611 acres	0.713 acres
	Alternative G	0.084 acres	0.741 acres	0.825 acres
Homestead Canal	Alternative C	0.106 acres	33.935 acres	34.041 acres
	Alternative D	0.085 acres	33.959 acres	34.044 acres
	Alternative G	0.085 acres	34.111 acres	34.196 acres
	Alternative D1	0.032 acres	0.566 acres	0.598 acres
	Alternative G1	0.032 acres	1.458 acres	1.490 acres

Based on the analysis of all of the proposed action alternatives, Alternative C was determined to have the least impact (permanent and temporary) on wetland resources for the Cape Sable Extension canal and Alternative D1 was determined to have the least impact on wetland resources for the Homestead canal.

The preferred alternative for the Homestead canal was determined to be Alternative D1, which coincides with the wetland analysis. However, the preferred alternative for the East Cape Extension canal was determined to be Alternative D, which was determined to result in 0.053 acres of additional wetland impact (compared to Alternative C). Alternative D was chosen over Alternative C due to the alternative's greater ability to meet the purpose,

needs and objectives of the proposed project, in particular, the ability to function for a 50-year life-cycle to prevent the loss of natural and cultural resources; provide greater visitor enjoyment; and improve the efficiency of other Park operations. Please reference the VA/CBA report in the appendices of the EA for further details.

It must be noted that the overall benefit to local and regional wetlands in the greater Cape Sable area (total wetland functional gain) as a result of the construction of any action alternative presented herein was determined to far outweighs the total calculated functional loss to wetlands associated with construction. Thus, no matter which alternative is constructed, the project would provide a net benefit to wetlands in the greater Cape Sable area of Everglades National Park.

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