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Biscayne National Park
Florida

Coral Reef Restoration Plan

Draft Programmatic Environmental Impact Statement

April 2010

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

DRAFT CORAL REEF RESTORATION PLAN/PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT

BISCAYNE NATIONAL PARK, HOMESTEAD, FLORIDA

This draft Coral Reef Restoration Plan/Programmatic Environmental Impact Statement (RP/PEIS) analyzes two alternatives, the No Action alternative (Alternative 1) and Restoration Using a Programmatic Approach (Alternative 2). Alternative 1 would not change the existing approach to coral reef restoration planning and implementation, including National Environmental Policy Act (NEPA) compliance. Currently, Biscayne National Park (BISC) resource managers evaluate the impacts of coral reef restoration actions and specific restoration methods when planning and implementing restoration at each vessel-grounding incident. In contrast, to address each coral injury under Alternative 2, the most appropriate restoration actions and specific restoration methods would be selected from a "toolbox" of methods that already have had their impacts evaluated programmatically. The final RP/PEIS will provide BISC staff and the public with a systematic approach to addressing coral reef injuries at BISC.

Public Comment: If you wish to comment on this draft Coral Reef RP/PEIS, you may submit your comments by any one of several methods. You may comment via the Internet at http://parkplanning.nps.gov/bisc. You may also mail comments to Coral Reef Restoration Plan, Biscayne National Park, 9700 SW. 328th Street, Homestead, Florida 33033. Finally, you may hand-deliver comments to Biscayne National Park, 9700 SW. 328th Street, Homestead, Florida 33033. All comments must be postmarked, transmitted, or logged no later than 60 days from the date the U.S. Environmental Protection Agency notices this document's availability in the *Federal Register*. This deadline will be posted on the National Park Service (NPS) Planning, Environment, and Public Comment (PEPC) website at http://parkplanning.nps.gov/bisc and in a BISC press release.

Before including your address, phone number, e-mail address, or other personal information in your comments, please be aware that your entire comment, including your personal identifying information, may be made publicly available at any time.

Once public comments are received and considered, a final RP/PEIS will be produced that addresses substantive public comments and identifies the alternatives considered and their environmental consequences. A Record of Decision (ROD) describing the actions to be taken (selected alternative) will also be issued. Both the final PEIS and ROD will be made available to the public.

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SUMMARY

Many vessel groundings occur annually in Biscayne National Park (BISC), Florida, causing injuries to submerged Park resources. Vessel groundings and subsequent injuries are common in shallow waters outside marked channels. It is estimated that only a small fraction of groundings are ever reported.

The goal of coral reef restoration actions in BISC is to create a stable, self-sustaining reef environment of similar topography and surface complexity to that which existed prior to injury, such that natural recovery processes, enhanced through mitigation, if needed, will lead to a fully functioning coral reef community with near natural complexity, structure, and make-up of organisms.

This Coral Reef Restoration Plan/Programmatic Environmental Impact Statement (RP/PEIS) provides BISC staff and the public with a systematic approach to addressing injuries to coral reefs caused by vessel groundings within BISC. It also describes the environmental impacts of implementing coral reef restoration under the existing process (Alternative 1) versus under a programmatic approach (Alternative 2). Alternative 1 would not change the existing approach to coral reef restoration planning and implementation, including National Environmental Policy Act (NEPA) compliance. Currently, BISC resource managers evaluate the impacts of coral reef restoration actions and specific restoration methods when planning and implementing restoration at each vessel-grounding incident. In contrast, to address each coral injury under Alternative 2, the most appropriate restoration actions and specific restoration methods would be selected from a "toolbox" of methods that already have had their impacts evaluated programmatically. Under this programmatic alternative, all restoration actions would be considered in addressing future coral reef injuries at BISC, and the most appropriate restoration actions and specific restoration method(s) would be selected based on an assessment of the injury and site conditions. The action selected, like all actions in the toolbox, would have already been analyzed and approved for use in the restoration of the site-specific injuries under the existing conditions.

Under Alternative 2, 11 reasonable and common coral reef restoration actions, some of which include a variety of methods, were identified and evaluated by an Interdisciplinary Team (IDT) for inclusion in the "toolbox" proposed as a means of facilitating and expediting the selection of restoration actions at specific injury sites:

1. No Active Restoration/No Monitoring
2. Monitoring Only
3. Reattach Biota
4. Biological Seeding
5. Abate Fuel/Chemical Spills
6. Remove Bottom Paint/Fouling Substance from Reef
7. Seal Fractures
8. Stabilize Displaced Substrate

9. Stabilize Displaced Substrate with Artificial Structures
10. Stabilize Rubble
11. Rubble Removal From Injury Site

The first step in the evaluation process was assessing each of the 11 listed restoration actions against the following set of screening criteria to determine whether it met the minimum level of acceptability needed to warrant further consideration.

- Technical Feasibility
- Compliance with Policies and Procedures of Biscayne National Park
- Compliance with Laws and Regulations
- Consistent with Restoration Goals
- Public Health and Safety

All 11 coral reef restoration actions, and their associated methods, met the minimum acceptability requirements defined by the screening criteria. These actions were evaluated as part of the "toolbox" under Alternative 2, which is summarized in Table S-1. When a coral reef injury occurs at BISC, after injuries and site conditions have been identified and assessed, under Alternative 2 an appropriate restoration action would be selected from the "toolbox" and would serve as the basis for the site-specific Restoration Plan.

The RP/PEIS describes the resources expected to be affected by the proposed alternatives. The RP/PEIS also describes the impacts that the proposed restoration alternatives are predicted to have on the affected resources, which are summarized in Table S-2. Three categories of effects are considered and analyzed: (1) direct effects, which occur at the same time and in the same place as the action; (2) indirect effects, which occur later or at a location away from the action; and (3) cumulative effects, which are additive and include those that occur in the past, present, and foreseeable future. Because this RP/PEIS is not site specific, the potential impacts of restoration actions are discussed in general terms. The following resources are evaluated:

1. Geology
2. Water Quality
3. Epibenthic Biota
4. Other Invertebrates
5. Ichthyofauna
6. Seagrasses
7. Essential Fish Habitat
8. Threatened and Endangered Species
9. Historical and Cultural Resources
10. Recreation and Visitor Experience
11. Human Health and Safety

12. Park Operations

Technical information gained from the development and implementation of individual RPs for vessel groundings within the Park over the last 10 years has been incorporated into this RP/PEIS. Most of the restoration methods identified above were previously analyzed under the NEPA process during the development of the Allie B RP (NPS, 2007a) and the Igloo Moon RP (NPS, 2007b) and subsequently applied during the active restoration of these sites. The impact analysis incorporated information from these completed restoration projects as applicable.

Implementation of either restoration alternative considered in this RP/PEIS would not result in impairment to Park resources. All restoration actions considered would improve reef resources within the Park.

Table S-1. Summary of Alternatives Considered

Alternative	Typical Injury Types	Result/Considerations
Alternative 1: No Action: Address coral reef injuries through existing framework and do not implement a programmatic approach	All coral reef injuries	▪ Site-specific planning and NEPA compliance occurs after each injury
Alternative 2: Restoration using a Programmatic Approach: Use a toolbox of suitable coral reef restoration actions and specific methods	See descriptions by restoration actions below	▪ Site-specific planning tiers to programmatic approach ▪ Streamlines process to use funds more efficiently and sooner
Actions Comprising Alternative 2		
No Active Restoration/No Monitoring: Leave injured site as is with no restoration and no monitoring	Injuries when restoration funding is not available or when safety or other constraints make visits to the site impossible	▪ Natural recovery may take longer than restoration activities ▪ Further deterioration of the coral reef may occur due to ineffective natural recovery
Monitoring Only: Collect quantitative and qualitative data about the biological recovery at grounding sites; photo-documentation and direct measurement of injuries	Surficial scarring, scraped/gouged substrate, and/or Injuries with relatively small likelihood of secondary injury before natural recovery, or where any restoration is too difficult because of high-energy conditions or risk of impacting T&E species. Possible response to any coral reef injury	▪ Monitor to ensure that further deterioration of the coral reef does not occur and that natural recovery does occur ▪ Natural recovery may take longer than restoration activities ▪ Further deterioration of the coral reef may occur due to ineffective natural recovery
Reattach Biota: Transplant species present before grounding from nearby sources to the site, usually securing pieces or whole colonies with cement	Displaced organisms or fractured/sheared biota	▪ Source of material may not be available from onsite ▪ Corals of opportunity may out compete original corals ▪ Corals from nurseries
Biological Seeding: Collect larvae during spawning events, maintain under laboratory conditions, and subsequently deploy within a mesh enclosure directly over the injured areas	Displaced organisms and fractured, displaced, crushed, or scraped/gouged substrate	▪ Raising corals *in situ* is a time-consuming process, making corals more prone to impacts resulting from environmental disturbances ▪ Conditions onsite may not be favorable for larvae recruitment, impeding settlement ▪ Biological seeding may provide or increase genetic diversity within the restored reef system
Abate Fuel/Chemical Spills: Remove surficial portion of substrate with toxic material and dispose	Release of toxic substances	▪ Reduces further damage to affected biota and to exposed surrounding biota ▪ Additional damage possible during removal of grounded vessel
Remove Bottom Paint/Fouling Substance from Reef: Remove surficial portion of substrate with toxic material and dispose	Deposition of toxic substances on reef	▪ Reduces further damage to affected biota and to exposed surrounding biota ▪ Minimal dispersal of toxic material may occur during removal activities, causing secondary damage to adjacent biota

Table S-1. Summary of Alternatives Considered (Concluded)

Alternative	Typical Injury Types	Result/Considerations
Seal Fractures: Clean and roughen opposing substrate surfaces, work cement or epoxy into visible fissures and cracks, and seal fractures	Restoration of fractured substrate	▪ Sealing fractures can immediately reestablish the structural framework of the reef ▪ May provide suitable stable substrate for recruitment of biota ▪ Spilled adhesive material may harm biota near the injury
Stabilize Displaced Substrate: Reestablish topography by placing displaced substrate or non-native materials in natural reef depressions	Displaced substrate injuries	▪ May immediately reestablish the structural complexity of the reef and can increase the amount of suitable stable substrate for recruitment ▪ Spilled adhesive material may injure surrounding biota ▪ Reattached biota may be more prone to dislodgment after a storm event ▪ Material chosen for fabricated structures may negatively affect biota recruitment and may alter the biological structure of the injured reef system
Stabilize Displaced Substrate with Artificial Structures: Use fabricated artificial structure (e.g., made of articulated mats, cement, steel/fiberglass, or Reef Balls™) to mimic naturally occurring outcrops	Displaced substrate injuries	▪ Can restore the three-dimensional complexity of the reef system ▪ Chosen material may affect the type of organisms that will inhabit the substrate ▪ Reattached biota may be more prone to dislodgment after a storm event
Stabilize Rubble: Stabilize and/or relocate rubble onsite to more stable locations, and use barge, crane, and diver assistance to place concrete blocks of articulating mats to stabilize rubble	Displacement/burial injuries including where substrate rubble is prone to movement during high-energy events	▪ Removal of unconsolidated rubble will reduce secondary impacts to surrounding biota ▪ Rubble can be placed in a location where it can provide substrate for biota settlement or aid in reestablishing the reef's structural framework
Rubble Removal From Injury Site: Remove loose onsite substrate with a small barge or pontoon boat, winch/crane, and dive assistance	Displacement/burial injuries and specifically for grounding-related substrate pieces that cannot be used onsite in other restoration alternatives, such as filling fractures and reattaching displaced substrate to restore lost topography	▪ Immediately reduces further damage to surrounding biota resulting from the movement caused by currents and storm events ▪ Transportation of removed rubble to disposal sites may be difficult and time consuming, especially in sites where unconsolidated rubble is abundant

Table S-2. Summary of Environmental Consequences of the Alternatives

Impact Topic	Alternative 1: No Action (Current Activities Continued)	Alternative 2: Restoration Using a Programmatic Approach – Impacts of Programmatic Approach	Alternative 2: Restoration Using a Programmatic Approach – Impacts of Restoration Actions
Geology	Minor direct and indirect adverse impacts to geology are anticipated. However, moderate adverse effects, both direct and indirect, would likely occur with the more severe grounding injuries. Impacts incurred during the planning time-lag may be either short-term or long-term and are expected to last 4 to 22 months longer than with a programmatic restoration plan in place. The increased timeframe could allow erosional processes from high-energy storm events and water currents to damage and enlarge the impact area, further deteriorating the reef framework. Reef framework damage resulting from high-energy events and vessel groundings is common and often impacts unaffected reef communities. Cumulative effects are expected to be minor to moderate and long-term (continue indefinitely). No impairment to geology would occur under the No Action alternative.	The programmatic approach would have similar direct, indirect, and cumulative effects on geology as under Alternative 1; however, the effects would likely be shorter in duration and thus less severe (minor). With Alternative 2, restoration activities would likely be implemented within a reduced timeframe and therefore would decrease the probability of high-energy events and erosional processes causing further degradation of the reef matrix. No impairment to geology would occur under the programmatic approach.	Direct adverse impacts to the reef substrate from restoration implementation are anticipated to be negligible to minor. These effects may be incurred during the installation of pins/markers used to establish assessment and monitoring transects or stations, while removing bottom paint, and the use of mechanical methods (e.g., clamshell bucket) to move rubble or dislodged substrate. The duration of these impacts is anticipated to be short-term. Completion of restoration actions would provide long-term (indefinite) beneficial indirect effects. Reattaching biota and substrate and stabilizing/removing rubble would add rugosity, structural complexity, structural support, and stability to the reef matrix. In addition, these actions could reduce degradation of the reef structure from scouring, erosion, and adverse impacts from unstable substrate and rubble by restoration and stabilization of surficial substrate. Both the injury area and the adjacent reef communities would benefit from these actions. Adverse cumulative impacts would be minor to moderate and long-term. No impairment to geology is anticipated from the restoration actions.
Water Quality	Under Alternative 1 direct and indirect effects to water quality are anticipated to be adverse and minor. The duration of these effects are anticipated to be both short-term and long-term. Water quality impacts resulting from releases of fuel or other toxic material are likely short-term following a vessel grounding. Destabilization of the reef matrix resulting in higher than normal turbidity levels during high-energy events	Water quality impacts—direct, indirect, and cumulative—under a programmatic approach are anticipated to be the same as those under Alternative 1; however, the direct and indirect effects are anticipated to be shorter in duration and thus less severe. Cumulative impacts would be minor to moderate adverse and long-term. No impairment to water quality would occur under the programmatic approach.	Restoration actions are anticipated to have both beneficial and adverse direct and indirect effects on water quality. During the implementation of restoration activities minor, short-term adverse effects could occur, such as increases in turbidity at the impact site, re-suspension of bonding agent particulates, and re-suspension of toxic material. During the implementation of reef stabilization actions, such as rubble

Impact Topic	Alternative 1: No Action (Current Activities Continued)	Alternative 2: Restoration Using a Programmatic Approach – Impacts of Programmatic Approach	Alternative 2: Restoration Using a Programmatic Approach – Impacts of Restoration Actions
	could be long-term and continue until the reef matrix is stabilized either naturally or through appropriate restoration actions. Toxic materials deposited or released during a grounding incident generally result in short-term effects, as these substances are dealt with quickly during the initial response or the emergency restoration phase. Water quality impacts, although negligible to minor, are generally not localized and affect adjacent areas of the reef. Cumulative water quality impacts would be minor to moderate and long-term. No impairment to water quality is anticipated under the No Action alternative.		stabilization, rubble removal, and stabilization of displaced substrate, short-term direct and indirect effects to water quality are anticipated. Although designed for minimal dispersion in the water column, bonding agents used for reef stabilization actions and for reattaching biota could become suspended during use. These effects are generally localized and contained within the impact area. Beneficial effects would be both short-term and long-term. Cumulative effects to water quality within BISC are expected to be minor to moderate adverse and long-term. No impairment to water quality would occur with the restoration actions.
Epibenthic Biota	Both direct and indirect adverse effects to epibenthic biota are expected from Alternative 1. The magnitude of these effects ranges from minor to moderate and is directly related to the scale of the injury and the duration of the planning period. Direct effects are considered to be more severe (moderate) as the epibenthic biota within the vicinity of the grounding site generally sustains the most severe damage. The duration of these effects can be either short-term or long-term. Direct effects to epibenthic biota include scouring, erosion, scraping, burial, displacement, and exposure to toxic materials. Epibenthic biota exposed to these types of stressors can become susceptible to disease or death. Indirect effects are similar and may be caused by loose and unstable rubble/boulders. Loose and unstable rubble/boulders are especially prevalent with severe injury and following severe weather events. Colonization of primary recruiting species, although natural and important for succession following a disturbance, may be detrimental for	Epibenthic biota impacts under a programmatic approach are anticipated to be the same adverse impacts as those of Alternative 1. The reduced time-lag under programmatic restoration would likely shorten the period of time when these effects could occur; therefore, the impacts are anticipated to be adverse, shorter in duration (6 months or less), and less severe (minor) than under Alternative 1. Cumulative impacts are expected to be adverse, minor to moderate, and long-term. No impairment to epibenthic biota within BISC is anticipated under the programmatic approach.	Beneficial and adverse direct and indirect effects are anticipated from the performance of restoration actions. The intensity of adverse effects is anticipated to be negligible to minor and short-term. Localized adverse impacts to the reef community could occur as a result of diver contact and/or restoration equipment contact during implementation of the restoration actions. Additionally, turbidity caused during site preparation, bottom paint removal, and/or use of bonding agents can cause negligible to minor direct and indirect effects. However, the beneficial effects resulting from the performance of restoration actions are anticipated to be long-term as restoration actions are aimed for stabilization of a resource or its substrate thereby adding complexity and structure and would enhance re-colonization and settlement of corals and sponges and help restore the natural diversity of the reef. Cumulative impacts are expected to be adverse, minor to moderate, and long-term. No impairment to epibenthic biota would occur from restoration activities.

Impact Topic	Alternative 1: No Action (Current Activities Continued)	Alternative 2: Restoration Using a Programmatic Approach – Impacts of Programmatic Approach	Alternative 2: Restoration Using a Programmatic Approach – Impacts of Restoration Actions
	decolonization of the slower growing climatic species such as scleractinian corals. Cumulative effects would be minor to moderate and long-term. No impairment to epibenthic biota within BISC is anticipated under the No Action alternative.		
Other Invertebrates	Both direct and indirect adverse effects to other invertebrates are expected under Alternative 1. The magnitude of these effects would likely be moderate and would relate directly to the scale of the injury and the duration of the planning period. Direct effects are considered to be more severe (moderate), as other invertebrates within the vicinity of the grounding site generally sustain the most severe damage. In addition, unstable and temporary habitat often results from vessel groundings (e.g., rubble berm), which is quickly colonized by motile invertebrate species. The degree of colonization is directly related to the time-lag associated with the planning process. The longer these artificial injury features remain, the larger the population of other invertebrates that would utilize the habitat. Thus, restoration implementation conducted long after the vessel grounding would adversely affect a larger population of other invertebrates, resulting in a greater magnitude of effect. Cumulative effects are anticipated to be adverse, minor to moderate, and long-term. No impairment to motile invertebrates is anticipated under the No Action alternative.	Direct and indirect impacts to other invertebrates under a programmatic approach are anticipated to be the same as those of Alternative 1; however, the effects are anticipated to be shorter in duration and thus potentially less severe (minor). Cumulative impacts are expected to be adverse, minor to moderate, and long-term. No impairment to motile invertebrates is anticipated with the programmatic approach.	Beneficial and adverse direct and indirect effects are anticipated from the performance of restoration actions. The intensity of adverse effects is anticipated to be negligible to minor and short-term. Localized adverse impacts to the reef community could occur as a result of diver contact and/or restoration equipment contact during implementation of the restoration actions. Additionally, turbidity caused during site preparation, bottom paint removal, and/or use of bonding agents can cause negligible to minor direct and indirect effects. The beneficial effects resulting from the performance of restoration actions are anticipated to be long-term as restoration actions are aimed for stabilization of a resource or its substrate, thereby adding complexity and structure, and would enhance re-colonization and settlement of corals and sponges and help restore the natural diversity of the reef. Cumulative impacts are expected to be adverse, minor to moderate, and long-term. No impairment to motile invertebrates would occur as a result of restoration activities.
Ichthyofauna	The No Action alternative would have short-term and long-term minor to moderate adverse direct and indirect impacts on fish populations. The increased planning period would likely result in these impacts occurring for longer periods of time with potentially greater impacts. Greater loss of structural	Adverse impacts to ichthyofauna under a programmatic approach are anticipated to be the same as those of Alternative 1; however, the effects are anticipated to be short-term in duration and less likely due to the decreased planning time-lag. Cumulative impacts are expected to be adverse, minor to moderate,	Implementation of restoration actions would have negligible adverse and beneficial direct and indirect impacts to ichthyofauna. Restoration actions are aimed to stabilize and restore lost structural and biological complexity of the reef. Ichthyofauna is beneficially affected with the application of

Impact Topic	Alternative 1: No Action (Current Activities Continued)	Alternative 2: Restoration Using a Programmatic Approach – Impacts of Programmatic Approach	Alternative 2: Restoration Using a Programmatic Approach – Impacts of Restoration Actions
	complexity and biotal cover could result from the lag-time associated with Alternative 1. Cumulative impacts on ichthyofauna are considered to be long-term, minor to moderate adverse. Impacts from Alternative 1 would contribute minimally to these effects. No impairment to ichthyofauna is anticipated under the No Action alternative.	and long-term. No impairment to ichthyofauna would occur with the programmatic approach.	these actions by providing stable and complex habitat. However, during implementation, negligible impacts to ichthyofauna are associated with the performance of these actions, whereby diver presence, restoration equipment, and materials may cause short-term, localized disturbances that cause fish to temporarily leave the area. As some species leave the area during restoration action implementation, others remain and are beneficially affected. Feeding opportunities often occur when cryptic species are exposed during implementation of restoration actions. These effects would provide a negligible contribution to the existing cumulative effects, which are expected to be minor to moderate adverse and long-term. No impairment to ichthyofauna would occur with the implementation of restoration actions.
Seagrasses	The No Action alternative would have short-term to long-term minor to moderate adverse direct and indirect impacts on seagrasses. The increased planning period would likely result in impacts such as burial, exposure to toxic chemicals, and increased turbidity occurring for longer periods of time which could lead to potentially greater impacts. Greater loss of seagrass cover could result from the lag-time associated with Alternative 1. Cumulative impacts on seagrasses are considered to be long-term, minor to moderate, and adverse. Impacts from Alternative 1 would contribute minimally to these effects. No impairment to seagrasses would occur under the No Action alternative.	Seagrass impacts—direct, indirect, and cumulative—under a programmatic approach are anticipated to be the same as those of Alternative 1; however, direct and indirect effects are anticipated to be short-term in duration. No impairment to seagrasses would occur with the programmatic approach.	Implementation of restoration actions would have short-term negligible to minor adverse and short-term to long-term beneficial direct and indirect impacts to seagrasses. Direct adverse effects associated with performance of restoration actions include diver contact and turbidity caused during restoration implementation. However, direct beneficial effects associated with restoration implementation include re-exposure of buried seagrasses. Indirect beneficial effects result from stabilization of the site which reduces both the potential for burial by movement of rubble and the turbidity caused by the high energy events. Impacts associated with the implementation of restoration actions would not make an appreciable contribution to cumulative effects, which are expected to be minor to moderate adverse and long-term. No

Impact Topic	Alternative 1: No Action (Current Activities Continued)	Alternative 2: Restoration Using a Programmatic Approach – Impacts of Programmatic Approach	Alternative 2: Restoration Using a Programmatic Approach – Impacts of Restoration Actions
			impairment to seagrasses would occur with the implementation of restoration activities.
Essential Fish Habitat	The No Action alternative is anticipated to have negligible to minor adverse direct effects and minor to moderate adverse indirect effects on Essential Fish Habitat. These impacts may be short-term or long-term depending on the severity of the grounding and the duration of the time-lag associated with this alternative. Cumulative impacts to Essential Fish Habitat are expected to be adverse, minor to moderate, and long-term. No impairment to Essential Fish Habitat is anticipated under the No Action alternative.	Under a programmatic approach, direct and indirect impacts to Essential Fish Habitat are expected to be the same as those of Alternative 1; however, they are expected to be short-term in duration. Cumulative impacts to Essential Fish Habitat are expected to be adverse, minor to moderate, and long-term. No impairment to Essential Fish Habitat is anticipated under a programmatic approach.	Direct adverse impacts to Essential Fish Habitat resulting from restoration activities include temporary displacement of fish species from Essential Fish Habitat. These impacts would be short-term and negligible. Long-term, indirect beneficial effects would result from a restoration of reef complexity. Cumulative impacts to Essential Fish Habitat are expected to be adverse, minor to moderate, and long-term. No impairment to Essential Fish Habitat is anticipated from restoration activities.
Threatened and Endangered Species	**Sea Turtles –** Potential direct impacts with Alternative 1 include reduced foraging areas and changes in food sources and availability. Due to the small area of sea turtle habitat affected within BISC, these impacts were determined to be insignificant and not likely to adversely affect sea turtle populations within BISC. Alternative 1 would make no appreciable contribution to the cumulative impacts to sea turtles as a species. No impairment to sea turtles is expected with the No Action alternative. **Smalltooth Sawfish –** The direct and indirect potential for changes in population and distribution of their primary food source (small schooling reef fish that rely on reef habitat) would be localized and temporary. These impacts are considered insignificant and are not likely to adversely affect smalltooth sawfish. The direct and indirect effects of the No Action alternative would make no appreciable contribution to the cumulative impacts to the species. No impairment to smalltooth sawfish would	**Sea Turtles –** Potential direct and indirect impacts under a programmatic approach include reduced foraging areas and changes in food sources and availability. Due to the small area of sea turtle habitat affected within BISC and the short duration of effects, these impacts were determined to be insignificant and are not likely to adversely affect sea turtle populations within BISC. Additionally, Alternative 2 would make no appreciable contribution to the cumulative impacts to sea turtles as a species. No impairment to sea turtles is expected with Alternative 2. **Smalltooth Sawfish –** Potential direct and indirect impacts associated with the programmatic approach (changes in population and distribution of primary prey) are considered insignificant and are not likely to adversely affect smalltooth sawfish. Additionally, a programmatic approach would make no appreciable contribution to the cumulative impacts to smalltooth sawfish as a species. No impairment to smalltooth sawfish would occur with Alternative 2.	**Sea Turtles –** Direct impacts from restoration activities are insignificant and include avoidance of the area during restoration. Indirect effects from restoration actions are beneficial and include enhanced habitat for species on which sea turtles forage. Restoration activities associated with Alternative 2 may affect, but are not likely to adversely affect sea turtles. Alternative 2 would make no appreciable contribution to the adverse cumulative impacts to sea turtles as a species. No impairment to sea turtles is expected with Alternative 2. **Smalltooth Sawfish –** Potential direct impacts associated with restoration activities (avoidance of the area during restoration) are insignificant and not likely to adversely affect smalltooth sawfish. Indirect benefits of restoration actions include the recovery of distributions and populations of the prey of smalltooth sawfish. Restoration actions would make no appreciable contribution to the cumulative impacts to smalltooth sawfish as a species. No impairment to smalltooth sawfish would occur as a result of

Impact Topic	Alternative 1: No Action (Current Activities Continued)	Alternative 2: Restoration Using a Programmatic Approach – Impacts of Programmatic Approach	Alternative 2: Restoration Using a Programmatic Approach – Impacts of Restoration Actions
	occur with the No Action alternative.		restoration activities.
	Elkhorn and Staghorn Coral – Potential direct impacts include damage to dislodged corals that are not immediately salvaged from the injury site and potential indirect impacts include increased coral mortality/injury or reduced substrate suitable for colonization. These effects are considered localized and insignificant or discountable and therefore not likely to adversely affect the species. The No Action alternative would make no appreciable contribution to the cumulative impacts to the species. No impairment to elkhorn and staghorn corals would occur under Alternative 1. **West Indian Manatee** – No direct impacts are anticipated under Alternative 1. Indirect impacts include loss or alteration of foraging area. Impacts are considered insignificant due to the small area affected compared to the remaining foraging habitat in BISC. Therefore, Alternative 1 may affect, but is not likely to adversely affect the species. Alternative 1 would make no appreciable contribution to the cumulative impacts to the West Indian manatee as a species. No impairment to the West Indian manatee would occur under the No Action alternative. **Pillar Coral** – Potential direct impacts include damage to dislodged corals that are not immediately salvaged from the injury site and potential indirect impacts include increased coral mortality/injury or reduced substrate suitable for colonization. These	**Elkhorn and Staghorn Coral –** Potential direct impacts include damage to dislodged corals that are not immediately salvaged from the injury site and potential indirect impacts include increased coral mortality/injury or reduced substrate suitable for colonization. These effects are considered localized and insignificant or discountable and would be less likely with a programmatic approach. Therefore, they are not likely to adversely affect the species. Alternative 2 would make no appreciable contribution to the cumulative impacts to the species. No impairment to elkhorn and staghorn corals would occur with Alternative 2. **West Indian Manatee –** No direct impacts are anticipated under a programmatic approach. Indirect impacts include loss or alteration of foraging area. The reduced time-lag associated with a programmatic approach would reduce the period of time that indirect impacts could occur compared to Alternative 1. Impacts are considered insignificant due to the small area affected compared to the remaining foraging habitat in BISC. Therefore, Alternative 2 may affect, but is not likely to adversely affect the species. Alternative 2 would make no appreciable contribution to the cumulative impacts to the West Indian manatee as a species. No impairment to the West Indian manatee would occur under Alternative 2 **Pillar Coral** – Potential direct impacts of the programmatic approach include damage to dislodged corals that are not immediately salvaged from the injury site and potential indirect impacts include increased coral mortality/injury or reduced substrate suitable	**Elkhorn and Staghorn Coral –** Restoration actions associated with Alternative 2 may affect, but are not likely to adversely affect elkhorn and staghorn corals. There are discountable impacts associated with restoration work, and beneficial impacts through providing suitable substrate for recruitment and settlement, increased survival rate, a decreased likelihood of disease, and increased genetic diversity and density. Restoration actions will alleviate adverse cumulative effects on the corals as species. No impairment to elkhorn and staghorn corals would occur with implementation of restoration activities. **West Indian Manatee** – Potential direct impacts associated with restoration activities include changes in behavior from the presence of divers or boats, or collisions with restoration vessels. These impacts are extremely unlikely and are considered discountable. Anticipated indirect effects of restoration activities to the West Indian manatee are beneficial and include preventing the loss of seagrass foraging habitat. Therefore, restoration activities may affect, but are not likely to adversely affect the species. Restoration activities would make no appreciable contribution to the cumulative impacts to the West Indian manatee as a species. No impairment to the West Indian manatee would occur with the implementation of restoration activities. **Pillar Coral –** Restoration actions associated with Alternative 2 may affect, but are not likely to adversely affect pillar corals. There are discountable impacts associated with restoration work, and beneficial impacts through providing suitable substrate for

Impact Topic	Alternative 1: No Action (Current Activities Continued)	Alternative 2: Restoration Using a Programmatic Approach – Impacts of Programmatic Approach	Alternative 2: Restoration Using a Programmatic Approach – Impacts of Restoration Actions
	effects are considered localized and insignificant or discountable and therefore not likely to adversely affect the species. The No Action alternative would make no appreciable contribution to the cumulative impacts to the species. No impairment to pillar corals would occur under Alternative 1.	for colonization. These effects are considered localized and insignificant or discountable and would be less likely with a programmatic approach. Therefore, they are not likely to adversely affect the species. Alternative 2 would make no appreciable contribution to the cumulative impacts to the species. No impairment to pillar corals would occur with Alternative 2.	recruitment and settlement, increased survival rate, a decreased likelihood of disease, and increased genetic diversity and density. Alternative 2 would make no appreciable contribution to the cumulative impacts to the species. No impairment to pillar corals would occur with Alternative 2.
Historical and Cultural Resources	Potential indirect, negligible to moderate adverse impacts identified under Alternative 1 include additional scouring and erosion during the increased planning period (time-lag) that could cause loss of the qualities that qualify the cultural resource as eligible to the NRHP. For purposes of Section 106 of the NHPA, the determination would be *adverse affect.* Major adverse impacts would be prevented through emergency restoration. No impairment to historical and cultural resources is anticipated under the No Action alternative because historical and cultural resources within BISC will not be significantly impacted.	No direct adverse impacts are anticipated under this alternative. In the event of impacts to cultural resources at an injury site, indirect impacts associated with the time-lag to conduct Section 106 consultation could range from negligible to minor and adverse. Benefits would occur by means of the more expeditious nature of restoration activities under Alternative 2 relative to the No Action alternative. For purposes of Section 106 of the NHPA, the determination would be no adverse affect. No impairment to historical and cultural resources is anticipated under Alternative 2.	No direct adverse impacts are anticipated under this alternative. In the event of impacts to cultural resources at an injury site, indirect impacts associated with the time-lag to conduct Section 106 consultation could range from negligible to minor and adverse. Benefits would occur by means of the more expeditious nature of restoration activities under Alternative 2 relative to the No Action alternative. For purposes of Section 106 of the NHPA, the determination would be no adverse affect. No impairment to historical and cultural resources is anticipated under Alternative 2.
Recreation and Visitor Experience	Under the No Action alternative, minor, direct and indirect, short- to long-term adverse effects could include closure of the area to recreational boaters, divers, and fisherman until restoration was completed and biological injury from movement of rubble or further destabilization of reef. Adverse cumulative impacts would be minor, adverse, and long-term.	Under a programmatic approach, minor, direct and indirect, short-term adverse effects could include closure of the area to recreational boaters, divers, and fisherman until restoration was completed and biological injury from movement of rubble or further destabilization of reef. Effects would likely be shorter in duration than under Alternative 1. Cumulative impacts would be minor, long-term, and adverse.	Restoration actions would have negligible to minor, short-term to long-term adverse impacts on recreation and visitor experience through potential temporary site closure, use of permanent pins or stakes for monitoring, and temporary closure of boat ramps and upland staging areas. Restoration actions would impact recreation and visitor experience beneficially through improved reef complexity and habitat. Cumulative impacts would be minor, long-term, and adverse.
Human Health and Safety	Adverse impacts to human health and safety from the No Action alternative would be short-term to long-term and negligible to minor. Such impacts would include boater confusion caused by closures and potential	Any potential adverse impacts (direct, indirect, and cumulative) identified under this alternative would be less than with Alternative 1 because of the reduced time-lag associated with the programmatic	Potential adverse direct impacts to NPS staff or contractors would be short-term and negligible to minor. Human health and safety within BISC would benefit from actions such as removal and stabilization of

Impact Topic	Alternative 1: No Action (Current Activities Continued)	Alternative 2: Restoration Using a Programmatic Approach – Impacts of Programmatic Approach	Alternative 2: Restoration Using a Programmatic Approach – Impacts of Restoration Actions
	exposure of divers to paint or chemicals. Cumulative effects would be adverse, long-term, and minor.	approach. Adverse impacts would be negligible to minor and short-term.	rubble and from reduction in boater traffic to un-injured sites.
Park Operations	Any potential adverse impacts (direct, indirect, and cumulative) identified under this alternative would be minor and short-term to long-term. Uncertainty related to temporary diversions of personnel and budgetary resources would continue because temporary commitments of resources to address restoration planning and environmental review would remain when addressing incidents individually.	Potential impacts (direct, indirect, and cumulative) to Park operations identified under this alternative for implementing a programmatic approach are anticipated to have beneficial effects. Uncertainty related to temporary diversions of personnel and budgetary resources would be reduced because temporary commitments of resources to address restoration planning and environmental review would be fewer, less frequent, and of shorter duration than by responding on an individual basis. Overall, Park operations within BISC would be improved by taking this action.	Negligible adverse impacts are anticipated upon Park operations from the implementation of any of the restoration activities proposed in the toolbox.

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ACRONYMS AND ABBREVIATIONS

ABRT	Acropora Biological Review Team
ACHP	Advisory Council on Historic Preservation
BISC	Biscayne National Park
BMP	best management practice
°C	degrees Celsius
CCA	crustose coralline algae
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cm	centimeter/centimeters
CWA	Clean Water Act
DRP	Damage Recovery Program
DERM	Dade County Department of Environmental Resources Management
DO-12	Director's Order #12: Conservation Planning, Environmental Impact Analysis, and Decision Making
DO-13A	Director's Order #13A: Environmental Management Systems
DO-14	Director's Order #14: Resource Damage Assessment and Restoration
EA	environmental assessment
EFH	Essential Fish Habitat
EO	Executive Order
ERP	Environmental Resource Permit
ESA	Endangered Species Act
°F	degrees Fahrenheit
FAC	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FKNMS	Florida Keys National Marine Sanctuary
ft	foot/feet
FWC	Florida Fish and Wildlife Conservation Commission
FWCA	Fish and Wildlife Coordination Act
FWRI	Florida Fish and Wildlife Research Institute
GMP	General Management Plan
HAPC	Habitat Area of Particular Concern
IDT	Interdisciplinary Team
IUCN	International Union of Conservation of Nature

ACRONYMS AND ABBREVIATIONS (CONCLUDED)

km	kilometer/kilometers
m	meter/meters
MLW	Mean Low Water
MOA	Memorandum of Agreement
N	nitrogen
NAD	North American Datum
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPS	National Park Service
NRHP	National Register of Historic Places
P	phosphates
PEIS	Programmatic Environmental Impact Statement
PEPC	Planning, Environment and Public Comment
PSRPA	Park System Resource Protection Act
ROD	record of decision
RP	restoration plan
SAFMC	South Atlantic Fishery Management Council
SCUBA	Self-Contained Underwater Breathing Apparatus
SHPO	State Historic Preservation Office
T&E	Threatened and Endangered
TCP	traditional cultural properties
THPO	Tribal Historic Preservation Officer
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USC	United States Code

1. INTRODUCTION

Biscayne National Park (BISC or Park), located in Homestead, Florida, is the largest marine park in the National Park System. It is located south of the city of Miami, in Miami-Dade County, Florida. The Park is about 22 miles long, with its northern boundary near Key Biscayne, and its southern boundary near Key Largo (Figure 1-1). BISC, which is administered by the National Park Service (NPS), is primarily a marine park, with 95 percent of its 173,000 acres submerged. [The Park's western boundary is roughly defined by the landward extent of a mature red mangrove forest that forms a narrow band, 100–2,000 feet (ft) wide, along the western shoreline of Biscayne Bay. The Park's eastern boundary follows the 60-ft-depth contour. The approximate width of the Park, from near-shore to off-shore environment, is 14 miles. The Park preserves a unique, sensitive marine environment that is an important component of the south Florida ecosystem and economy (NPS, 2003).

1.1 Background

Many vessel groundings occur annually in BISC, causing injuries to submerged Park resources. Vessel groundings and subsequent injuries are common in shallow waters outside marked channels. It is estimated that only a small fraction of groundings are ever reported. The frequency of vessel groundings occurring within BISC is attributed in part to the Park's proximity to public marinas (e.g., Black Point, Homestead Bayfront, and Matheson Hammock county marinas). Groundings of large marine commercial vessels occur less frequently than those of recreational and small commercial boats, but still account for significant natural resource injuries. Large vessel groundings can be attributed to the Park's location adjacent to commercial shipping lanes and major navigational routes, including the Intracoastal Waterway, used by various types and sizes of vessels.

When vessel-grounding injuries occur and the responsible party is identified, damages may be sought under the Park System Resource Protection Act (PSRPA) (16 United States Code [USC] Subchapter III-B §19jj). The act allows the NPS to seek recovery of damages from the responsible party for injury to any Park System resource. It allows for recovering response costs and damages to restore, replace, or acquire the equivalent of an injured Park System resource. NPS Director's Order #14 (DO-14) implements the PSRPA, and the Handbook for DO-14 provides guidance on the implementation process (NPS, 2004a,b). For some cases, damages are sought in magistrate court as restitution for Code of Federal Regulations violations.

An important planning step in the coral reef restoration process is developing a Restoration Plan (RP) that defines restoration actions appropriate for the specific injury. The planning process ensures compliance with National Environmental Policy Act (NEPA) requirements and NPS Director's Order #12 (DO-12) and its accompanying Handbook, which provide NPS-specific guidance for implementing NEPA (NPS, 2001). NPS has prepared this document, a RP and Programmatic Environmental Impact Statement (PEIS), to facilitate the restoration of coral reef resources within BISC. This RP/PEIS identifies a set of restoration actions to address restoration of a variety of coral reef injuries. This "toolbox" of restoration actions is proposed as a guide for planning future coral reef restoration projects in BISC.

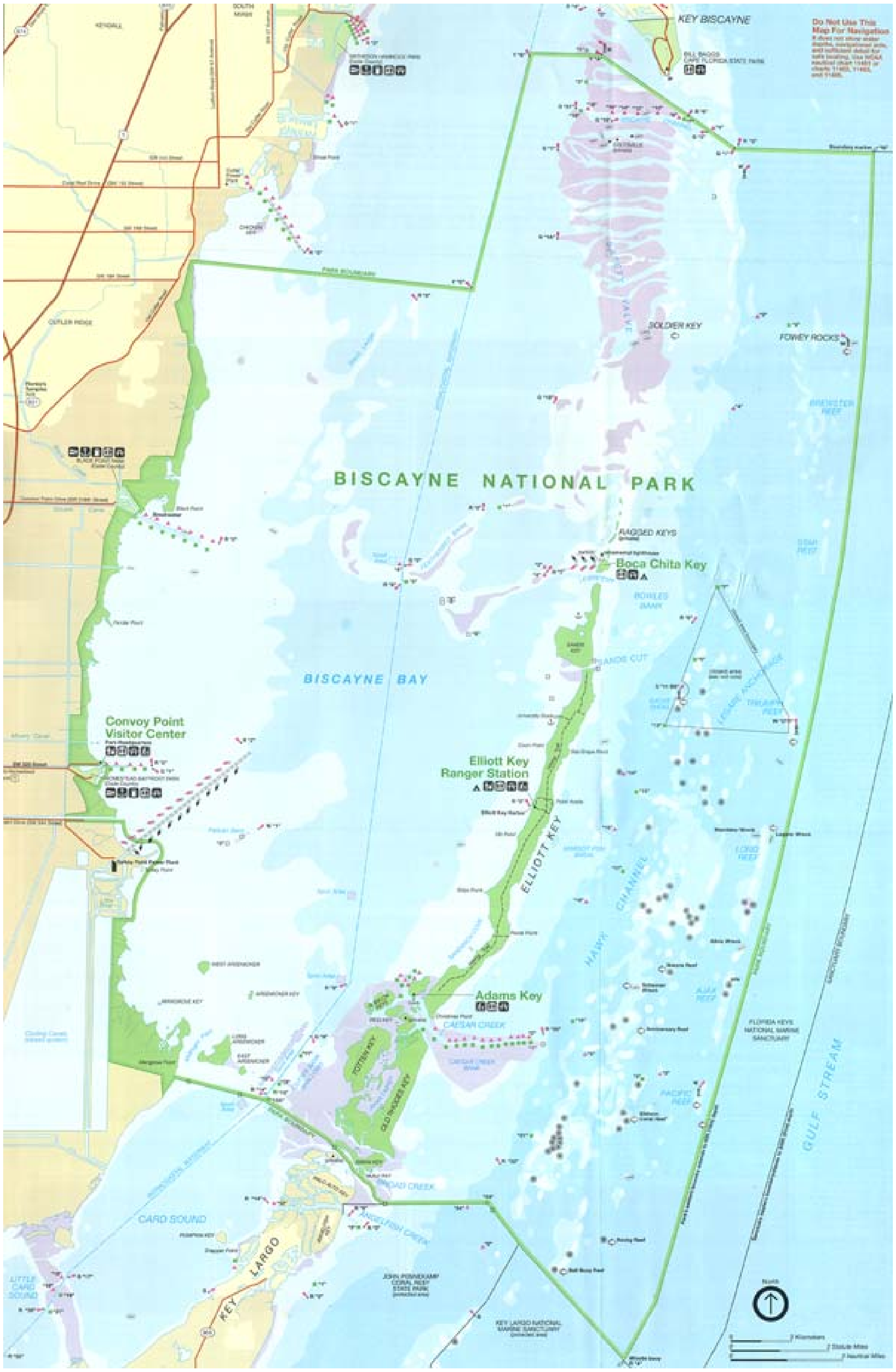

Figure 1-1. Biscayne National Park

An Interdisciplinary Team (IDT), whose members are listed in Chapter 5, assisted in the preparation of this RP/PEIS. Members of the IDT included technical experts and management team members from BISC and other NPS offices. In addition, the IDT received technical support and assistance from the contractor, Tetra Tech EC.

This RP/PEIS presents information to the public regarding vessel-grounding injuries to coral reef resources within BISC; possible restoration actions to address those injuries; potential alternatives available to BISC to restore injured coral reef resources; and technically feasible restoration techniques most compatible with Park policies and procedures, restoration goals, and existing laws and regulations. It systematically evaluates the short-term, long-term, and cumulative environmental effects related to the implementation of coral reef restoration actions in BISC. This RP/PEIS is not case- or site-specific, but rather focuses on potential coral reef restoration activities within BISC and includes a discussion of potential beneficial and adverse impacts on the physical, biological, cultural, social, and economic environments. After the issuance of this RP/PEIS and associated Record of Decision (ROD), developing a typical RP addressing site-specific coral reef injuries at BISC would include a review of this RP/PEIS to ensure that the environmental impacts of the proposed restoration action have already been analyzed. Unless relevant coral reef restoration technologies have changed or the site-specific conditions are not addressed in this RP/PEIS, then further NEPA analysis may not be required. Preparing a Memo to File, approved by the BISC Superintendent in consultation with the Regional Environmental Coordinator, may suffice in lieu of additional NEPA analysis and documentation.

1.2 Purpose and Need

The purpose and need for the proposed action, in which coral reef restoration actions at BISC would be selected from a specific toolbox of possible restoration actions, are described in the following sections.

1.2.1 Purpose

The goal of coral reef restoration actions in BISC is to create a stable, self-sustaining reef environment of similar topography and surface complexity to that which existed prior to injury, such that natural recovery processes, enhanced through mitigation, if needed, will lead to a fully functioning coral reef community with near natural complexity, structure, and make-up of organisms.

According to the Park's enabling legislation, the purpose of BISC is "to preserve and protect for the education, inspiration, recreation, and enjoyment of present and future generations a rare combination of terrestrial, marine, and amphibious life in a tropical setting of great natural beauty" (16 USC Chapter 1 Subsection LIX-E §410gg). Performing restoration is intended to assist the NPS in fulfilling its purpose of preserving and protecting the coral reef resources located within the Park.

Restoration of an injured site typically involves a planning phase and an implementation phase. A programmatic RP will assist NPS during the planning phase of future reef restoration projects by guiding the selection of preferred restoration actions. In addition, preparing a programmatic RP will enable the NPS to determine the need for actions more rapidly after an injury, thus assisting in timely implementation of necessary restoration. Furthermore, timely implementation of restoration projects in BISC can prevent injuries from expanding in size or increasing in severity and ensure site conditions necessary to expedite recovery to pre-incident conditions.

If the proposed action, a programmatic approach, were implemented, then prior to implementing restoration actions at any injury site within BISC, NPS would undertake an evaluation process to identify the appropriate restoration actions. That evaluation process would include a resource injury assessment performed by Park biologists to characterize and quantify the injuries and the loss of services that the injured resources had provided. Once the resource injury assessment is complete, Park biologists would use the "toolbox" to determine which restoration actions are appropriate for the specific conditions at the injury site. A site-specific RP would then be developed that specifies the restoration actions and methods to be used. Appendix A contains additional information related to the process of developing site-specific RPs for coral reef restoration.

1.2.2 Need

BISC was established in 1968. Currently, more than 500,000 people visit the Park annually (NPS, 2005b). Coral reefs are among the most biologically diverse ecosystems in the world. Coral reef is a dominant ecological component of the nearshore marine environments of south Florida and of the Park. The coral reefs of BISC are part of the 150-mile (240-kilometer [km])-long Florida Reef Tract, which extends from southeast Florida southwestward through the lower Florida Keys and Dry Tortugas. The coral reef system of the Florida Keys is North America's only living coral barrier reef and the third longest coral barrier reef in the world (NPS, 2009a). The reefs provide habitat for fish, stony and soft corals, sponges, jellyfish, anemones, snails, crabs, lobsters, rays, sharks, eels, sea turtles, dolphins, sea birds, and other animals. They are home to more than 150 species of tropical fish and 50 species of coral that represent 80 percent of the coral species in the tropical western Atlantic (NPS, 2005e).

Vessel-grounding incidents are common because both recreational boating and commercial vessel traffic occur within the Park boundaries. Approximately 200 vessel groundings are reported each year in BISC, but this represents only a portion of the groundings that occur because many incidents are unreported. About 90 percent of the vessel groundings reported in BISC occur in seagrass habitat. Nevertheless, groundings on coral reefs typically cause more substantial injuries because the vessels that most frequently run aground in coral reef habitats are large and capable of inflicting significant injuries both upon impact and during their extrication. In addition, injuries to reefs are slow to recovery.

When a vessel runs aground on a coral reef, it can produce many types of injuries, including surficial scarring; displaced, buried, fractured, or sheared biota; fractured or displaced substrate; tissue toxicity; and water quality. Besides the injuries caused by impact, when a vessel attempts to "power off" an area where it has grounded and come to rest, it can create large excavations (blow holes) in the reef topography from the hydraulic forces of the propeller wash, displacing large volumes of reef, biota, and substrate. Dislodged and displaced materials often abrade or smother bottom-dwelling organisms, causing additional injury.

It can take decades for coral reefs to recover from grounding injuries, and in some areas, they may never grow back. Because of this slow, and sometimes incomplete, natural recovery phase, there may be a need to perform active restoration to help accelerate reef recovery. In addition, there is often a need to decrease the time it takes to plan and implement coral reef restoration to reduce the interim service losses that result from injuries.

1.3 Environmental Issues

An "issue" describes the relationship between the proposed action and environmental resources. Issues are usually environmental problems that an alternative (including the No Action alternative) might cause, but they may be questions, concerns, problems, or other relationships, including beneficial ones.

NEPA and the Council on Environmental Quality (CEQ) regulations direct agencies engaged in the NEPA process to "avoid useless bulk… and concentrate effort and attention on important issues" (40 Code of Federal Regulations [CFR] 1502.15). Many environmental issues were considered during the development of this RP/PEIS. Resource issues judged both relevant and irrelevant to the proposed actions or the alternatives considered in this RP/PEIS are discussed in the following sections; however, issues that were judged irrelevant were not further analyzed.

1.3.1 Issues and Impact Topics Included for Analysis

The issues and impact topics that have been included in this RP/PEIS are:

- **Physical Environment** (geology and water quality)—The Park's physical resources are key components of the Park's environment and are essential to the health of the marine system. Changes to the physical environment could potentially affect biological and physical components of the reef and reef organisms. The alternatives and restoration methods analyzed in this PEIS may affect the physical environment of coral reef ecosystems, specifically geology and water quality. The analysis described in this PEIS considers the impacts of each of the alternatives on these two physical components of the reef system.

- **Biological and Natural Resources** (epibenthic biota [hard corals, gorgonians, sponges, and marine algae], other invertebrates, ichthyofauna, and seagrasses)—BISC's biological and natural resources are an integral part of the Park's environment. It is the Park's purpose to protect these resources, and therefore important to identify and analyze any potential impacts (adverse or beneficial) that could affect these resources. The alternatives and restoration methods analyzed in this PEIS may affect the biological and natural resources of the reef system, specifically epibenthic biota, other invertebrates, ichthyofauna, and seagrasses, as well as their habitat. The analysis described in this PEIS considers the impacts of each of the alternatives on these biological/natural resources within BISC.

- **Essential Fish Habitat (EFH)**—The President's CEQ guidelines (CEQ, 1978) for implementing NEPA require an analysis of resources that would be considered ecologically critical areas. Ecologically critical areas in BISC include EFH and EFH-Habitat Area of Particular Concern, both of which could be affected by the alternatives and restoration methods analyzed in this PEIS. The analysis described in this PEIS considers the impacts of each of the alternatives on EFH within BISC.

- **Threatened or Endangered (T&E) Species** (sea turtles, smalltooth sawfish, elkhorn coral, staghorn coral, West Indian manatee, pillar coral)—The NPS Management Policies (NPS, 2006b) require that potential effects of agency actions on federal, state, or locally listed species be considered. NPS is required to control access to important habitat for such species and to perpetuate the natural distribution and abundance of these species and the ecosystems upon which they depend (NPS, 2007a). The analysis described in this PEIS considers the impacts of each of the alternatives on T&E habitat and species within BISC.

- **Historical and Cultural Resources**—Through legislation the NPS is charged with the protection and management of historical and cultural resources in its custody. Impacts to these resources therefore are identified and analyzed in this document.

- **Recreation and Visitor Experience**—The NPS Management Policies (NPS, 2006b) state that the "enjoyment of park resources and values by the people of the United States is part of the fundamental purpose of all parks." Aesthetics is considered part of the visitor experience. Maintaining scenery of great natural beauty is a key component in enhancing visitor experience. Analysis of all potential impacts to recreation and visitor experience, including aesthetics, is provided in this document.

- **Human Health and Safety**—Maintaining human health and safety is essential for the enjoyment of the Park's physical and natural resources. Analyzing potential impacts (adverse or beneficial) to human health and safety will aid in assisting BISC in fulfilling its primary purpose (stated above).

- **Park Operations**—Maintaining functional Park operations is essential for enhanced visitor experience, conserving Park resources, maintaining safety, and promoting cost-effective management. Potential impacts (adverse or beneficial) to Park operations are identified and considered for analysis.

1.3.2 Issues Eliminated from Further Analysis

NEPA and the CEQ regulations direct agencies to "avoid useless bulk… and concentrate effort and attention on important issues" (40 CFR 1502.15). Resource issues judged irrelevant to the proposed actions or the alternatives considered in this RP/PEIS are listed below along with the reasons they were eliminated. All other topics listed in the NPS DO-12 Handbook (Section 4.5.F.2) (NPS, 2001) as mandatory (for consideration in an EIS) were considered but judged inconsequential and eliminated from further analysis.

1.3.2.1 Socioeconomics

NEPA requires an analysis of impacts to the "human environment," which includes economic, social, and demographic elements in the affected area. Because many Miami-Dade County residents often use the Park for recreational and commercial purposes, they would directly benefit from the restoration of offshore reef formations to their baseline conditions. However, the cost of the restoration actions would not be enough to create a significant number of jobs for Miami-Dade County residents. The alternatives would not impact fishing practices, the primary economic activity associated with the Park, in BISC. Furthermore, the proposed restoration activities would not affect socially or economically disadvantaged populations. As a result, this issue is not included for further analysis in this RP/PEIS.

1.3.2.2 Environmental Justice

Executive Order (EO) 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations, requires all federal agencies to identify and address disproportionately high and adverse human health or environmental effects of their programs and policies on minorities and low-income populations and communities. Coral reef restoration projects at BISC are expected to have no direct or indirect impacts on minority or low-income populations or communities. Environmental justice considerations, therefore, were not included for further analysis in this RP/PEIS.

1.3.2.3 Air Quality

The 1970 Federal Clean Air Act stipulates that federal agencies have an affirmative responsibility to protect a Park's air quality from adverse air pollution impacts. Coral reef restoration activities require the use of a variety of equipment, ranging from small vessels to large barge operations, which produce air emissions. Further, vehicular travel by personnel to and from project staging areas also would contribute to emissions. However, these emissions would not be outside the normal range of emissions from other activities in the Park and therefore impacts from restoration activities would be negligible. Air quality was therefore not included for further analysis.

1.3.2.4 State Listed Species

Florida enacted its state Endangered Species Act (ESA) in 1976, which is implemented by the Florida Fish and Wildlife Conservation Commission (FWC) in accordance with Chapter 68A-27. There are currently 118 species listed as endangered, threatened, or of special concern within the state of Florida. Within BISC, 17 birds, two reptiles, and three invertebrates that are not included under the federal listing are included under the state listing. Only species that utilize the reef in BISC were considered for further analysis. The only state listed species that utilizes the reef that is also not a federally listed species is pillar coral, which is discussed in Chapters 3 and 4. All other state listed species are terrestrial and do not utilize the reef and therefore were excluded from further consideration.

1.3.2.5 Energy Requirements, Greenhouse Gas Emissions, and Climate Change

The NPS DO-12 Handbook requires an analysis of impacts from energy requirements in the affected area. Because implementing restoration activities outlined in this RP/PEIS would involve only small quantities of fuel for vehicles, equipment, and boating operations during implementation and monitoring activities, energy requirements would not have an impact.

There is strong evidence linking global climate change to human activities, especially greenhouse gas emissions associated with the burning of fossil fuels (IPCC, 2007). Coral reef restoration activities require the use of a variety of equipment which ranges from small vessels and equipment to large, heavy equipment and barge operations. Restoration operations and vehicular travel by personnel to and from project staging areas would result in fossil fuel consumption and contribute to greenhouse gas emissions. However, fossil fuel consumption and greenhouse gas emissions associated with these activities would be negligible compared to park-related, local, and state fossil fuel consumption greenhouse gas emissions. Therefore, the issue of the contribution of coral reef restoration activities to climate change through fossil fuel consumption and greenhouse gas emissions was dismissed from further analysis.

1.3.2.6 Land-Use Conflicts

The NPS DO-12 Handbook requires an analysis of impacts due to land-use conflicts between the proposed action and land-use plans in the affected area. The project area is entirely within the boundaries of BISC and does not include any non-NPS lands. Since the proposed action is restoration of the injured coral reefs, there would be no land-use conflicts; therefore, no further analysis is required.

1.3.2.7 Agricultural Lands

The NPS DO-12 Handbook requires an analysis of impacts to prime and unique agricultural lands in the affected area. Because there are no agricultural lands impacted as a result of either the vessel groundings or proposed restoration action, agricultural lands were not included for further analysis.

1.3.2.8 Wetlands and Floodplains

The NPS DO-12 Handbook requires an analysis of impacts to 100- and 500-year floodplains in the affected area. Because there are no wetlands or floodplains impacted as a result of either the vessel groundings or proposed restoration action, they were not included for further analysis.

1.3.2.9 Noise

Noise will be generated during restoration activities from a variety of sources including motor vessel operation and other mechanical equipment (e.g., pumps, compressors, heavy equipment) that may be required to perform the restoration activities. Noise considerations were not included for further analysis in this RP/PEIS because the proposed restoration actions are of short duration and the types of noise generated are not unusual to everyday activities within the Park. Therefore, noise generated would not have a direct or indirect impact to visitor experience in the Park or to the Park's marine resources.

1.3.2.10 Ethnographic Resources

The NPS Management Policies (NPS, 2006b) direct the NPS to be respectful of ethnographic resources and carefully consider the effects that NPS actions may have on them. Park ethnographic resources are the cultural and natural features of a park that are of traditional significance to traditionally associated peoples. These peoples are the contemporary park neighbors and ethnic or occupational communities that have been associated with a park for two or more generations, and whose interests in the park's resources began before the park's establishment. Traditionally associated peoples generally differ as a group from other park visitors in that they typically assign significance to ethnographic resources—places closely linked with their own sense of purpose, existence as a community, and development as ethnically distinctive peoples. No ethnographic resources in BISC would be affected by the proposed alternatives, and so these are not further addressed.

1.3.2.11 Sacred Sites

Federal agencies must take into consideration the effects of their actions on sacred sites or traditional cultural properties (TCPs). A TCP is defined as property that is eligible for inclusion in the National Register because of its association with the cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community. To date, no TCPs have been identified within BISC.

1.3.2.12 Indian Trust Resources

In the event that an evaluation reveals impacts on Indian trust resources, trust assets, or tribal health and safety, bureaus and offices must consult with the affected recognized tribal government(s), the appropriate office(s) of the Bureau of Indian Affairs, the Office of the Solicitor, and the Office of American Indian Trust. BISC does not currently contain formally designated Indian trust resources or trust assets. However, if it is determined that a vessel grounding has affected, or restoration of a grounding may affect such resources, assets, or tribal health and safety, NPS shall initiate appropriate consultations with the affected tribes.

1.3.2.13 Museum Collections

The implementation of coral reef restoration alternatives would not have any effects on BISC museum collections.

1.3.2.14 Structures

Under the NPS Management Policies (NPS, 2006b), "No administrative or public use will be permitted that would threaten the stability or character of a structure, the museum objects within it, or the safety of its users, or that would entail alterations that would significantly compromise its integrity." Within BISC, the Sweeting Homestead historic site is deemed significant for the information it is likely to yield about the early settlement of the Florida Keys. The United States Coast Guard currently owns the Fowey Rocks Lighthouse, an 1877 historic structure. All other surviving architectural resources associated with the Park are located within Boca Chita Key Historic District, included in the National Register of Historic Places (NRHP). Ten of the structures in this district are noted on the List of Classified Structures. None of the structures associated with these sites would be impacted under the proposed alternatives, and so they are not further discussed.

1.4 Public Participation

NEPA and DO-12 require public review of a PEIS. Therefore, the public is invited to comment on this RP/PEIS, NPS's proposed plan for future coral reef restoration actions at BISC.

NPS issued a Notice of Intent (NOI) to prepare this RP/PEIS. The NOI was published in the *Federal Register* (on February 17, 2006) to inform the public that a RP/PEIS was being prepared, to describe the scoping process, to announce a 60-day comment period, and to request scoping comments on any issue. The NOI describes the proposed action and alternatives, issues, and environmental impacts to be analyzed in the RP/PEIS. No public comments were received in response to the NOI.

Informal scoping for the Coral Reef PR/PEIS was also conducted during public meetings held for the Allie B and Igloo Moon RP/Environmental Assessments (EAs) in 2006 in Homestead, Florida. The NPS gave verbal notice to individuals at that public meeting that the NPS was planning to prepare the Coral Reef RP/PEIS. The public feedback at the meeting related to this announcement was positive.

1.5 Related Plans, Applicable Laws, Regulations, and Guidance

1.5.1 Related Plans

Related plans for this RP/PEIS refer to other environmental projects in BISC and the vicinity, particularly those affecting coral reef resources and habitat. They include other NPS planning efforts and coral reef restoration projects as well as coral reef restoration program planning currently in force or underway by entities other than the NPS. Connected and similar actions include, but are not limited to:

- Current preparation of an updated General Management Plan (GMP) for BISC;
- Current preparation of a BISC Fishery Management Plan (NPS, 2009b);
- National Oceanic and Atmospheric Administration (NOAA) Draft PEIS for Coral Reef Restoration in The Florida Keys and Flower Garden Banks National Marine Sanctuaries (NOAA, 2008a);
- Allie B Grounding Site RP/EA (NPS, 2007a);
- Igloo Moon Grounding Site RP/EA (NPS, 2007b);
- Final Implementation Plan for the Coral Reef Restoration at BISC at the Allie B and Igloo Moon Vessel-Grounding Sites (NPS, 2008b); and
- Current preparation of the BISC Coral Nursery Operating Procedures (NPS, 2008a).

1.5.2 Related Laws, Regulations, and Guidance

1.5.2.1 National Environmental Policy Act, as amended, 42 USC 4321, et seq., 40 CFR Parts 1500–1508

NEPA is implemented through regulations of the CEQ (40 CFR 1500-1508). The purpose of NEPA is "to declare a national policy which will encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; and to enrich the understanding of the ecological systems and natural resources important to the Nation" (42 USC Section 4321). The NPS has in turn adopted procedures to comply with the act and the CEQ regulations, as found in DO-12 and its accompanying Handbook (NPS, 2001).

The NEPA process encourages public participation and comment, and it ensures that all branches of government consider environmental consequences of federal projects that may affect the quality of the human environment. Any decision made will be in compliance with NEPA.

1.5.2.2 Clean Water Act (Federal Water Pollution Control Act), 33 USC Section 1251, et seq.

The Clean Water Act (CWA) contains a comprehensive program for protecting the chemical, physical, and biological integrity of the nation's water. The CWA is the principal statute governing pollution control and water quality of the nation's waterways. To this end, Section 404 of the CWA requires a permit from the U.S. Army Corps of Engineers (USACE) for the discharge of dredge or fill material into waters of the United States, including jurisdictional wetlands. Section 401 of the CWA requires states to certify that any federally permitted or licensed activity that might result in a discharge to waters of the United States, including issuance of a Section 404 permit, would not violate applicable water quality standards established by the states. Together, the statutory authority of NEPA and CWA regulate most types of work conducted in wetlands. The proposed action complies with the CWA.

1.5.2.3 Section 10 of the Rivers and Harbors Act, 33 USC 403

Under Section 10 of the Rivers and Harbors Act, the building of any wharfs, piers, jetties, and other structures is prohibited without Congressional approval, and excavation or fill within navigable waters requires the approval of the Chief of Engineers. Concerns include contaminated sediments associated with dredge or fill projects in navigable waters. In accordance with this act, the proposed project will require approval by Congress and the Chief of Engineers.

1.5.2.4 Section 106 of the National Historic Preservation Act of 1966, as amended, 16 USC 470

Section 106 of the National Historic Preservation Act (NHPA) requires federal agencies to consider the effects of their proposed actions on historic properties (cultural resources that meet the criteria for listing in the NRHP). The Section 106 process requires federal agencies to consult with the Florida State Historic Preservation Office (SHPO), Tribal Historic Preservation Officers (THPOs), and, as necessary, the Advisory Council on Historic Preservation (ACHP), and provides a reasonable opportunity for their review and comment on the proposed action. If a proposed action cannot avoid effects to historic properties, steps would be taken to develop an appropriate treatment plan that would be formalized within a project-specific Memorandum of Agreement executed by the lead federal agency, SHPO, THPOs, the ACHP, and interested stakeholders. Implementation of the treatment plan would be required prior to implementation of the proposed action.

1.5.2.5 Magnuson-Stevens Fisheries Conservation and Management Act, Public Laws 94-265, as amended

The passage of the Sustainable Fisheries Act in 1996, reauthorizing the Magnuson-Stevens Fishery Conservation Management Act, changed the NOAA Fisheries legislative mandate to manage living marine resources. This act provided NOAA Fisheries with strengthened management authority to address human impacts on the marine environment. This legislation resulted from a greater recognition of the need to prioritize EFH, catch size reduction, fishing communities, and fishing vessel safety. The act also re-focused the management of marine fisheries in the United States, with more stringent requirements to rebuild depleted fisheries and prevent over fishing. The proposed action will comply with the goals and objectives of this act.

1.5.2.6 Fish and Wildlife Coordination Act of 1958

The Fish and Wildlife Coordination Act (FWCA) of 1958 requires that fish and wildlife receive equal consideration as other project components for proposed water resource development projects, and that appropriate mitigation for impacts be provided. This act requires the monitoring of nongame fish and wildlife in order to assess the effects of environmental changes and anthropogenic impacts. This statute is implemented through consultation with the U.S. Fish and Wildlife Service (USFWS). The NPS will initiate consultation with the USFWS to ensure compliance with this act.

1.5.2.7 Coastal Zone Management Act, 16 USC 1451 et seq.

The Coastal Zone Management Act established a voluntary national program within the Department of Commerce to encourage coastal states to develop and implement coastal zone management plans. Each federal agency conducting or supporting activities directly affecting the coastal zone shall conduct or support those activities in a manner that is, to the maximum extent practicable, consistent with approved state management programs. The proposed action is consistent with the Florida Coastal Zone Management Program.

1.5.2.8 Endangered Species Act, 16 USC § 1531-1543

The Endangered Species Act (ESA) of 1973 replaced the Endangered Species Conservation Act of 1969 and provides protection for species that are threatened or endangered throughout all or a significant portion of their geographic range and the habitats that those species use. In the ESA, "endangered" species are defined as in danger of extinction throughout all or a significant portion of its range; "threatened" species are likely to become endangered within the foreseeable future throughout all or a significant portion of its range; and "species of special concern" might need concentrated conservation actions to facilitate recovery.

The purpose of the ESA is to conserve "the ecosystem upon which endangered and threatened species depend" and to conserve and recover listed species. The ESA is a comprehensive wildlife conservation law administered by the USFWS and the NOAA Fisheries. This act mandates that all federal agencies protect listed species and preserve their habitats. Coordination between the NPS and USFWS will involve a determination of effects to listed species by comparing existing conditions to the proposed action in a biological assessment. If necessary, a biological opinion will be obtained from the USFWS before the ROD is issued.

1.5.2.9 Marine Mammal Protection Act of 1972, as amended

The Marine Mammal Protection Act prohibits the taking of marine mammals in United States waters and by United States citizens on the high seas, and also prohibits importation of marine mammals and marine mammal products into the United States. This act mandates that efforts be made in order to protect EFH and other areas of importance to marine mammals. Its purpose is to protect and conserve marine mammal populations from "diminishing beyond the point at which they cease to be a significant functioning element in the ecosystem of which they are a part." The proposed action complies with this act.

1.5.2.10 Park System Resource Protection Act, 16 USC 19jj

Public Law 101-337, the PSRPA, allows the NPS to seek compensation for injuries to Park System resources and use the recovered funds to restore, replace, or acquire equivalent resources, and to monitor and study such resources. The act specifically allows the Secretary of the Interior to recover response costs and damages from the responsible party(s) causing the destruction, loss of, or injury to Park System resources. Any monies recovered by the NPS may be used to reimburse the costs of response and damage assessment and to restore, replace, or acquire the equivalent of the injured resources. The proposed action complies with the PSRPA.

1.5.2.11 The National Park Service Organic Act (16 USC l, 2, 3, and 4)

The National Park Service Organic Act, created within the Department of the Interior, promotes and regulates the use of federal areas known as national parks, monuments, and reservations. The NPS has the fundamental purpose to conserve the scenery, the natural and historic objects, and the wildlife therein, and to provide for the enjoyment for the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations. The proposed action complies with the National Park Service Organic Act.

1.5.2.12 National Park Service Director's Order #12 (DO-12): Conservation Planning, Environmental Impact Analysis, and Decision Making, and the Handbook for DO-12

DO-12, issued in 2001, is the most recent NPS Director's Order on NEPA documentation. The NPS DO-12 Handbook is an update and revision of the 1982 version of DO-12. Most of the sections in this handbook are derived, in whole or in part, from the CEQ regulations or NEPA guidelines, giving them the force of law. The DO-12 Handbook contains basic information needed to meet the legal requirements of NEPA and for practicing excellent impact assessment and resource conservation. The proposed action complies with the goals and objectives of DO-12.

1.5.2.13 National Park Service Director's Order #13A (DO-13A): Environmental Management Systems

DO-13A (NPS, 2009c) provides guidelines for making decisions that impact the environment. Its purpose is "to help ensure compliance with regulatory requirements and a commitment to pollution prevention, waste reduction, sustainable planning, environmentally preferable purchasing, and the incorporation of environmental best management practices." This Order supplements EO 13148. The proposed action complies with the goals and objectives of DO-13A.

1.5.2.14 National Park Service Director's Order #14 (DO-14): Resource Damage Assessment and Restoration, and the Handbook for DO-14—Guidance for Damage Assessment and Restoration Activities in the National Park Service

The goal of the damage assessment and restoration process, regardless of the specific underlying statutory authority, is to restore injured resources to their baseline conditions. Specifically, the PSRPA (16 USC 19jj) allows NPS to seek compensation for injuries to National Park System resources and use the recovered funds to restore, replace, or acquire equivalent resources, and to monitor and study such resources. Resources covered by PSRPA include natural and cultural resources, as well as other Park facilities. The DO-14 Handbook provides the authority granted to NPS by PSRPA and provides guidance for preparing a claim for damages. The proposed action complies with the goals of DO-14.

1.5.2.15 U.S. Code Title 16—Conservation Chapter 1—National Parks, Military Parks, Monuments, and Subchapter LIX-E—Biscayne National Park

This enabling legislation established BISC in order to preserve and protect for the education, inspiration, recreation, and enjoyment of present and future generations a rare combination of terrestrial, marine, and amphibious life in a tropical setting of great natural beauty. The proposed action complies with the goals and objectives of preserving and protecting BISC.

1.5.2.16 Executive Order 13112—Invasive Species

EO 13112 applies to all federal agencies whose actions may affect the population and distribution status of invasive species. This order requires agencies to identify such actions, and to the extent practicable and permitted by law, (1) take actions specified in the order to address the problem consistent with their authorities and budgetary resources, and (2) not authorize, fund, or carry out actions that they believe are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere. These requirements apply unless, "pursuant to guidelines that it has prescribed, the agency has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions." The proposed action complies with the goals of EO 13112.

1.5.2.17 40 CFR 1500-1508; Executive Order 11514 as amended by Executive Order 11991

EO 11514, as amended by EO 11991, directs all federal agencies to provide leadership in protecting and enhancing the quality of the environment to sustain and enrich human life. This order defines the responsibilities and procedures for preparation of an EIS. The proposed action complies with the goals and objectives of EO 11514 as amended by EO 11991.

1.5.2.18 Executive Order 12875, Enhancing the Intergovernmental Partnership

The purpose of EO 12875 is to enhance intergovernmental consultation and collaboration on federal matters and to prevent the federal government from imposing unfunded regulations on state, local, and tribal governments. It prohibits federal agencies from putting into effect any regulations that are not required by statute unless the affected state, local, and tribal governments are provided funds by the federal government. However, this order only applies to those regulations that the federal government has the power to waive. It requires federal agencies to provide the Director of the Office of Management and Budget a representation of all consultations and collaborations that occur between the agency and the affected governments. This order also requires that the federal agency allow time for state, local, and tribal governments to participate in the development of such regulations. The agency shall take into account any application provided by the affected government to waive regulatory requirements in order to provide flexibility to the affected government as long as these are in compliance with the federal policy objectives. The proposed action complies with the goals and objectives of EO 12875.

1.5.2.19 Executive Order 12866, Regulatory Planning and Review

EO 12866 aims to improve the process of planning and reviewing of regulations and to increase the efficiency of this process. Its objective is to reestablish the federal government's primary position in the regulatory decision-making process and to make the process more accessible to the public. This order is intended to complement and shall not replace any requirements stated in EO 12866. The proposed action complies with the goals and objectives of EO 12866.

1.5.2.20 Florida Department of Environmental Protection (FDEP)—Chapter 62, Florida Administrative Code (FAC)

Florida implemented an independent state permit program that is in addition to the federal dredge and fill permit program. The Environmental Resource Permit (ERP) program, authorized under Part IV of Chapter 373 of the Florida Statutes, regulates virtually all alterations to Florida's landscape, including all tidal and freshwater wetlands and other surface waters and uplands. The ERP regulates dredging and filling in wetlands and other surface waters; stormwater runoff quality and quantity; and runoff resulting from alterations to uplands. Issuance of the ERP also constitutes a Water Quality Certification or waiver thereto under Section 401 of the CWA. In addition, issuance of an ERP in coastal counties constitutes a finding of consistency under Section 307 of Florida's Coastal Zone Management Program (Coastal Zone Management Act).

1.5.2.21 State Water Quality Standards FDEP 62-302.530, FAC

Each coral reef restoration project is required to comply with the state water quality standards by including turbidity monitoring during operations that may degrade water quality. If turbidity levels exceed the Florida water quality standards for the designated water classification, then operations will cease until turbidity levels return to the state standard. If the water quality standard is exceeded more than twice a day, the operations will be evaluated for the implementation of mitigation measures.

1.5.2.22 Pollution Control Sections 403.141 and 403.161 Florida Statutes

These subsections of the Chapter 403, Florida Statutes prohibit pollution that harms or injures human health or welfare and animal, plant, or aquatic life or property. Violators are liable for damage to the state's air, waters, or property (including animal, plant, or aquatic life) and for reasonable costs and expenses incurred by the state in tracing the source of the discharge, in controlling and abating the source and the pollutants, and in restoring the state's air, waters, and property (including animal, plant, and aquatic life) to their former condition. Violators are also subject to the judicial imposition of a civil penalty of not more than $10,000 or 6 months in jail per offense. The implementation of the proposed action will fully comply with this statute.

1.5.2.23 Miami-Dade County Department of Environmental Resource Management

The Miami-Dade County Board of Commissioners created the Department of Environmental Resource Management (Department) in 1974 to regulate and manage activities affecting south Florida's environment. Section 24-58 of the Miami-Dade County Code requires that a Class I permit be obtained prior to performing any work in tidal waters or coastal wetlands. The Department's objective is to determine that proposed projects have been designed to avoid and/or minimize impacts to environmental, aesthetic, and navigational resources. The implementation of the proposed action will fully comply with the county's regulations.

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2. RESTORATION ALTERNATIVES

2.1 Introduction

To identify the coral reef restoration alternatives presented in this RP/PEIS, the IDT listed reasonable techniques commonly used for coral reef restoration. This "toolbox" of possible restoration actions, including "Monitoring Only," was evaluated as the "Restoration Using a Programmatic Approach" alternative (Alternative 2). A "No Action" alternative was also evaluated as required under NEPA (Alternative 1).

Under the "No Action" alternative, BISC would continue using its current management practices to accomplish coral reef restoration. This alternative is entitled "No Action" because it involves no change from the current approach; that is, meeting NEPA requirements (and selecting the preferred restoration alternative/method) for coral reef restoration projects as they occur. The "No Action" alternative is analyzed in this RP/PEIS to provide a basis of comparison with the "Programmatic" alternative, which is defined by a programmatic approach to restoring coral reefs. Under this "Programmatic" alternative, all preferred restoration actions including "Monitoring Only" (i.e., those in the "toolbox") would be considered in addressing future coral reef injuries at BISC, and the most appropriate restoration actions and specific restoration method(s) would be selected based on an assessment of the injury and site conditions. The action selected, like all actions in the toolbox, would have already been analyzed and approved for use in the restoration of the site-specific injuries under the existing conditions.

2.2 Descriptions of Reasonable Alternatives

A reasonable range of alternatives, including the No Action alternative and Restoration Using a Programmatic Approach alternative, were considered and evaluated during development of this RP/PEIS. Within the Programmatic alternative, a range of coral reef restoration actions, including those used in recently completed restoration and implementation plans (NPS, 2007a,b; 2008b), were considered and evaluated. Some of the actions considered may involve one or more restoration methods. The alternatives and their associated actions that were considered, and the restoration action evaluation criteria are described below.

2.2.1 Alternative 1: No Action

As required by NEPA, a No Action alternative was considered. The No Action alternative for coral reef restoration would not implement a programmatic approach to restoring coral reefs after injuries. Instead, feasible restoration actions, including relying on natural processes, would be examined, analyzed for environmental impacts according to NEPA requirements, and selected on an individual basis. This process would be used for each injury event using the restoration procedures currently in effect in BISC.

2.2.2 Alternative 2: Restoration Using a Programmatic Approach

This alternative involves the use of a systematic approach to select suitable coral reef restoration actions from a toolbox containing viable restoration actions previously analyzed and judged suitable under specified conditions. In the following injury subsections, restoration actions are described along with the rationales for their use. Some actions are suitable for more than one injury type and, therefore, may be described more than once. Appropriate restoration actions and more specific restoration methods are provided for injury type follows in Section 2.3 below.

2.3 Restoration Objectives, Actions, and Methods

The following section describes restoration objectives, actions, and methods that may be implemented based on injury type. Several possible types of reef grounding injuries and corresponding restoration objectives are described. It is important to note that actions and methods used to restore injured coral reef may be designed to achieve multiple objectives, and that more than one restoration action and method may be used for each injury type. For example, two restoration actions are listed under the injury type that involves release/deposition of toxic substances: 1) abate fuel/chemical spills; and 2) remove bottom paint/fouling substance from reef. Under each of these restoration actions, there is more than one restoration method that can be utilized to perform the restoration action and achieve the restoration objective. Similarly, different methods may be employed together to achieve multiple restoration objectives, or to respond to a range of injury types.

Important considerations of implementing the actions are also described with the methods. For the purposes of this RP/PEIS, all restoration actions and methods that are currently utilized by the Park are described and not repeated under each applicable injury type. Rather, when there are multiple actions and methods that can be utilized, and those actions and methods are previously discussed, the reader is referred to the first section (or injury type) in which the actions and methods are described.

2.3.1 Restoration Actions Possible Under Any Injury

Two restoration actions that could be implemented following any injury type related to coral reef grounding are described below.

Monitoring Only

Monitoring may be used either to augment active coral reef restoration methods or as a stand-alone activity. The extent and location of some coral reef injuries may make active restoration methods technically and logistically infeasible (e.g., at high-energy sites). Some coral reef injuries, if left alone, may achieve restoration to baseline conditions through natural processes. For these reasons, the Monitoring Only method is a viable restoration action and should, if circumstances warrant, be considered.

Because natural coral reef recovery is a slow process, the Monitoring Only approach may be required over a long period. In this respect, it may differ from monitoring after active restoration methods are performed, which may involve a shorter timeframe if recovery is accelerated through active restoration.

Whether monitoring is performed as a stand-alone activity or in conjunction with active restoration methods, it is important to identify monitoring parameters that are linked to the site-specific restoration objectives, and to define the target levels, or success criteria for those parameters. If monitoring indicates that the restoration action implemented is not meeting established criteria, then, additional restoration methods may be implemented to enhance the original restoration activities and achieve the desired success.

Each site-specific monitoring plan should include relevant restoration objectives, monitoring parameters, and monitoring methods appropriate to the monitoring parameters, success criteria, and data analysis protocols.

No Active Restoration/No Monitoring

In some circumstances, NPS may choose to leave an injured site as is, with no monitoring. These cases are most likely when funding cannot be secured for restoration or when safety or other considerations make site visits impossible.

2.3.2 Restoration Actions for Specific Injuries

In the following sections, appropriate restoration objectives, actions, methods are provided for each of the injury types typically caused by coral reef grounding incidents. Table 2-1 summarizes this information and also presents additional issues for consideration for each of the restoration actions.

2.3.2.1 Surficial Scarring of Biota

Surficial scarring is an injury to the outer living tissue of an organism (typically a sessile organism) that produces a visible mark or sign of damage. It is caused by abrading the surface with considerable pressure. The objective of restoration methods that address surficial scarring is to facilitate the healing of lesions. Because of the delicate nature of the injuries to living tissue caused by surface scarring, there are currently no viable active restoration actions that address this type of injury. Only monitoring of natural recovery has been identified as an appropriate restoration action.

Monitor Natural Recovery

Monitoring provides information concerning the quantity and quality of recovery at grounding sites. The objective of monitoring surficial scarring injuries is to document healing of lesions. The proposed monitoring program must be rigorous enough to permit the detection of, and response to, significant natural changes in habitat and community structure due to external disturbances (i.e., major storms), and should be performed at regular intervals after the initial assessment or monitoring event for an appropriate duration. The duration of monitoring activities would vary depending on the injury type and other site specific considerations. Monitoring of surficial scarring injuries could include quantitative or qualitative photography to document lesion sizes or direct measurement of lesions immediately after the grounding and at intervals following the baseline.

Table 2-1. Restoration Objectives, Actions, and Methods by Injury Type

Injury Type	Restoration Objective	Restoration Action	Restoration Method
Surficial scarring	Healing of lesions	Monitor natural recovery	▪ Quantitative photography to document lesion size ▪ Qualitative photography to document lesion size ▪ Direct measurement of lesions
Fractured/dislodged biota	▪ Maximize chance of survival of injured organisms ▪ Return biotal cover to pre-injury levels	Reattach biota	▪ Attachment with adhesive (cement, epoxy) ▪ Attachment with mechanical anchoring devices (rebar, cable ties) ▪ Consideration of source of material (from site, corals of opportunity, nursery)
		Biological seeding	▪ Field settlement or wild-caught larvae ▪ Outplanting of lab-reared larvae ▪ Consideration of larval source (wild-caught, nursery-reared) ▪ Consideration of settlement substrate (natural substrate, tiles, rubble) ▪ Consideration of larval attractants (naturally-occurring CCA, engineered chemical attractant [flypaper])
Release/deposition of toxic substances	Eliminate source of toxicity	Abate fuel/chemical spills	▪ Vessel removal ▪ Boom surface spills ▪ Dispersants
		Remove bottom paint/fouling substance from reef	▪ Scraping of material from substrate with hand tools ▪ Removal of fouled rubble ▪ Consideration of disposal of paint, fouled material
Fractured substrate	Abate or minimize erosional processes	Seal fractures	▪ Injection of adhesive (e.g., cement grout) into fractures ▪ Filling fractures with rubble ▪ Electroaccretion ▪ Consideration of augmenting fracture fill with non-native substrate (e.g., quarried limestone)
Displaced substrate	▪ Prevent additional injury from movement of substrate pieces ▪ Restore altered topography (e.g., high points) ▪ Uncover buried biota	Stabilize displaced substrate	▪ Attachment to substrate with adhesive (cement, epoxy) ▪ Attachment to substrate with mechanical anchoring devices (rebar, cable ties) ▪ Electroaccretion (Seacrete™, Biorock™, etc) ▪ Consideration of how to move material (individual pieces by hand or with aid of lift bags, containerized material in nets/buckets moved with aid of lift bags, large pieces/containers with surface davit/winch/crane) ▪ Consideration of reattachment site (stable areas, flat-topped areas, holes/depressions, areas devoid of organisms) ▪ Consideration of augmenting displaced substrate with non-native substrate (e.g., quarried limestone)

Table 2-1. Restoration Objectives, Actions, and Methods by Injury Type (Concluded)

Injury Type	Restoration Objective	Restoration Action	Restoration Method
Displaced substrate (Continued)		Stabilize displaced substrate with artificial structures	▪ Attachment of structure to substrate with adhesive (cement, epoxy) ▪ Create pre-fabricated and *in situ* fabricated artificial structures ▪ Pre-fabricated structures of native and non-native materials stabilize reef substrate and form platform for reattachment of hard corals. ▪ Create coral reattachment modules mimicking natural substrates; design with openings to increase microhabitat; or include limestone boulders or natural substrate embedded on exposed surfaces ▪ *In situ* structures of created from concrete and substrate material such as calcium carbonate boulders ▪ Consideration of design, materials, and fabrication method of reef site modules to promote flexibility in size, shape, and internal structure to mimic naturally occurring outcrops ▪ Consideration of how to place *in situ* fabricated structures; deployment by single diver with no need for a barge and crane
Crushed substrate (rubble)	▪ Prevent additional injury from movement of rubble ▪ Restore altered topography (e.g., fill blowholes) ▪ Uncover buried biota	Stabilize rubble	▪ Attachment of rubble to substrate with adhesive (cement, epoxy) ▪ Creation of rubble patches and attachment to substrate with adhesive and/or mechanical anchoring devices ▪ Creation of reef modules and attachment to substrate with adhesive and/or mechanical anchoring devices ▪ Placement of articulating revetment mats ▪ Electroaccretion ▪ Use sponges to bind and consolidate rubble. Consideration of how to move material (individual pieces by hand or with aid of lift bags, containerized material in nets/buckets moved with aid of lift bags, large pieces/containers with surface davit/winch/crane, suction dredge) ▪ Consideration of augmenting displaced substrate with non-native substrate (e.g., limestone boulders)
		Remove rubble from injury site	▪ Consideration of how to move material (individual pieces by hand or with aid of lift bags, containerized material in nets/buckets moved with aid of lift bags, large pieces/containers with surface davit/winch/crane, suction dredge) ▪ Consideration of disposal sites (terrestrial, marine) ▪ Consideration of alternative uses (restoration of another reef site, shoreline stabilization, etc.)
Scraped/gouged substrate	Colonization of scrapes/gouges	Monitor natural recovery	▪ Quantitative photography to document colonization ▪ Qualitative photography to document colonization

2.3.2.2 Fractured/Dislodged Biota

Sessile organisms such as corals, gorgonians, and sponges maybe detached from the substrate at their attachment points during a grounding incident. Biota also may be broken, ruptured, cracked, or sheared from the reef. The restoration objectives for this injury type are to maximize the chance of survival of injured organisms and to return biotal cover to pre-injury levels. Sites with fractured and/or dislodged biota may be restored by methods that physically reattach biota or that involve biological seeding.

Reattach Biota

Reattaching biota is a restoration action that includes locating a source of biotal material onsite and/or offsite, transporting the material to the restoration site, and attaching the material at the site. If biota are unavailable for onsite reattachment, transplantation may rely on offsite sources of biotal material that would be identified prior to restoration. Potential sources include viable organisms collected from storm-damaged reefs, grounding sites, or from off-site mitigation actions. Biotal material may temporarily be relocated to a cache area that will be determined prior to the commencement of restoration activities.

Hard corals are currently maintained at coral nurseries within the Park. Utilization of nursery corals may be limited by the availability and quantity of desired coral types or size maturities to meet the restoration needs at grounding sites. As sufficient quantities and sizes of corals increase in these nurseries, nursery-raised corals may become usable as a source for restoration activities.

Depending on the amount of time that passes between the grounding event and restoration activities, some of the biological components (e.g., algae, sponges, soft corals) may begin to recover. Living biota would be salvaged and translocated from impacted reef areas and reattached onto areas of bare substrate and/or other material placed at the site as part of the restoration project. Living organisms that remain attached to the reef after the incident would not be detached for transplanting. Under these circumstances, transplantation efforts should concentrate on species such as hard corals, which have relatively slow growth and recruitment rates and low survivorship on the outer bank reefs of BISC (Miller et al., 2000).

Transplanted species, including corals from nurseries or that are translocated, would target those originally found at the grounding sites. The number of transplant candidates for various species will depend on availability prior to restoration efforts. There are several materials available for reattaching biota. The most common attachment technique involves securing pieces or whole colonies using concrete as the bonding agent. Other methods for transplanting biotal material include loose distribution, epoxy, and mechanical anchoring devices (e.g., metal threaded rods, wire, and cable ties).

In addition to restoring the biological complexity of the reef and increasing coral cover and diversity, transplanting activities must consider restoring the original genetic composition and genotypic diversity of the injured reef. The genetic diversity of introduced species may affect growth rates and the overall recovery of organisms within the injured ecosystem (Baums, 2008). In addition, as a result of deviations in genetic composition from local coral species, transplanted corals do not always survive their new surroundings. In order to increase survival rates the genetic source of the coral larvae used in coral nurseries must be taken into consideration as they may be different from local species, and may therefore not be well adapted to survive in the new environment. Baums (2008) proposed that corals from reefs near the injured site be used in nurseries in order to attain genetically similar transplant corals in an attempt to increase post-transplant survival.

Biological Seeding

This action involves using recent technological advances to accelerate biological recovery and includes settlement attractants and localized larval seeding. Biological seeding involves field settlement and outplanting of larvae. The larval material may be either from wild-caught or nursery-reared sources. The settlement substrate may be natural substrate, tiles, or rubble. Tile or rubble can be preconditioned with larval attractants including naturally occurring crustose coralline algae (CCA) or engineered chemical attractant (e.g., flypaper).

Morse and Morse (1996) determined that settlement and recruitment of several coral species can be influenced by chemical signals originating in the molecules of specific CCA. By introducing these organisms into the injured environment or by isolating and reproducing these chemical signals and introducing them into an injured site, coral settlement may be induced.

Morse and Morse (1996) isolated chemical morphogens (components) that stimulate coral larval settlement and developed a morphogen-containing artificial surface referred to as "larval flypaper." The "flypaper" is reported to induce substratum-specific settlement and metamorphosis of coral larvae. With this method, larvae would be collected during spawning events, maintained under laboratory conditions, and subsequently deployed within a mesh enclosure directly over the injured areas (NOAA, 2002a). The enclosed larvae should be held over the area for 2 to 3 days to increase likelihood of settlement on the selected injured substrate (NOAA, 2002a).

2.3.2.3 Release/Deposition of Toxic Substances

Tissue toxicity involves injury, illness, or death from an introduced poisonous substance. In coral reef groundings, toxicity can involve fuel or chemical leaks or transfer of paint from the bottom of vessels to the coral. Antifouling paint from vessel bottoms can contain contaminants like tributyltin, copper, and zinc (Negri et al., 2002). Restoration that addresses tissue toxicity/water quality focuses on the removal of substances or materials that are toxic to reef organisms or cause degradation of water quality within the reef environment. Two methods have been identified to address tissue toxicity injuries.

Abate Fuel/Chemical Spills

Restoration activities used to abate fuel and chemical spills include removing the grounded vessel, using booms to contain surface spills, and applying dispersants capable of removing oils from the sea surface by transferring it into the water column.

Remove Bottom Paint/Fouling Substance from Reef

This action involves the removal of paints and other fouling substances from the grounding sites. The materials and the surficial portion of the embedded substrate could be removed with scraping tools. Fouled rubble also would be removed. Materials lifted from direct impact areas will be placed in re-sealable plastic bags or other containment alternatives to minimize the dispersal of materials underwater.

2.3.2.4 Fractured Substrate

Fractured substrate results from an impact causing a break, rupture, or crack in the reef matrix. Fractured substrates include various sized fissures and/or fragments. Fracturing may expose the unconsolidated reef matrix, which may exacerbate erosion. The restoration objective for fractured substrate is to abate or minimize erosional processes.

Seal Fractures

This action involves repairing prominent fractures in the reef structure. Existing fractures characterized by lateral separation of substrate pieces would be sealed to secure the exposed substrate and unconsolidated material and abate erosional degradation. Bonding agents used for sealing fractures include cement and/or epoxy. Fracture sealing requires the bonding agent to be worked into visible fissures and cracks to create a cohesive substrate matrix.

Fractures also can be filled with rubble prior to sealing. This method involves repairing the prominent fractures in the reef structure by filling them with rubble acquired onsite and sealing to secure the exposed substrate and prevent erosional degradation. Onsite natural substrate rubble that is loose and without hard coral would be used in conjunction with a bonding agent as fill augmentation for large fractures. Bonding agents, as described above, would be used to seal and secure the filled fracture.

Substantial fractures or excavations in the reef structure also can be filled with non-native materials and sealed. Existing fractures characterized by lateral separation of substrate pieces would be filled and sealed to secure the exposed substrate and minimize erosional degradation. Quarried rock could be used in conjunction with a bonding agent as fill augmentation for large fractures. Another option for large fractures is to use fiberglass anchor rods to stabilize the fracture prior to filling with cement. Holes would be drilled into the stable substrate; fiberglass or stainless steel rebar would be placed into the holes; and rubble or boulders would be used in conjunction with a bonding agent to augment fill. Bonding agents, as described above, would be used to seal and secure the filled fracture.

Another approach to sealing fractures uses electroaccretion, such as the relatively new technologies represented by the brand names SeaCrete™ and Biorock™. Electroaccretion technology promotes mineral accretion by applying low-voltage electricity through seawater, which causes limestone (calcium carbonate) to accrete on a cathode (e.g., metal mesh). Electricity generated from a renewable resource such as solar panels, windmills, or tidal current generators can be used as power sources. Biorock™ structures are reported to bond to hard-bottom substrates (Global Coral Reef Alliance, 2005), which would promote opposing substrate surfaces to bond across fractures. Developers of this technology estimate that recruitment of hard coral and growth of transplanted corals is three to four times faster on Biorock™ structures than on natural rock (Global Coral Reef Alliance, 2005).

Biological Seeding

Biological seeding may also be utilized to assist in stabilizing fractures. The biological seeding action was previously discussed in detail in Section 2.3.2.2.

2.3.2.5 Displaced Substrate

Physical separation or unconsolidation of reef substrate results in displaced substrate that has been removed from its original place or position. This injury can be very detrimental to reef habitat because it can severely reduce habitat stability and complexity by altering the substrate topography. It also can cause collateral biological damage from burial and abrasion of associated biota. The restoration objectives are to stabilize displaced substrate to prevent further reef injury and to recreate, to the extent practical, the pre-grounding, three-dimensional structure of the habitat and restore altered topography (e.g., high points). A third objective is to uncover buried biota that may have been buried by the displaced substrate.

Stabilize Displaced Substrate

Pieces of displaced substrate may be stabilized in place, or may first be moved to also restore topography and surface complexity. The vast majority of field-tested reef restoration methods use materials that incorporate bonding agents (e.g., cement and/or epoxy) or mechanical anchoring devices to stabilize structural components of the restoration.

If the original displaced substrate is no longer present or cannot be removed, lost habitat topography and structure can be restored using quarried limestone (i.e., calcium carbonate) boulders, with or without a bonding agent, to stabilize the boulders within the habitat. Limestone boulders can be acquired at local quarries. Boulders placed without a bonding agent should be of sufficient size and weight that they are unlikely to move during storm events. Smaller substrate pieces of substrate or quarried boulders may be safely maneuvered by divers and would not require specialized equipment or personnel for deployment. Movement or deployment of large substrate pieces or limestone boulders would require a barge, crane, and dive assistance.

Another option for stabilizing displaced substrate could be place it in natural reef depressions to help ensure stability during high-energy events. Boulders and/or displaced substrate could be configured on graded topography of affected reef contact sites to replace three-dimensional structure and create voids and crevasses as refuge for mobile fauna. The boulders would also provide stable and textured substrate for epibiotal recruitment.

Stabilize Displaced Substrate with Artificial Structures

Artificial structures that could be used to restore and stabilize injured substrate include pre-fabricated and *in situ* fabricated structures. Field-tested artificial structures of non-native materials are typically constructed of molded cement, reinforcing steel/fiberglass, and/or other artificial structures such as EcoReefs™ and Reef Balls™. Deployment of smaller *in situ* fabricated structures may be positioned by an individual diver without requiring a barge and crane. Larger structures would require a barge, crane, and dive assistance. Structures could be designed with various openings to increase microhabitat and include limestone boulders or natural substrate embedded on exposed surfaces. Embedded boulders or natural substrate would provide textural rugosity (roughness) and mask bonding agents, both of which would enhance epibiotal recruitment and improve the aesthetic appeal of the structure.

Structures may also be designed to provide a footprint that would be site-specific for injuries. A module could be used to cap graded topographic features at the grounding site. The design, materials, and method of fabrication of reef site modules allow flexibility in the size, shape, and internal structure to mimic closely the naturally occurring outcrops. Calcium carbonate boulders from the injured areas could be used to form the module structure. Use of onsite substrate rubble for the site modules would facilitate maximum biotic interactions to provide stable conditions that promote immediate access for boring and sessile biota to create micro-relief and habitat.

Biological Seeding

Biological seeding may also be utilized to assist in stabilizing displaced substrate. The biological seeding action was previously discussed in detail in Section 2.3.2.2.

2.3.2.6 Crushed Substrate (Rubble)

Crushed substrate produces loose rubble that may bury other substrate or biota. Various degrees of burial are possible, with complete coverage as the most extreme. Restoration objectives for rubble injuries include the removal of rubble to prevent additional injury to adjacent habitats from the movement of rubble, to restore altered topography (e.g., fill blowholes), and to uncover buried biota.

Stabilize Rubble

Stabilizing the loose rubble at a grounding site may involve relocating and securing it onsite. Substrate rubble considered prone to movement during high-energy events would be relocated to another area onsite determined to be more stable (i.e., low energy environment). Rubble of a manageable weight would be transported by divers underwater. In areas with more rubble than could be effectively used in restoration activities, concrete would be incorporated into the piles of rubble in such a manner so as to bind them into one cohesive unit that could be anchored securely to intact substrate for stability. Additional loose pieces of rubble would be pressed into the new concrete, maximizing natural surface area exposure and minimizing exposed concrete. To avoid loss of organisms that have recruited onto exposed rubble, pieces of rubble on which substantial biological recruitment has occurred would be cached and subsequently replaced on the surface of the stabilized rubble area.

Another possible method for stabilizing rubble is sponge mediated consolidation of rubble (Wulff, 1984). This method involves utilizing sponges to expedite the natural rubble stabilization processes. The sponges quickly bind to the rubble, providing adequate stability for carbonate secreting organisms to establish and consolidate rubble to the remaining reef structure.

Other non-native materials may be used to stabilize displaced substrate. Restoration methods considered for blowhole sites or other areas of substantial framework loss include fabricated articulated mats. Articulated mats of non-native materials are typically constructed of concrete blocks that are manufactured together with cable or anchors to form an erosion-resistant overlay with specific stability characteristics. The term "articulated" implies that the mats have joints or internal junctions that provide the ability of individual blocks of the system to conform to changes in grade while remaining interlocked or otherwise restrained. The interlocking properties provided by the independent nature of the blocks also allows for movement within an acceptable range of conditions. The concrete blocks of the articulating mats are a suitable substrate for the attachment of natural substrate, surrounding rubble, and/or biota and provide stabilizing weight to the underlying substrate rubble (NPS, 2007a).

The pre-assembled mats can be installed to follow a footprint that is specific to injuries at blowhole sites. A mat could be used to cap blowhole sites or other areas of substantial framework loss, and can be installed to follow a footprint that is specific to the injured site. The design, materials, and method of fabrication of modules would allow for flexibility concerning the size, shape, and internal structure to closely mimic naturally occurring topography. Deployment of articulating mats would require a barge, crane, and diver assistance. Substantial response time is required to manufacture the mats, and therefore, recovery at the site would be delayed while materials were fabricated, transported, and deployed onsite.

Rubble also could be stabilized by using non-native material, such as quarried limestone (i.e., calcium carbonate) boulders with a bonding agent. Limestone boulders can be acquired at local quarries. Boulders should be of sufficient size and weight that they are unlikely to move during storm events. Large boulders could be deployed to help stabilize underlying substrate rubble. Deployment of large limestone boulders would require a barge, crane, and dive assistance.

Local rubble piles could be used as a source to fill blowholes or other excavations at the site. The loose rubble would be re-situated in topographic depressions related to the injury to repair the lost topography. Rubble may be stabilized in stable areas, flat-topped areas, holes/depressions, or areas devoid of organisms. Relocation of onsite materials should be done in conjunction with other methods to ensure substrate stabilization.

Several methods could be used to reattach displaced substrate. Smaller pieces could be reattached using a thick, non-flowing concrete mix. Pieces of detached substrate placed in a suitable location and orientation among the existing substrate is recommended, providing that no additional loss of biota occurs. Larger pieces of substrate would be re-attached using mechanical anchoring devices (e.g., rebar, cable ties, inert fiberglass anchor rods), if appropriate, for stability.

Electroaccretion, described previously, could be used to create substrate and topography that closely resembles the existing habitat and minimizes visual degradation.

Remove Rubble from Injury Site

This action involves the removal of loose and unconsolidated substrate or rubble from a site. Rubble at a grounding site has the potential to cause additional damage to adjacent habitats in the event it is disturbed by a major storm event. This method is most often considered for grounding-related substrate pieces that cannot be used onsite in other restoration alternatives, such as filling fractures and reattaching displaced substrate to restore lost topography. Removal of loose onsite substrate would require a vessel and heavy equipment depending upon the quantity of material to be removed. Individual pieces may be removed by hand or with the aid of lift bags. Containerized material in nets or buckets can be moved using lift bags. Large pieces or containers can be removed with surface davits, winches, cranes, or by suction dredge. Removed rubble may be disposed of or used in restoration of another reef site, shoreline stabilization, and other projects. Disposing of removed material from the injury site will require compliance with federal and state regulations. The proper permits will be acquired through the USACE and the FDEP. Disposal sites will have to be identified on a case-by-case basis.

Biological Seeding

Biological seeding may also be utilized to assist in stabilizing crushed rubble. The biological seeding action was previously discussed in detail in Section 2.3.2.2.

2.3.2.7 Scraped/Gouged Substrate

A vessel can scrape and gouge the coral reef substrate during a grounding incident. These injuries are commonly superficial and are therefore difficult to repair. The objective of restoration with this injury is to establish biotal cover and thus the biological function of the injured substrate. The only active restoration method currently feasible for this injury type is biological seeding, which was previously discussed in detail in Section 2.3.2.2. Monitoring the natural recovery of the scraped/gouged substrate, described previously in Section 2.3.2.1, is the most common action taken with this injury type.

2.4 Screening Criteria and Included Restoration Actions

The restoration actions and specific methods proposed for inclusion in the toolbox under the Restoration Using a Programmatic Approach alternative were evaluated by the NPS IDT. Team members are listed in Chapter 5.

The team developed criteria to evaluate whether the restoration actions were suitable for inclusion in the toolbox. The evaluation criteria ensure that the selected restoration actions not only comply with laws, policies, and regulations pertinent to NPS, but also are technically feasible and consistent with programmatic restoration goals. The IDT evaluated each restoration action against the screening criteria to determine whether they met the minimum level of acceptability required to merit further consideration. The evaluation of each action against each of the screening criteria resulted in either a "yes" or "no" response, for meeting or not meeting the criteria, respectively. If a restoration action did not obtain a "yes" response for all the screening criteria, it was not considered further. Specific restoration actions that passed the screening criteria (i.e., all "yes" responses) could be evaluated against additional criteria based on their effectiveness in restoring the specific types of injury under the specific site conditions for which they are intended. The criteria, listed below, appear in order of priority.

Public Health and Safety

The proposed restoration action poses no threat to the health or safety of the public or agency staff, and it complies with applicable health or safety requirements and guidelines.

Compliance with Laws and Regulations

The proposed restoration action complies with all applicable federal, state, and county laws and regulations.

Compliance with Policies and Procedures of Biscayne National Park

The proposed restoration action can be implemented in a manner consistent with established policies and procedures applicable to BISC.

Consistent with Restoration Goals

The proposed restoration action will achieve BISC's restoration goal, also expressed in the purpose and need for this RP/PEIS, which is based on existing site conditions: to create a stable, self-sustaining environment of similar topography and sediment composition to that existing prior to injury. It will also comply with the PSRPA (16 USC 19jj) to "restore, replace, or acquire the equivalent of resources which were the subject of that action and (to) monitor and study such resources."

Technical Feasibility

The proposed restoration action is believed to be technically feasible, and its complexity and potential technical problems do not limit its chance of success.

Table 2-2 presents an assessment of all reasonable coral reef restoration actions against the evaluation criteria, which are described above. For those actions that received all "yes" ratings (needed to pass the screening criteria), the restoration actions were included in the proposed toolbox.

Table 2-2. Restoration Actions Evaluation Table—Screening Criteria (Consensus of ratings are shown)

	Screening Criteria				
Restoration Actions	Technically Feasible	Complies with BISC Policies/ Procedures	Complies with Laws/Regs	Consistent with BISC Restoration Goal	No Threat to Public Health & Safety
No active restoration/No monitoring	Yes	Yes	Yes	Yes	Yes
Monitoring only	Yes	Yes	Yes	Yes	Yes
Monitoring natural recovery from surficial scarring	Yes	Yes	Yes	Yes	Yes
Reattach biota	Yes	Yes	Yes	Yes	Yes
Biological seeding	Yes	Yes	Yes	Yes	Yes
Abate fuel/chemical spills	Yes	Yes	Yes	Yes	Yes
Remove bottom paint/fouling substance from reef	Yes	Yes	Yes	Yes	Yes
Seal fractures	Yes	Yes	Yes	Yes	Yes
Stabilize displaced substrate	Yes	Yes	Yes	Yes	Yes
Stabilize displaced substrate with artificial structures	Yes	Yes	Yes	Yes	Yes
Stabilize rubble	Yes	Yes	Yes	Yes	Yes
Remove rubble from injury site	Yes	Yes	Yes	Yes	Yes
Monitoring natural recovery from scraped/gouged substrate	Yes	Yes	Yes	Yes	Yes

Ratings: Yes = Action meets criterion; No = Action *does not meet criterion

Based on this evaluation, all 13 coral reef restoration actions were judged suitable and included in the Restoration Using a Programmatic Approach alternative (Table 2-3).

2.5 Mitigation

Mitigation measures for the alternatives include best management practices (BMPs). To mitigate the environmental impacts of restoration work under Alternative 1 or Alternative 2, numerous management actions common to many of the restoration methods would be performed before and during restoration implementation. Mitigation measures would be prepared with either a site-specific restoration plan under Alternative 1, or a site-specific restoration implementation plan under Alternative 2. General mitigation measures under either of the alternatives include (NPS, 2007a,b):

- An anchoring plan will be prepared and approved by BISC resource managers to minimize the potential damage from anchoring vessels during restoration activities.
- Any native or non-native materials brought to the site for placement will be from a local quarry or direct from the manufacturer to ensure the placement of only clean materials.
- Care will be taken to prevent spilling of any bonding agents used as necessary.
- A designated T&E species observer will be onsite during all restoration activities. Work will cease if a T&E species enters the area and will not resume until the area is cleared.
- Divers will take care to minimize contact with the biota and the reef structure.
- Disturbance to the sediments will be minimized during the selected restoration actions.
- Turbidity screens will be used as necessary.
- Laydown areas will be minimized.
- Standard manatee construction conditions will (included in Appendix C) be followed.
- Standard smalltooth sawfish construction conditions (included in Appendix D) will be followed.
- BISC Cultural Resources Manager will determine whether cultural resources survey would be necessary to identify whether historic properties are present within the APE prior to implementing any selected restoration action.
- Special precautions will be taken to prevent disturbance of archeological resources in the Area of Potential Effect. Prior to the beginning of work, BISC Resource Management staff, under direction from BISC Cultural Resources Manager, will visit the site and clearly mark artifacts with colored pin flags and/or flagging tape to indicate objects that should not be disturbed. A BISC Resource Management technician trained in the identification of submerged cultural resources will oversee all restoration activities to confirm that no artifacts are disturbed or inadvertently removed from the site.
- Information about cultural resources at the site is confidential. Those performing the work will agree not to divulge any information about these resources to any individual or entity unless otherwise notified by BISC Cultural Resources Manager.

- A notice to mariners will be advertised with the United States Coast Guard.
- Construction sites will be limited to the smallest feasible area.
- Protective fencing and barricades will be provided for safety and to preserve natural and cultural resources.
- Solid, volatile and hazardous wastes will be stockpiled, transported and disposed of in compliance with federal, state, and local laws and regulations.
- Construction equipment will be in satisfactory condition and all materials imported into the Park will be free of undesirable species.

2.6 Other Alternatives Considered but Eliminated

During the initial internal scoping process, the IDT tried to identify and screen all reasonable technical restoration actions that could be assembled into viable alternatives. To be thorough, the IDT did not limit itself to just active field restoration techniques and methods, but also considered several administrative procedures, decision-making techniques, and organizational approaches that could enhance or facilitate implementing actions in the field. Two such approaches were identified, but were eliminated after either receiving considerable analysis or following usage in two site-specific cases. Each are described below along with the rationale for elimination from further consideration.

2.6.1 Decision Tree Process

The IDT identified decision tree analysis as a potential administrative process to facilitate the assessment and selection of restoration actions for coral reef injury sites. NPS commonly prepares decision trees for use by managers and technical staff to arrive at consistent and logical decisions in various situations where multiple factors and conditions must be considered. NPS personnel with substantial experience in successfully implementing decision trees in other complex situations developed several draft decision trees that could be used in the coral reef restoration planning process. However, after several attempts, the IDT determined that the various decision trees were cumbersome and overly complex because of the extremely complicated nature of the coral reef habitat, coupled with the variable and overlapping nature of grounding injuries. As a result, no substantial benefit could be shown from the use of decision trees in selecting restoration actions at a grounding site and making decisions based on site-specific conditions was considered a preferable approach.

2.6.2 Identifying Individual Restoration Actions as Separate Alternatives

The IDT considered organizing this RP/PEIS so that each restoration action was a stand-alone alternative, instead of combining all actions into a restoration toolbox under a single active restoration alternative. The IDT decided not to make each action an alternative in this PEIS after trying that approach for site-specific restoration. The multiple alternative approach was used for the RP/EAs for the Allie B and Igloo Moon grounding sites (NPS, 2007a,b). Analyzing each specific method as an alternative was effective for selecting specific restoration methods for each injury type at the numerous subareas of those two grounding sites and for assessing direct and indirect effects on the reef resources at each location. However, the multiple alternative approach was determined to be less appropriate for programmatic restoration planning for the entire BISC reef tract.

Evaluating cumulative effects is more complex in the PEIS than at individual grounding sites because of the larger geographic area over which restoration is considered. In addition, the purpose and need for this PEIS addresses the need to prepare a comprehensive restoration plan (such as the toolbox) to enable the NPS to respond to injuries as quickly as possible.

2.7 How Alternatives Meet Purpose and Need

Alternative 1 would not meet the purpose and need of the plan because under this alternative, environmental planning and compliance after coral reef injuries would continue to occur on a case-by-case basis and not through a programmatic approach. Alternative 2 would meet the purpose and need of the plan because it would implement a programmatic approach to coral reef restoration, which would assist the NPS by guiding the selection of preferred restoration actions. In addition, implementation of Alternative 2 would enable the NPS to respond to injuries with necessary restoration more quickly. Timely implementation of restoration projects would prevent injuries from increasing in size or severity.

2.8 NPS Preferred Alternative

To identify the preferred alternative, the IDT evaluated each alternative based on its ability to meet restoration objectives (see Table 2-3) and the potential impacts on the environment (in the "Environmental Consequences" chapter and summarized in Table 2-4). Alternative 2 (Restoration Using a Programmatic Approach) was identified as the NPS preferred alternative. Under this alternative, the most appropriate coral reef restoration actions and specific restoration methods would be selected from a "toolbox" after each coral injury. Because the impacts of these restoration actions are evaluated in this programmatic EIS, the required impact analysis for NEPA compliance could be tiered off this document. The timeframe required to evaluate environmental impacts of restoration actions after site-specific injuries have occurred would be minimized substantially under Alternative 2, resulting in fewer adverse effects and/or more beneficial effects to Park resources.

2.9 Environmentally Preferred Alternative

The environmentally preferred alternative will most effectively promote the national environmental policy expressed in NEPA, causing the least damage to the biological and physical environment, and best protect, preserve, and enhance historic, cultural, and natural resources. The environmentally preferred alternative is selected based on criteria stated in NEPA under Section 101 [42 USC § 4331] of the act. NEPA criteria and evaluation for the environmentally preferred alternative are as follows:

Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations.

Alternative 2, Restoration Using a Programmatic Approach, would facilitate restoration efforts once a vessel grounding occurs by allowing the Park to conduct restoration to injured corals and coral resources in a timely manner. Under both alternatives, restoration actions would occur; however, Alternative 2 would allow the Park to address injuries more quickly than under Alternative 1 because the documents required under NEPA already would have been prepared and the restoration actions for specific injury types already would have been evaluated. Applying faster restoration to injured reef resources may result in increased survival of the resource and preserve the Park reef resources for succeeding generations.

Assure for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings

Injury to coral reefs, including rock and rubble displacement and de-stabilization, the excavation of large holes, and displaced corals and coral reef resources from vessel groundings, result in poor aesthetics of underwater resources. Under Alternatives 1 and 2 emergency restoration of the site would occur once the grounding site was determined to be safe. However, Alternative 2 would result in more rapid implementation of restoration actions that would stabilize rock and rubble, remove debris, and re-attach corals, which would expedite habitat recovery and productivity.

Attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences

Under the programmatic approach in Alternative 2, NEPA planning would have been conducted for most vessel groundings likely to occur in the Park, and the potential impacts would have been assessed for possible restoration actions based on injury types. This streamlining would allow the Park to expedite restoration efforts which could result in halting further degradation to injured coral reef resources and could make the site safe for visitors to use more quickly. Under Alternative 1, the Park would be required to conduct separate environmental assessments under NEPA for individual vessel-grounding sites, which could take an extended period of time, potentially leaving the area closed to visitors, such as fishers, divers, and/or snorkelers, who would otherwise be able to visit the site. In addition, once NEPA planning was completed the site would be closed while restoration activities were taking place and until the site was deemed safe. Alternative 2 would provide the greatest benefit to expedite the uses of the environment while minimizing degradation, risk of health or safety, or any other undesirable and unintended consequences.

Preserve important historic, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity, and variety of individual choice

Alternative 2 would allow the BISC to restore injured coral and coral resources and preserve the marine environment more quickly than under Alternative 1, which could reduce further degradation that could otherwise occur after vessel groundings. Alternatives 1 and 2 would not directly affect historic or cultural resources. However, any marine historic or cultural resources damaged directly from the vessel grounding would be expected to be preserved more quickly under the RP/PEIS.

Achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities

Alternative 1 would delay the time for BISC to conduct coral reef restoration, potentially limiting or halting any visitor activity at the vessel-grounding site. Under the RP/PEIS, BISC would be able to expedite restoration activities to best achieve a balance between population and resource use.

Enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources

Alterative 2 would enhance the quality of renewable resources (i.e., corals) by conducting coral reef restoration activities more efficiently and expeditiously than Alternative 1.

In conclusion, upon full consideration of the elements of Section 101 of NEPA, Alternative 2 represents the environmentally preferable alternative for the BISC Coral Reef RP/PEIS.

Table 2-3. Summary of Alternatives Considered

Alternative	Typical Injury Types	Result/Considerations
Alternative 1: No Action: Address coral reef injuries through existing framework and do not implement a programmatic approach	All coral reef injuries	▪ Site-specific planning and NEPA compliance occurs after each injury
Alternative 2: Restoration using a Programmatic Approach: Use a toolbox of suitable coral reef restoration actions and specific methods	See descriptions by restoration actions below	▪ Site-specific planning tiers to programmatic approach ▪ Streamlines process to use funds more efficiently and sooner
Actions Comprising Alternative 2		
No Active Restoration/No Monitoring: Leave injured site as is with no restoration and no monitoring	Injuries when restoration funding is not available or when safety or other constraints make visits to the site impossible	▪ Natural recovery may take longer than restoration activities ▪ Further deterioration of the coral reef may occur due to ineffective natural recovery
Monitoring Only: Collect quantitative and qualitative data about the biological recovery at grounding sites; photo-documentation and direct measurement of injuries	Surficial scarring, scraped/gouged substrate, and/or Injuries with relatively small likelihood of secondary injury before natural recovery, or where any restoration is too difficult because of high-energy conditions or risk of impacting T&E species. Possible response to any coral reef injury	▪ Monitor to ensure that further deterioration of the coral reef does not occur and that natural recovery does occur ▪ Natural recovery may take longer than restoration activities ▪ Further deterioration of the coral reef may occur due to ineffective natural recovery
Reattach Biota: Transplant species present before grounding from nearby sources to the site, usually securing pieces or whole colonies with cement	Displaced organisms or fractured/sheared biota	▪ Source of material may not be available from onsite ▪ Corals of opportunity may out compete original corals ▪ Corals from nurseries
Biological Seeding: Collect larvae during spawning events, maintain under laboratory conditions, and subsequently deploy within a mesh enclosure directly over the injured areas	Displaced organisms and fractured, displaced, crushed, or scraped/gouged substrate	▪ Raising corals *in situ* is a time-consuming process, making corals more prone to impacts resulting from environmental disturbances ▪ Conditions onsite may not be favorable for larvae recruitment, impeding settlement ▪ Biological seeding may provide or increase genetic diversity within the restored reef system
Abate Fuel/Chemical Spills: Remove surficial portion of substrate with toxic material and dispose	Release of toxic substances	▪ Reduces further damage to affected biota and to exposed surrounding biota ▪ Additional damage possible during removal of grounded vessel
Remove Bottom Paint/Fouling Substance from Reef: Remove surficial portion of substrate with toxic material and dispose	Deposition of toxic substances on reef	▪ Reduces further damage to affected biota and to exposed surrounding biota ▪ Minimal dispersal of toxic material may occur during removal activities, causing secondary damage to adjacent biota

Table 2-3. Summary of Alternatives Considered (Concluded)

Alternative	Typical Injury Types	Result/Considerations
Seal Fractures: Clean and roughen opposing substrate surfaces, work cement or epoxy into visible fissures and cracks, and seal fractures	Restoration of fractured substrate	▪ Sealing fractures can immediately reestablish the structural framework of the reef ▪ May provide suitable stable substrate for recruitment of biota ▪ Spilled adhesive material may harm biota near the injury
Stabilize Displaced Substrate: Reestablish topography by placing displaced substrate or non-native materials in natural reef depressions	Displaced substrate injuries	▪ May immediately reestablish the structural complexity of the reef and can increase the amount of suitable stable substrate for recruitment ▪ Spilled adhesive material may injure surrounding biota ▪ Reattached biota may be more prone to dislodgment after a storm event ▪ Material chosen for fabricated structures may negatively affect biota recruitment and may alter the biological structure of the injured reef system
Stabilize Displaced Substrate with Artificial Structures: Use fabricated artificial structure (e.g., made of articulated mats, cement, steel/fiberglass, or Reef Balls™) to mimic naturally occurring outcrops	Displaced substrate injuries	▪ Can restore the three-dimensional complexity of the reef system ▪ Chosen material may affect the type of organisms that will inhabit the substrate ▪ Reattached biota may be more prone to dislodgment after a storm event
Stabilize Rubble: Stabilize and/or relocate rubble onsite to more stable locations, and use barge, crane, and diver assistance to place concrete blocks of articulating mats to stabilize rubble	Displacement/burial injuries including where substrate rubble is prone to movement during high-energy events	▪ Removal of unconsolidated rubble will reduce secondary impacts to surrounding biota ▪ Rubble can be placed in a location where it can provide substrate for biota settlement or aid in reestablishing the reef's structural framework
Rubble Removal From Injury Site: Remove loose onsite substrate with a small barge or pontoon boat, winch/crane, and dive assistance	Displacement/burial injuries and specifically for grounding-related substrate pieces that cannot be used onsite in other restoration alternatives, such as filling fractures and reattaching displaced substrate to restore lost topography	▪ Immediately reduces further damage to surrounding biota resulting from the movement caused by currents and storm events ▪ Transportation of removed rubble to disposal sites may be difficult and time consuming, especially in sites where unconsolidated rubble is abundant

Table 2-4. Summary of Environmental Consequences of the Alternatives

Impact Topic	Alternative 1: No Action (Current Activities Continued)	Alternative 2: Restoration Using a Programmatic Approach – Impacts of Programmatic Approach	Alternative 2: Restoration Using a Programmatic Approach – Impacts of Restoration Actions
Geology	Minor direct and indirect adverse impacts to geology are anticipated. However, moderate adverse effects, both direct and indirect, would likely occur with the more severe grounding injuries. Impacts incurred during the planning time-lag may be either short-term or long-term and are expected to last 4 to 22 months longer than with a programmatic restoration plan in place. The increased timeframe could allow erosional processes from high-energy storm events and water currents to damage and enlarge the impact area, further deteriorating the reef framework. Reef framework damage resulting from high-energy events and vessel groundings is common and often impacts unaffected reef communities. Cumulative effects are expected to be minor to moderate and long-term (continue indefinitely). No impairment to geology would occur under the No Action alternative.	The programmatic approach would have similar direct, indirect, and cumulative effects on geology as under Alternative 1; however, the effects would likely be shorter in duration and thus less severe (minor). With Alternative 2, restoration activities would likely be implemented within a reduced timeframe and therefore would decrease the probability of high-energy events and erosional processes causing further degradation of the reef matrix. No impairment to geology would occur under the programmatic approach.	Direct adverse impacts to the reef substrate from restoration implementation are anticipated to be negligible to minor. These effects may be incurred during the installation of pins/markers used to establish assessment and monitoring transects or stations, while removing bottom paint, and the use of mechanical methods (e.g., clamshell bucket) to move rubble or dislodged substrate. The duration of these impacts is anticipated to be short-term. Completion of restoration actions would provide long-term (indefinite) beneficial indirect effects. Reattaching biota and substrate and stabilizing/removing rubble would add rugosity, structural complexity, structural support, and stability to the reef matrix. In addition, these actions could reduce degradation of the reef structure from scouring, erosion, and adverse impacts from unstable substrate and rubble by restoration and stabilization of surficial substrate. Both the injury area and the adjacent reef communities would benefit from these actions. Adverse cumulative impacts would be minor to moderate and long-term. No impairment to geology is anticipated from the restoration actions.
Water Quality	Under Alternative 1 direct and indirect effects to water quality are anticipated to be adverse and minor. The duration of these effects are anticipated to be both short-term and long-term. Water quality impacts resulting from releases of fuel or other toxic material are likely short-term following a vessel grounding. Destabilization of the reef matrix resulting in higher than normal turbidity levels during high-energy events could be long-term and continue until the	Water quality impacts—direct, indirect, and cumulative—under a programmatic approach are anticipated to be the same as those under Alternative 1; however, the direct and indirect effects are anticipated to be shorter in duration and thus less severe. Cumulative impacts would be minor to moderate adverse and long-term. No impairment to water quality would occur under the programmatic approach.	Restoration actions are anticipated to have both beneficial and adverse direct and indirect effects on water quality. During the implementation of restoration activities minor, short-term adverse effects could occur, such as increases in turbidity at the impact site, re-suspension of bonding agent particulates, and re-suspension of toxic material. During the implementation of reef stabilization actions, such as rubble stabilization, rubble removal, and

Impact Topic	Alternative 1: No Action (Current Activities Continued)	Alternative 2: Restoration Using a Programmatic Approach – Impacts of Programmatic Approach	Alternative 2: Restoration Using a Programmatic Approach – Impacts of Restoration Actions
	reef matrix is stabilized either naturally or through appropriate restoration actions. Toxic materials deposited or released during a grounding incident generally result in short-term effects, as these substances are dealt with quickly during the initial response or the emergency restoration phase. Water quality impacts, although negligible to minor, are generally not localized and affect adjacent areas of the reef. Cumulative water quality impacts would be minor to moderate and long-term. No impairment to water quality is anticipated under the No Action alternative.		stabilization of displaced substrate, short-term direct and indirect effects to water quality are anticipated. Although designed for minimal dispersion in the water column, bonding agents used for reef stabilization actions and for reattaching biota could become suspended during use. These effects are generally localized and contained within the impact area. Beneficial effects would be both short-term and long-term. Cumulative effects to water quality within BISC are expected to be minor to moderate adverse and long-term. No impairment to water quality would occur with the restoration actions.
Epibenthic Biota	Both direct and indirect adverse effects to epibenthic biota are expected from Alternative 1. The magnitude of these effects ranges from minor to moderate and is directly related to the scale of the injury and the duration of the planning period. Direct effects are considered to be more severe (moderate) as the epibenthic biota within the vicinity of the grounding site generally sustains the most severe damage. The duration of these effects can be either short-term or long-term. Direct effects to epibenthic biota include scouring, erosion, scraping, burial, displacement, and exposure to toxic materials. Epibenthic biota exposed to these types of stressors can become susceptible to disease or death. Indirect effects are similar and may be caused by loose and unstable rubble/boulders. Loose and unstable rubble/boulders are especially prevalent with severe injury and following severe weather events. Colonization of primary recruiting species, although natural and important for succession following a disturbance, may be detrimental for decolonization of the slower growing climatic	Epibenthic biota impacts under a programmatic approach are anticipated to be the same adverse impacts as those of Alternative 1. The reduced time-lag under programmatic restoration would likely shorten the period of time when these effects could occur; therefore, the impacts are anticipated to be adverse, shorter in duration (6 months or less), and less severe (minor) than under Alternative 1. Cumulative impacts are expected to be adverse, minor to moderate, and long-term. No impairment to epibenthic biota within BISC is anticipated under the programmatic approach.	Beneficial and adverse direct and indirect effects are anticipated from the performance of restoration actions. The intensity of adverse effects are anticipated to be negligible to minor and short-term. Localized adverse impacts to the reef community could occur as a result of diver contact and/or restoration equipment contact during implementation of the restoration actions. Additionally, turbidity caused during site preparation, bottom paint removal, and/or use of bonding agents can cause negligible to minor direct and indirect effects. However, the beneficial effects resulting from the performance of restoration actions are anticipated to be long-term as restoration actions are aimed for stabilization of a resource or its substrate thereby adding complexity and structure and would enhance re-colonization and settlement of corals and sponges and help restore the natural diversity of the reef. Cumulative impacts are expected to be adverse, minor to moderate, and long-term. No impairment to epibenthic biota would occur from restoration activities.

Impact Topic	Alternative 1: No Action (Current Activities Continued)	Alternative 2: Restoration Using a Programmatic Approach – Impacts of Programmatic Approach	Alternative 2: Restoration Using a Programmatic Approach – Impacts of Restoration Actions
	species such as scleractinian corals. Cumulative effects would be minor to moderate and long-term. No impairment to epibenthic biota within BISC is anticipated under the No Action alternative.		
Other Invertebrates	Both direct and indirect adverse effects to other invertebrates are expected under Alternative 1. The magnitude of these effects would likely be moderate and would relate directly to the scale of the injury and the duration of the planning period. Direct effects are considered to be more severe (moderate), as other invertebrates within the vicinity of the grounding site generally sustain the most severe damage. In addition, unstable and temporary habitat often results from vessel groundings (e.g., rubble berm), which is quickly colonized by motile invertebrate species. The degree of colonization is directly related to the time-lag associated with the planning process. The longer these artificial injury features remain, the larger the population of other invertebrates that would utilize the habitat. Thus, restoration implementation conducted long after the vessel grounding would adversely affect a larger population of other invertebrates, resulting in a greater magnitude of effect. Cumulative effects are anticipated to be adverse, minor to moderate, and long-term. No impairment to motile invertebrates is anticipated under the No Action alternative.	Direct and indirect impacts to other invertebrates under a programmatic approach are anticipated to be the same as those of Alternative 1; however, the effects are anticipated to be shorter in duration and thus potentially less severe (minor). Cumulative impacts are expected to be adverse, minor to moderate, and long-term. No impairment to motile invertebrates is anticipated with the programmatic approach.	Beneficial and adverse direct and indirect effects are anticipated from the performance of restoration actions. The intensity of adverse effects are anticipated to be negligible to minor and short-term. Localized adverse impacts to the reef community could occur as a result of diver contact and/or restoration equipment contact during implementation of the restoration actions. Additionally, turbidity caused during site preparation, bottom paint removal, and/or use of bonding agents can cause negligible to minor direct and indirect effects. The beneficial effects resulting from the performance of restoration actions are anticipated to be long-term as restoration actions are aimed for stabilization of a resource or its substrate, thereby adding complexity and structure, and would enhance re-colonization and settlement of corals and sponges and help restore the natural diversity of the reef. Cumulative impacts are expected to be adverse, minor to moderate, and long-term. No impairment to motile invertebrates would occur as a result of restoration activities.
Ichthyofauna	The No Action alternative would have short-term and long-term minor to moderate adverse direct and indirect impacts on fish populations. The increased planning period would likely result in these impacts occurring for longer periods of time with potentially greater impacts. Greater loss of structural complexity and biotal cover could result from	Adverse impacts to ichthyofauna under a programmatic approach are anticipated to be the same as those of Alternative 1; however, the effects are anticipated to be short-term in duration and less likely due to the decreased planning time-lag. Cumulative impacts are expected to be adverse, minor to moderate, and long-term. No impairment to	Implementation of restoration actions would have negligible adverse and beneficial direct and indirect impacts to ichthyofauna. Restoration actions are aimed to stabilize and restore lost structural and biological complexity of the reef. Ichthyofauna is beneficially affected with the application of these actions by providing stable and

Impact Topic	Alternative 1: No Action (Current Activities Continued)	Alternative 2: Restoration Using a Programmatic Approach – Impacts of Programmatic Approach	Alternative 2: Restoration Using a Programmatic Approach – Impacts of Restoration Actions
	the lag-time associated with Alternative 1. Cumulative impacts on ichthyofauna are considered to be long-term, minor to moderate adverse. Impacts from Alternative 1 would contribute minimally to these effects. No impairment to ichthyofauna is anticipated under the No Action alternative.	ichthyofauna would occur with the programmatic approach.	complex habitat. However, during implementation, negligible impacts to ichthyofauna are associated with the performance of these actions, whereby diver presence, restoration equipment, and materials may cause short-term, localized disturbances that cause fish to temporarily leave the area. As some species leave the area during restoration action implementation, others remain and are beneficially affected. Feeding opportunities often occur when cryptic species are exposed during implementation of restoration actions. These effects would provide a negligible contribution to the existing cumulative effects, which are expected to be minor to moderate adverse and long-term. No impairment to ichthyofauna would occur with the implementation of restoration actions.
Seagrasses	The No Action alternative would have short-term to long-term minor to moderate adverse direct and indirect impacts on seagrasses. The increased planning period would likely result in impacts such as burial, exposure to toxic chemicals, and increased turbidity occurring for longer periods of time which could lead to potentially greater impacts. Greater loss of seagrass cover could result from the lag-time associated with Alternative 1. Cumulative impacts on seagrasses are considered to be long-term, minor to moderate, and adverse. Impacts from Alternative 1 would contribute minimally to these effects. No impairment to seagrasses would occur under the No Action alternative.	Seagrass impacts—direct, indirect, and cumulative—under a programmatic approach are anticipated to be the same as those of Alternative 1; however, direct and indirect effects are anticipated to be short-term in duration. No impairment to seagrasses would occur with the programmatic approach.	Implementation of restoration actions would have short-term negligible to minor adverse and short-term to long-term beneficial direct and indirect impacts to seagrasses. Direct adverse effects associated with performance of restoration actions include diver contact and turbidity caused during restoration implementation. However, direct beneficial effects associated with restoration implementation include re-exposure of buried seagrasses. Indirect beneficial effects result from stabilization of the site which reduces both the potential for burial by movement of rubble and the turbidity caused by the high energy events. Impacts associated with the implementation of restoration actions would not make an appreciable contribution to cumulative effects, which are expected to be minor to moderate adverse and long-term. No impairment to seagrasses would occur with

Impact Topic	Alternative 1: No Action (Current Activities Continued)	Alternative 2: Restoration Using a Programmatic Approach – Impacts of Programmatic Approach	Alternative 2: Restoration Using a Programmatic Approach – Impacts of Restoration Actions
			the implementation of restoration activities.
Essential Fish Habitat	The No Action alternative is anticipated to have negligible to minor adverse direct effects and minor to moderate adverse indirect effects on Essential Fish Habitat. These impacts may be short-term or long-term depending on the severity of the grounding and the duration of the time-lag associated with this alternative. Cumulative impacts to Essential Fish Habitat are expected to be adverse, minor to moderate, and long-term. No impairment to Essential Fish Habitat is anticipated under the No Action alternative.	Under a programmatic approach, direct and indirect impacts to Essential Fish Habitat are expected to be the same as those of Alternative 1; however, they are expected to be short-term in duration. Cumulative impacts to Essential Fish Habitat are expected to be adverse, minor to moderate, and long-term. No impairment to Essential Fish Habitat is anticipated under a programmatic approach.	Direct adverse impacts to Essential Fish Habitat resulting from restoration activities include temporary displacement of fish species from Essential Fish Habitat. These impacts would be short-term and negligible. Long-term, indirect beneficial effects would result from a restoration of reef complexity. Cumulative impacts to Essential Fish Habitat are expected to be adverse, minor to moderate, and long-term. No impairment to Essential Fish Habitat is anticipated from restoration activities.
Threatened and Endangered Species	**Sea Turtles –** Potential direct impacts with Alternative 1 include reduced foraging areas and changes in food sources and availability. Due to the small area of sea turtle habitat affected within BISC, these impacts were determined to be insignificant and not likely to adversely affect sea turtle populations within BISC. Alternative 1 would make no appreciable contribution to the cumulative impacts to sea turtles as a species. No impairment to sea turtles is expected with the No Action alternative. **Smalltooth Sawfish –** The direct and indirect potential for changes in population and distribution of their primary food source (small schooling reef fish that rely on reef habitat) would be localized and temporary. These impacts are considered insignificant and are not likely to adversely affect smalltooth sawfish. The direct and indirect effects of the No Action alternative would make no appreciable contribution to the cumulative impacts to the species. No impairment to smalltooth sawfish would	**Sea Turtles –** Potential direct and indirect impacts under a programmatic approach include reduced foraging areas and changes in food sources and availability. Due to the small area of sea turtle habitat affected within BISC and the short duration of effects, these impacts were determined to be insignificant and are not likely to adversely affect sea turtle populations within BISC. Additionally, Alternative 2 would make no appreciable contribution to the cumulative impacts to sea turtles as a species. No impairment to sea turtles is expected with Alternative 2. **Smalltooth Sawfish –** Potential direct and indirect impacts associated with the programmatic approach (changes in population and distribution of primary prey) are considered insignificant and are not likely to adversely affect smalltooth sawfish. Additionally, a programmatic approach would make no appreciable contribution to the cumulative impacts to smalltooth sawfish as a species. No impairment to smalltooth sawfish would occur with Alternative 2.	**Sea Turtles –** Direct impacts from restoration activities are insignificant and include avoidance of the area during restoration. Indirect effects from restoration actions are beneficial and include enhanced habitat for species on which sea turtles forage. Restoration activities associated with Alternative 2 may affect, but are not likely to adversely affect, sea turtles. Alternative 2 would make no appreciable contribution to the adverse cumulative impacts to sea turtles as a species. No impairment to sea turtles is expected with Alternative 2. **Smalltooth Sawfish –** Potential direct impacts associated with restoration activities (avoidance of the area during restoration) are insignificant and not likely to adversely affect smalltooth sawfish. Indirect benefits of restoration actions include the recovery of distributions and populations of the prey of smalltooth sawfish. Restoration actions would make no appreciable contribution to the cumulative impacts to smalltooth sawfish as a species. No impairment to smalltooth sawfish would occur as a result of

Impact Topic	Alternative 1: No Action (Current Activities Continued)	Alternative 2: Restoration Using a Programmatic Approach – Impacts of Programmatic Approach	Alternative 2: Restoration Using a Programmatic Approach – Impacts of Restoration Actions
	occur with the No Action alternative. **Elkhorn and Staghorn Coral –** Potential direct impacts include damage to dislodged corals that are not immediately salvaged from the injury site and potential indirect impacts include increased coral mortality/injury or reduced substrate suitable for colonization. These effects are considered localized and insignificant or discountable and therefore not likely to adversely affect the species. The No Action alternative would make no appreciable contribution to the cumulative impacts to the species. No impairment to elkhorn and staghorn corals would occur under Alternative 1. **West Indian Manatee** – No direct impacts are anticipated under Alternative 1. Indirect impacts include loss or alteration of foraging area. Impacts are considered insignificant due to the small area affected compared to the remaining foraging habitat in BISC. Therefore, Alternative 1 may affect, but is not likely to adversely affect, the species. Alternative 1 would make no appreciable contribution to the cumulative impacts to the West Indian manatee as a species. No impairment to the West Indian manatee would occur under the No Action alternative. **Pillar Coral** – Potential direct impacts include damage to dislodged corals that are	**Elkhorn and Staghorn Coral –** Potential direct impacts include damage to dislodged corals that are not immediately salvaged from the injury site and potential indirect impacts include increased coral mortality/injury or reduced substrate suitable for colonization. These effects are considered localized and insignificant or discountable and would be less likely with a programmatic approach. Therefore, they are not likely to adversely affect the species. Alternative 2 would make no appreciable contribution to the cumulative impacts to the species. No impairment to elkhorn and staghorn corals would occur with Alternative 2. **West Indian Manatee –** No direct impacts are anticipated under a programmatic approach. Indirect impacts include loss or alteration of foraging area. The reduced time-lag associated with a programmatic approach would reduce the period of time that indirect impacts could occur compared to Alternative 1. Impacts are considered insignificant due to the small area affected compared to the remaining foraging habitat in BISC. Therefore, Alternative 2 may affect, but is not likely to adversely affect, the species. Alternative 2 would make no appreciable contribution to the cumulative impacts to the West Indian manatee as a species. No impairment to the West Indian manatee would occur under Alternative 2 **Pillar Coral** – Potential direct impacts of the programmatic approach include damage to dislodged corals that are not immediately	restoration activities. **Elkhorn and Staghorn Coral –** Restoration actions associated with Alternative 2 may affect, but are not likely to adversely affect, elkhorn and staghorn corals. There are discountable impacts associated with restoration work, and beneficial impacts through providing suitable substrate for recruitment and settlement, increased survival rate, a decreased likelihood of disease, and increased genetic diversity and density. Restoration actions will alleviate adverse cumulative effects on the corals as species. No impairment to elkhorn and staghorn corals would occur with implementation of restoration activities. **West Indian Manatee –** Potential direct impacts associated with restoration activities include changes in behavior from the presence of divers or boats, or collisions with restoration vessels. These impacts are extremely unlikely and are considered discountable. Anticipated indirect effects of restoration activities to the West Indian manatee are beneficial and include preventing the loss of seagrass foraging habitat. Therefore, restoration activities may affect, but are not likely to adversely affect, the species. Restoration activities would make no appreciable contribution to the cumulative impacts to the West Indian manatee as a species. No impairment to the West Indian manatee would occur with the implementation of restoration activities. **Pillar Coral –** Restoration actions associated with Alternative 2 may affect, but are not likely to adversely affect, pillar corals.

Impact Topic	Alternative 1: No Action (Current Activities Continued)	Alternative 2: Restoration Using a Programmatic Approach – Impacts of Programmatic Approach	Alternative 2: Restoration Using a Programmatic Approach – Impacts of Restoration Actions
	not immediately salvaged from the injury site and potential indirect impacts include increased coral mortality/injury or reduced substrate suitable for colonization. These effects are considered localized and insignificant or discountable and therefore not likely to adversely affect the species. The No Action alternative would make no appreciable contribution to the cumulative impacts to the species. No impairment to pillar corals would occur under Alternative 1.	salvaged from the injury site and potential indirect impacts include increased coral mortality/injury or reduced substrate suitable for colonization. These effects are considered localized and insignificant or discountable and would be less likely with a programmatic approach. Therefore, they are not likely to adversely affect the species. Alternative 2 would make no appreciable contribution to the cumulative impacts to the species. No impairment to pillar corals would occur with Alternative 2.	There are discountable impacts associated with restoration work, and beneficial impacts through providing suitable substrate for recruitment and settlement, increased survival rate, a decreased likelihood of disease, and increased genetic diversity and density. Alternative 2 would make no appreciable contribution to the cumulative impacts to the species. No impairment to pillar corals would occur with Alternative 2.
Historical and Cultural Resources	Potential indirect, negligible to moderate adverse impacts identified under Alternative 1 include additional scouring and erosion during the increased planning period (time-lag) that could cause loss of the qualities that qualify the cultural resource as eligible to the NRHP. Major adverse impacts would be prevented through emergency restoration. No impairment to historical and cultural resources is anticipated under the No Action alternative because historical and cultural resources within BISC will not be significantly impacted.	No direct adverse impacts are anticipated under this alternative. In the event of impacts to cultural resources at an injury site, indirect impacts associated with the time-lag for conducting Section 106 consultation could range from negligible to minor and adverse. Benefits would occur by means of the more expeditious nature of restoration activities under Alternative 2 relative to the No Action alternative. For purposes of Section 106 of the NHPA, the determination would be no adverse affect. No impairment to historical and cultural resources is anticipated under Alternative 2.	No direct adverse impacts are anticipated under this alternative. In the event of impacts to cultural resources at an injury site, indirect impacts associated with the time-lag for conducting Section 106 consultation could range from negligible to minor and adverse. Benefits would occur by means of the more expeditious nature of restoration activities under Alternative 2 relative to the No Action alternative. For purposes of Section 106 of the NHPA, the determination would be no adverse affect. No impairment to historical and cultural resources is anticipated under Alternative 2.
Recreation and Visitor Experience	Under the No Action alternative, minor, direct and indirect, short- to long-term adverse effects could include closure of the area to recreational boaters, divers, and fisherman until restoration was completed and biological injury from movement of rubble or further destabilization of reef. Adverse cumulative impacts would be minor, adverse, and long-term.	Under a programmatic approach, minor, direct and indirect, short-term adverse effects could include closure of the area to recreational boaters, divers, and fisherman until restoration was completed and biological injury from movement of rubble or further destabilization of reef. Effects would likely be shorter in duration than under Alternative 1. Cumulative impacts would be minor, long-term, and adverse.	Restoration actions would have negligible to minor, short-term to long-term adverse impacts on recreation and visitor experience through potential temporary site closure, use of permanent pins or stakes for monitoring, and temporary closure of boat ramps and upland staging areas. Restoration actions would impact recreation and visitor experience beneficially through improved reef complexity and habitat. Cumulative impacts would be minor, long-term, and adverse.
Human Health and Safety	Adverse impacts to human health and safety from the No Action alternative would be short-term to long-term and negligible to	Any potential adverse impacts (direct, indirect, and cumulative) identified under this alternative would be less than with	Potential adverse direct impacts to NPS staff or contractors would be short-term and negligible to minor. Human health and

Impact Topic	Alternative 1: No Action (Current Activities Continued)	Alternative 2: Restoration Using a Programmatic Approach – Impacts of Programmatic Approach	Alternative 2: Restoration Using a Programmatic Approach – Impacts of Restoration Actions
	minor. Such impacts would include boater confusion caused by closures and potential exposure of divers to paint or chemicals. Cumulative effects would be adverse, long-term, and minor.	Alternative 1 because of the reduced time-lag associated with the programmatic approach. Adverse impacts would be negligible to minor and short-term.	safety within BISC would benefit from actions such as removal and stabilization of rubble and from reduction in boater traffic to un-injured sites.
Park Operations	Any potential adverse impacts (direct, indirect, and cumulative) identified under this alternative would be minor and short-term to long-term. Uncertainty related to temporary diversions of personnel and budgetary resources would continue because temporary commitments of resources to address restoration planning and environmental review would remain when addressing incidents individually.	Potential impacts (direct, indirect, and cumulative) to Park operations identified under this alternative for implementing a programmatic approach are anticipated to have beneficial effects. Uncertainty related to temporary diversions of personnel and budgetary resources would be reduced because temporary commitments of resources to address restoration planning and environmental review would be fewer, less frequent, and of shorter duration than by responding on an individual basis. Overall, Park operations within BISC would be improved by taking this action.	Negligible adverse impacts are anticipated upon Park operations from the implementation of any of the restoration activities proposed in the toolbox.

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3. AFFECTED ENVIRONMENT

This section describes the environment expected to be affected by the coral reef restoration alternatives proposed in this RP/PEIS for vessel-grounding sites in BISC. The environments/issues discussed include the physical environment, the biological and natural resources, critical habitat, T&E species, historical and cultural resources, recreation and visitor experience, human health and safety, aesthetics, and Park operations. This section also discusses the issues eliminated from further discussion.

3.1 Physical Environment

BISC is located in south Florida, a region with a subtropical climate. The following mean monthly meteorological data for BISC were recorded at the Fowey Rocks data buoy (Buoy ID #FWYF1) for the 10-year period between 1991 and 2001 (NOAA, 2005b):

- Mean monthly air temperatures: 17 to 30 degrees Celsius (°C) (63 to 86 degrees Fahrenheit [°F]);
- Mean monthly water temperature: 22 to 31°C (72 to 88°F); and
- Mean monthly wind speed: 5 to 22 knots (5.7 to 25.3 miles per hour).

Cold fronts and associated winds with a northerly component are common during the winter months. Seasonality in south Florida is also characterized by wet and dry seasons. The dry season extends from November to April and the wet season from May through October. Annual rainfall is approximately 62 inches, but may fluctuate greatly from year to year. Most rain falls in summer in brief, intense afternoon thunderstorms. Summer and fall are peak seasons for tropical storms and hurricanes.

Water depths range from 0.0 to 18.2 meters (m) (0 to 60 ft) from Biscayne Bay east to the Florida Reef Tract near the eastern limits of the Park. Tides in the Park are semi-diurnal or "mixed," having two high tides and two low tides per lunar day. The mean tidal elevation is 0.24 m (0.8 ft) Mean Low Water (MLW) (North American Datum [NAD] 83) and the mean tidal range is 0.46 m (1.5 ft) (NOAA, 2005b).

Hydrographic conditions are influenced by BISC's position between the seaward Florida Current and the landward low-lying keys. The northerly flowing Florida Current moderates winter water temperatures along the Florida Straits. Larval transport and nutrient enhancement to this coastal ecosystem can be attributed to eddies generated within the Florida Current.

3.1.1 Geology

Biscayne Bay lies within a bedrock basin that is bounded on the east by a narrow, elongated ridge composed of Key Largo limestone, and on the west by the Atlantic Coastal Ridge composed of Miami limestone and the low platform of the Everglades. The coral reefs injured by groundings in BISC are part of the Florida Reef Tract, which is underlain by Pleistocene coralline limestone (Shinn et al., 1989). The outer bank reef system is an elongated feature whose long axis is oriented parallel to the continental shelf edge (north-south).

The coral reef formations in BISC are comprised of consolidated rock with a substrate matrix of encrusted and lithified limestone-secreting organisms, primarily corals, algae, and bryozoans, that has developed on pre-existing bedrock facies. The bank reef topography varies within the reef matrix as a result of disproportional erosional processes occurring over a geological time scale (1.6 million years). Maximum vertical relief of the coral reef communities varies and is defined by the substrate topography and associated biological community.

3.1.2 Water Quality

Urbanization and development of Miami-Dade County have led to anthropogenic alterations of natural flows into Biscayne Bay. As a result, the timing, sources, quantity, and quality of freshwater flow into the bay have changed over time. Water quality in Biscayne Bay is highly dependent on the land use and influence from its watershed (Caccia and Boyer, 2005). Furthermore, salinity has increased over the past 100 years, due to the bay's enclosed configuration and restricted natural freshwater input from the Everglades (NPS, 2005a).

Runoff flows containing sediment, elevated concentrations of nutrients (nitrogen [N] and phosphates [P]), hormonally active pharmaceutical products, and other emerging pollutants of concern and chlorophyll are transported to the surface waters of BISC via an extensive network of canals. A robust nutrient gradient, driven mostly by dissolved inorganic N, has been observed from alongshore to offshore in the bay, and exists as a result of freshwater inflow that drains from the surrounding urban areas (Caccia and Boyer, 2005). The marsh and mangrove communities lining the western edge of the Park assist in filtering these freshwater nutrients. However, N and P loading can deplete oxygen and increase phytoplankton biomass (algal blooms), which in turn has a direct effect on light attenuation. Chlorophyll a and sedimentation directly influence surface water transparency by increasing turbidity in receiving surface waters.

The salinity gradient in Park waters generally increases from east to west, but there may be high variability in salinity throughout the Park. The freshwater-fed bay transitions to an oceanic pelagic zone dominated by the Florida Current. Upwelling of cool, nutrient-rich waters from the Florida Current is transported to the reef crest and landward by cross-shore transport, which provides nutrient pulses that can affect the health and reproductive processes of reef and seagrass communities, and the organisms that depend upon these habitats (Leichter et al., 2003).

3.2 Biological and Natural Resources

3.2.1 Epibenthic Biota

The Florida Reef Tract lies due east of the Florida Keys and comprises the northernmost extension of living coral reefs in the United States. A west-to-east profile across the reef tract reveals two major zones: the back reef and outer reef. Intermittent patch reefs, seagrass beds, and sand lenses make up an irregular pattern of shallow banks and relatively deeper channels within the back reef zone. The outer reef (bank reef) forms the seaward edge of the reef platform, and usually consists of a series of terraces that increase in depth to the east (NPS, 2005c). It is an elongated feature whose long axis is oriented parallel (north-south) to the continental shelf edge. Coral reef formations in BISC provide valuable habitat for soft corals (gorgonians), hard corals (scleractinians), sponges, and a variety of other sessile plant and animal species. These formations also support protected sea turtle species and numerous fish species (ichthyofauna).

The Park's eastern boundary follows the 60-ft (18.3-m)-depth contour. In the Park, the reef environment extends eastward from the keys to the outer edge of the coral reef tract. The salinities of the reef area are oceanic and have very little seasonal variability. Bottom substrates are a mosaic of seagrass, hard bottom, and bare-bottom communities; however, coral reefs are the most prominent feature. Two types of coral reef communities are present in the reef system, inshore patch reefs and the offshore bank reef (reef tract).

The patch reefs are comprised of living masses of coral heads and soft corals rising directly from the bottom in water typically 10 to 20 ft deep. These reefs may rise to within 2 to 3 ft of the water surface, and range in size from individual coral heads to masses in excess of 150 ft across (NPS, 2009b). The bottom surrounding the reefs is usually flat and covered with seagrass, although there is typically a bare sand halo around the reef resulting from grazing by fish. These patch reefs provide habitat to a large variety of fish and other marine life.

The Florida Reef Tract is underlain by Pleistocene coralline limestone (Shinn et al., 1989). The hard bottom is part of the outer bank reef system. Although this reef system supported a fringing elkhorn coral (*Acropora palmata*) in the recent geological past, it is now a series of limestone ridges with minimal Holocene deposition (Shinn, 1988). As described under Section 3.1.1, Geology, the hard bottom is composed of a substrate matrix of encrusted and lithified limestone-secreting organisms, primarily corals, algae, and bryozoans, that has developed on pre-existing bedrock facies. The bank reef topography is quite variable within the reef matrix as a result of disproportional erosional processes occurring over a geological time scale.

Within the Park, coral reefs have been negatively affected by human-related impacts associated with boating, fishing, snorkeling, and diving activities. Vessel groundings on patch reefs occur multiple times annually, resulting in severe and long-term injuries to the grounding site. Anchors from recreational boaters harm coral habitat. Corals have been destroyed and injured directly by recreational divers and snorkelers. The reef is littered with fishing tackle from recreational and commercial fishing. Fishing line and lines from crab and lobsters traps become entwined in the reef, resulting in damage to coral. Preliminary surveys by the FWC Fish and Wildlife Research Institute (FWRI) staff indicate that the density of fishing-related marine debris is greater in BISC than in any other area surveyed throughout the Florida Keys (NPS, 2009b)

3.2.1.1 Hard Corals

Hard corals (scleractinians) are critical for providing structural framework for the reef system. Coral reef community dynamics can be described based on temporal changes in coral species abundance, density, and age structure (Porter and Meier, 1992). Data from BISC bank reefs indicate that coral coverage ranges from 1.9 to 12.7 percent. (Miller et al., 2000). Coral species that occur in BISC belong to the Caribbean-Western Atlantic biogeographic province. The coral reef formations within BISC support a relatively diverse hard coral community; up to 43 species have been recorded (Burns, 1985; Miller et al., 2000). The BISC hard coral fauna represents over two-thirds of the total species of hard corals recorded in the province (Laydoo, 1990). Some of the most common species of hard coral found on BISC reefs include starlet corals (*Siderastrea* spp.), star corals (*Montastrea* spp.), the elliptical star coral (*Dichocoenia stokesii*), the mustard hill coral (*Porites asteroides*), and brain corals (*Diploria* spp.). Fire coral (*Millepora* spp.) is hydrozoan that is also commonly observed on BISC reefs. The sheet-like branches of *Millepora complanata* are resistant to high wave energy (Edmunds, 1999), and add to the structural complexity of the reef.

3.2.1.2 Gorgonians

Frequently the most conspicuous sessile organisms on BISC reefs are gorgonians. Gorgonians are important to coral reef communities because of their structural complexity, i.e., vertical and horizontal branching, which provides habitat for a variety of organisms. The vertical extension above the sea floor provides these organisms with access to food resources higher in the water column (Mitchell et al., 1992). Bryozoans, hydrozoans, and brittle stars utilize the branching network of gorgonians for refuge and foraging. As such, the branching and shaded community provided by gorgonians contributes to increased abundance and diversity on the reef (Mitchell et al., 1992). Some of the most common species on BISC reefs include the sea fans (*Gorgonia* spp.), encrusting corky sea finger (*Erythropodium caribaeorum*), sea plumes (*Pseudopterogorgia* spp.), and sea rods (*Plexaura*).

3.2.1.3 Sponges

Sponges (Porifera) are an important epibenthic component of Florida's reefs. Sponges are major competitors with other reef epibiota for space and other resources and have the greatest overgrowth capability of reef-encrusting organisms (Jaap, 1984). Prominent ecological roles of sponges include providing shelter and food as well as contributing to both erosional and depositional processes. Common sponges in BISC include the boring sponge (*Cliona* spp.), the giant barrel sponge (*Xestospongia muta*), branching vase sponge (*Callyspongia vaginalis*) and various cavity-dwelling species (e.g., *Agelas* spp., *Clathira* spp., and *Chondrosia* spp.). Sponges provide habitat for numerous sponge inquilines that include brittle stars, juvenile spiny lobster, and snapping shrimp.

3.2.1.4 Marine Algae

Benthic algae are primary producers that provide food, oxygen, and habitat, both directly and indirectly, to numerous marine species (Littler et al., 1989). Although various species of macroalgae are found within BISC, a few of the most commonly occurring species include the green algae *Dasycladus vermicularis*, *Caulerpa spp*., and *Halimeda spp*.; the brown algae *Dictyota spp*., *Sypopodium sp*., and *Padina spp*.; the red algae *Laurencia sp*., *Liagora ceranoides*, *Gelidium pusillum*, *Gracilaria spp*., and coralline algae, as well as blue green algae (cyanobacteria).

Fleshy macroalgae are a direct food source for reef fish and invertebrates (parrotfish, surgeonfish, sea urchins, hermit crabs, etc.). These herbivores, in turn, play a crucial role in preventing the overgrowth of algae within reef systems. Crustose coralline red algae accrete calcium carbonate onto the reef to help build and maintain the structure. This algae has been linked to chemical stimuli that allow coral to recognize suitable substrate for settlement and metamorphosis (Negri et al., 2001).

3.2.2 Other Invertebrates

The commercially important Caribbean spiny lobster (*Panulirus argus*) inhabits the coastal and shallow continental shelf waters from North Carolina to Brazil (Marx and Herrnkind, 1986) and is found throughout BISC. The spiny lobster has been commercially fished in Florida for more than 100 years and in 1999 exceeded the pink shrimp (*Penaeus duorarum*) as Florida's most valuable fishery (Muller et al., 2000). The ontogeny of the spiny lobster includes multiple structural and behavioral phases; consequently, the lobster makes use of a broad range of marine habitats during its lifetime. Adults inhabit reef crevices, ledges, and discontinuities in the coral reefs. Juveniles fine refuge within sponges in the reef community. Other commercially and recreationally important crustaceans found within BISC include the blue crab (*Callinectes sapidus*) and stone crab (*Menippe mercinaria*).

The long black spine sea urchin (*Diadema antillarum*) contributes to the reef community as a grazer, feeding on algal turf and macroalgae. *D. antillarum* are also present in seagrass beds, providing shelter to fish and other organisms (Gratwicke and Speight, 2005). Their continuous grazing on the reefs provides a clean substrate for coral larvae settlement and prevents established coral from being smothered by the overgrowth of algae. *D. antillarum* faced near extinction in 1983–1984 due to a poorly described epizootic episode (Bauer and Agerter, 1994). The disease spread quickly over a vast geographic area beginning in Panama and covering the entire Caribbean and tropical western Atlantic Ocean (Lessios, 1995). The mass mortality was described as an unprecedented biological disturbance (Knowlton, 2001). Although present on the Florida Reef Tract, *D. antillarum* have not rebounded in population as expected (Chiappone et al., 2002) even though these animals are highly fecund (Lessios, 1995). It has been proposed that the limited recovery may be due to the "Alee effect" (Knowlton, 2001). *D. antillarum* must aggregate to reproduce, and the male's sperm are limited as to how far they can travel, and how long they can last in seawater.

3.2.3 Ichthyofauna

Many fish utilize multiple habitats within BISC waters (NPS, 2003). For example, reef-associated species utilize reef habitat for shelter and seagrass habitat for feeding grounds. On a longer time scale, fish, as well as invertebrates, may sequentially utilize multiple habitats during different stages of their lifecycle. For example, some species of snappers and grunts live in seagrass habitat as early juveniles, migrate to mangrove habitat as later juveniles or early adults, and shift to offshore, coral reef habitat as adults.

Coral reef formations in BISC support an abundance of ichthyofauna, with more than 500 species reported to inhabit the BISC reefs (NPS, 2005d). The reef substrate and habitat complexity (e.g., vertical relief and number of interstices) are directly connected to reef fish density and species diversity (Luckhurst and Luckhurst, 1978; Dennis and Bright, 1988). Substrate and epibiotal complexity of reefs in BISC provide shelter from predation, spawning sites, and foraging areas. As dominant epibiotal components of the coral reef formations, gorgonians, scleractinians, and sponges provide valuable habitat for numerous invertebrates that are prey for fish. As reported in the South Atlantic Fishery Management Council (SAFMC) habitat plan (SAFMC, 1998), densities of octocoral (soft coral) colonies from patch reefs within BISC exceed densities of stony coral colonies on the same reefs. Furthermore, the fish communities associated with these octocoral-dominated reefs are very diverse (214 species), suggesting that ocotocorals are an important habitat component that provide not only refuge but a place for recruits to settle.

Both tropical and temperate fish species are well represented in BISC; however, tropical fish species make up the majority of species found. There is an apparent temporal pattern in species composition with more tropical species found in the summer months, and temperate species partially replacing tropical species (at the edge of their range) in the winter months. Examples of the more than 500 fish species in BISC include: barracuda (*Sphyraena barracuda*), hogfish (*Lachnolaimus maximus*), gray snapper (*Lutjanus griseus*), goliath grouper (*Epinephelus itajara*), tarpon (*Megalops atlanticus*), cero mackerel (*Scomberomorus regalis*), and many members of fish families such as snappers (Lutjanidae), groupers (Serranidae), grunts (Haemulidae), spadefish (Ephippidae), surgeonfish

(Acanthuridae), triggerfish (Balistidae), parrotfish (Scaridae), wrasse (Labridae), Damselfish (Pomacentridae), angelfish (Pomacanthidae), and jacks (Carangidae) (Ault et al., 2001; NPS, 2003).

Biscayne Bay supports a large year-round sport fishery that includes species such as bonefish (*Albula vulpes*), permit (*Trachinotus falcatus*), tarpon (*Megalops atlanticus*), spotted seatrout (*Cynoscion,* var. spp), snook (*Centropomus*, var. spp), dolphinfish (*Coryphaena hippurus*), hogfish (*Lachnolaimus maximus*), Crevalle jack (*Caranx hippos*), and a variety of groupers and snappers (FDEP, 2005). A fish stock assessment for the Florida Keys indicated that many commercially important fishes, including grouper (Epinephelinae), snappers (Lutjanidae), hogfish (Labridae), and grunts (Haemulidae), have been "overfished." Some stocks, particularly the largest, most desirable, and vulnerable species, have been chronically overfished since the late 1970s (Ault et al., 1998, Ault et al., 2007). Population changes as a result of overfishing could contribute to changes in overall community structure and dynamics.

3.2.4 Seagrasses

More than 40 percent of the Park's 172,925 acres are occupied by established seagrass beds (NPS, 2005a). Seagrasses are unique marine flowering plants that occur in areas of BISC covered by unconsolidated sediment in shallow subtidal or intertidal waters, generally closer to the shore than coral reefs. However, small patches of seagrasses do occur around the shallow reefs, providing habitat and food resources for fish and invertebrates. There are 45 known species of seagrasses world-wide and only 7 of those occur in Florida. The three major types of seagrasses found in BISC are turtle grass (*Thalassia testudinum*), shoal grass (*Halodule wrightii*), and manatee grass (*Syringodium filiforme*).

BISC's seagrass communities are valuable natural resources that provide important benefits to the marine environment. They enhance sediment stabilization through the utilization of their complex root and rhizome systems (Myers and Ewel, 1990). They increase primary productivity in environments of naturally low nutrient concentrations as they are able to use both their roots and leaves to uptake nutrients from the water column. They also aid in reducing wave action and providing nursery habitat and feeding grounds for economically important fish and invertebrates. In addition, seagrass communities provide feeding grounds for wading and diving birds, provide food and habitat for endangered species, and create habitat and substrate diversity (Porter and Porter, 2002). Seagrass beds also provide habitat for the development of many juvenile fish and invertebrate species. These communities are critical to their respective species including fish, reptiles, birds, and mammals that are protected (see Section 3.4) by state and federal regulations.

3.3 Essential Fish Habitat

The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act directed National Marine Fisheries Service (NMFS) and the Fisheries Management Council to include identification and protection of Essential Fish Habitat (EFH) in all federal fishery management plans. NMFS implements and enforces the act through consultation with federal agencies, which is required for any federally funded, permitted, or proposed work that may affect EFH. The Magnuson-Stevens Act defines EFH as "those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity" (NMFS, 1999). Essential Fish Habitat-Habitat Area of Particular Concern (EFH-HAPC) is a subset of the EFH designation for areas that are rare, considered particularly vulnerable to degradation by human activities, environmentally stressed, or especially ecologically important (NMFS, 1999). In general, HAPCs include high value intertidal and estuarine habitats, offshore areas of high habitat value or vertical relief, and habitats used for migration, spawning, and rearing of fish and invertebrates. HAPCs are designed to help provide additional focus for conservation efforts (NOAA, 2002b).

The President's CEQ guidelines (CEQ, 1978) for implementing NEPA requires an analysis of resources that would be considered ecologically critical areas. Ecologically critical areas in BISC include EFH and EFH-HAPC. Table 3-1 lists the EFHs and HAPCs designated in BISC.

Table 3-1. EFHs and HAPCs designated in BISC

EFH	EFH	EFH-HAPC
Spiny Lobster	X	X
Shrimp	X	X
Corals	X	X
Coastal Migratory Pelagics	X	
Snapper-Grouper	X	X

Source: NOAA, 2008b

NOAA NMFS implements and enforces the Magnuson-Stevens Act through consultation with federal agencies required for any federally funded, permitted, or proposed work that may affect EFH. BISC will coordinate with NOAA Fisheries Habitat Conservation Division to determine if an EFH assessment is warranted for this RP/PEIS.

3.4 Threatened and Endangered Species

3.4.1 Federally Listed Species

The ESA, the state of Florida Rules 39-27.004 and 39 27.005, and FAC Chapter 5C-4 (animals) and Chapter 5B-40 FAC (plants) direct federal and state agencies to protect and conserve listed T&E animals and plants. The habitat of T&E species takes on special importance because of these laws, and conservation of these species requires careful management.

Federally listed marine T&E species that occur within BISC and could be potentially affected by the proposed action are presented in Table 3-2 and described in Sections 3.4.1.1–3.4.1.5. The list includes one mammal, one fish, two invertebrates (hard corals), and six reptiles.

Only federally listed T&E species that utilize the reef in BISC were considered for analysis. The species listed below may be terrestrial or found in offshore waters, and were therefore excluded from detailed analysis because they do not utilize the reef. These species are not further considered:

- Avian Species: piping plover (*Charadrius melodus*), Everglade snail kites (R*ostrhamus sociabilis plumbeus*), and the wood stork (*Mycteria Americana*)
- Upland Species: Key Largo cotton mouse (*Peromyscus gossypinus allapaticola)*, Key Largo woodrat (*Neotoma floridiana smalli)*, and the eastern indigo snake (*Drymarchon corais couperi*)

- Whales: finback (fin) whales (*Balaenoptera physalus*), humpback whales (*Megaptera novaeangliae)*, North Atlantic right whales (*Eubalaena glacialis)*, sperm whales (*Physeter macrocephalus)*, and sei whales (*Balaenoptera borealis*)

- Submerged Aquatic Vegetation: Johnson's Seagrass (*Halophila johnsonii*)

Table 3-2. Federally Listed Threatened and Endangered Species Potentially Utilizing Coral Reefs in BISC

Common name	Scientific Name	Status
Mammals		
West Indian manatee	*Trichechus manatus*	Endangered
Fish		
Smalltooth sawfish	*Pristis pectinata*	Endangered
Invertebrates		
Elkhorn coral	*Acropora palmate*	Threatened
Staghorn coral	*Acropora cervicornis*	Threatened
Reptiles		
Green sea turtle	*Chelonia mydas*	Threatened
Hawksbill sea turtle	*Eretmochelys imbricata*	Endangered
Kemps Ridley sea turtle	*Lepidochelys kempii*	Endangered
Leatherback sea turtle	*Dermochelys coriacea*	Endangered
Loggerhead sea turtle	*Caretta caretta*	Threatened
American Crocodile	*Crocodylus acutus*	Threatened

Whales are seasonal migrants, spending the warmer summer months at higher latitudes and the colder winter months in lower latitudes. Whales that may be present off the eastern coast of Florida during migration include finback (fin) whales, humpback whales, North Atlantic right whales, sperm whales, and sei whales. These five whale species have been classified as endangered since June 2, 1970. While migrating to and from summer and winter feeding grounds, whales are typically found offshore in deep ocean waters. Therefore, whales are extremely rare within BISC due to shallow waters within BISC (maximum depth of 60 ft at the eastern border) and likely pass outside of BISC in deeper waters during their offshore migrations. BISC maintains a wildlife observation database, dating back to the early 1980s, which includes no sightings of live whales in Park waters (NPS, 2009b).

Johnson's seagrass (*Halophila johnsonii*) was listed as threatened throughout its range under the ESA on September 14, 1998. Johnson's seagrass has an extremely narrow distribution and is found only in lagoons along a 193-km (120-mile) stretch of coastline in southeast Florida, extending from Sebastian Inlet to North Biscayne Bay (NMFS, 2002). The southern range of Johnson's seagrass is north of BISC's northern boundary; therefore, since it does not occur in BISC it is not considered further in this PEIS.

3.4.1.1 Sea Turtles

Sea turtles are marine reptiles found throughout tropical, subtropical, and temperate waters. Five species of sea turtle can be found in estuaries and coastal waters along peninsular Florida, including BISC. In order from least to most abundant, the five species include Kemp's Ridley (*Lepidochelys* *kempii*), hawksbills (*Eretmochelys imbricata*), leatherbacks (*Dermochelys coriacea*), greens (*Chelonia mydas*), and loggerheads (*Caretta caretta*). The Kemp's Ridleys, hawksbills, and leatherbacks were federally listed as endangered in December of 1970. Loggerheads were listed as threatened under the ESA in 1978. Breeding populations of Greens in Florida and the Pacific coast of Mexico are listed as endangered under the ESA, while all other breeding populations are listed as threatened. Internationally, all species of sea turtles are considered endangered by the International Union for Conservation of Nature (IUCN) and listed in Appendix I of the Convention of International Trade in Endangered Species of Wild Fauna and Flora.

Sea turtles face many threats. Primary marine threats include collisions with boats, entanglement in and ingestion of floating debris, entrapment in fishing nets, and harvesting shells for decorations (poaching). Sea turtles crawl out of the water and nest on coastal beaches. They balance cues from the reflection of light off the ocean and the profile of dune vegetation to find the ocean after nesting and upon hatching. Beach and shoreline development is decreasing the suitability of nesting beaches in Florida. Artificial lights from beachfront developments disorient hatchlings and nesting females, shoreline armoring accelerates beach erosion, and inappropriate sand substrate and beach profiles from beach nourishment projects and erosion may prevent nesting.

The nesting season for the sea turtle in Florida extends from March 1 to October 31. The most commonly observed turtle in the Park is the loggerhead. Both loggerheads and hawksbills have been documented to nest in the Park, although hawksbill nesting has not been documented since 1990. Sea turtle nesting activity has been documented on Elliott Key (Petrel Point, Sawyers Cove, Adelle Cove, Palm Cove, Tannehill Beach, North University Beach, and South University Beach), Boca Chita Key, Sands Key (North Sands Beach and South Sands Beach), and Soldier Key (historically, but not in recent years). The southeastern United States nesting aggregation of loggerheads is the largest loggerhead nesting aggregation in the world, and is of paramount importance to the survival of the species (NMFS and USFWS, 1991).

During turtle nesting season, the Park performs nesting surveys three to seven times per week, depending on available staff and boat support. When a nest is identified, it is protected from potential predators with a self-releasing screen that allows hatchlings to emerge when hatching occurs. After hatching occurs, nests are excavated to determine number of hatchlings and hatching success (number of hatched eggs divided by the total number of eggs).

Sea turtles in BISC may be injured or killed from collisions with boats. On average, three to six turtles a year are reported or found by BISC staff to have been killed from collisions with boats (BISC unpub. data). It is likely that additional, undocumented turtle deaths from boat collisions occur. Sea turtles may be injured or drown from entanglement in marine debris, and are also susceptible to being collected as bycatch during recreational (e.g., hook-and-line) and commercial (e.g., purse seine) fishing activities.

3.4.1.2 Smalltooth Sawfish

The smalltooth sawfish (*Pristis pectinata*) was listed as endangered under the ESA in April 2003. Their distribution is circumtropical, including marine and estuarine waters of the peninsula and panhandle of Florida (NMFS, 2006). Originally, habitat for smalltooth sawfish was considered to be limited to shallow (less than 10 m [33 ft]) muddy and sandy bottoms of sheltered bays, shallow banks, estuaries, and river mouths (NMFS, 2000). However, recent research found that the habitat depends on size. Juveniles (less than 99 centimeters [cm] [40 inches] in length) spend their time mostly on mud or sand banks less than 0.3 m (1 ft) deep and likely in mangrove roots that provide protection (NMFS, 2006). As they grow, their association to shallow waters lessens. Adults inhabit similar habitats but may also be found in waters up to 122 m (400 ft) deep (Poulakis and Seitz, 2004). The diet of the smalltooth sawfish includes small schooling fish and crustaceans and other bottom dwellers.

Their main distribution constraint is their inability to survive in water temperatures lower than 16 to 18ºC (61 to 64ºF) and the limited availability of appropriate coastal habitat (NMFS, 2006). The species at one time flourished throughout Florida and its range extended from Texas to North Carolina. Its current range is limited to peninsular Florida and it is most prevalent in the Everglades region at the southern tip of the state (NOAA, 2005a). Sawfish range and populations have declined primarily because of bycatch (entanglement in fishing nets), loss of suitable habitat, and their low rate of population growth (NOAA, 2005a). The main threat to smalltooth sawfish is bycatch mortality from commercial fishing (Seitz and Poulakis, 2002). Degradation of the mangrove shorelines used by both juvenile and adult sawfish (NMFS, 2006) is a secondary factor contributing to smalltooth sawfish decline.

The endangered smalltooth sawfish is also confirmed to inhabit BISC waters, though the population is not well understood. In BISC, sawfish sightings have been reported (1) near the safety valve region (south of Key Biscayne), (2) southeast of Soldier Key, and (3) near the Arsenicker Keys (BISC unpub. data). Information is lacking regarding historical abundance or distribution in the waters of BISC.

3.4.1.3 Acroporid Corals

Elkhorn coral (*Acropora palmata*) and staghorn coral (*Acropora c ervicornis*), members of the Acroporidae family, are two of the most important reef building corals in shallow tropical reefs (ABRT, 2005). In 2006, the NMFS listed *A. palmata* and *A. cervicornis* as threatened species under the ESA. This designation was intended to promote conservation efforts to protect the existing *Acropora* populations. Fused staghorn (*A. prolifera*), a first generation hybrid of elkhorn and staghorn corals (Vollmer and Palumbi, 2002), is not proposed for T&E designation.

In BISC, Acroporid corals currently occur at relatively low densities throughout the reef tract, and have been in general decline since the 1980s. Acroporid skeletons, primarily *A. cervicornis,* make up a large percentage of the unconsolidated sediments surrounding the reefs.

Elkhorn coral reproduce asexually through fragmentation and sexually through broadcast spawning. The northern limit of their range is BISC, but their range extends as far south as Venezuela. Staghorn corals occur in back reef and fore reef environments and are found throughout the Florida Keys, Bahamas, Caribbean, and the west coast of South America. In November 2008, NOAA designated approximately 7,663 square km (2,959 square miles) of elkhorn and staghorn coral critical habitat located offshore of Florida, Puerto Rico, St. John/St. Thomas, and St. Croix (50 CFR parts 223 and 226). The greatest threats to these corals include diseases, increased temperature, hurricanes, increased predation, and anthropogenic impacts.

3.4.1.4 West Indian Manatee

The West Indian manatee (*Trichechus manatus*) has been listed as endangered throughout its range for both the Florida and Antillean subspecies (*T. m. latirostris* and *T. m. manatus*) since March 1967. It is also protected under the Marine Mammal Protection Act of 1972. In 2007, the USFWS recommended that the Florida manatee subspecies (*T. m. latirostris*) be reclassified as threatened, due to a possible population rebound. Contrary to that recommendation, the IUCN is considering changing the listing of *T. m. latirostris* from vulnerable to endangered on the basis of population size of less than 2,500 and estimated 20 percent population decline due to global warming (IUCN, 2008).

The Florida manatee (*Trichechus manatus latirostris*) is a distinct subpopulation of the West Indian manatee. The manatee can be found in fresh, brackish, and marine habitats. During the winter, cold temperatures concentrate the manatee population in peninsular Florida. The West Indian manatee can be found along the western Atlantic Ocean from North Carolina to the Florida Keys, the Caribbean Islands, Mexico, Central America, and northern South America. During the winter months, the entire United States population typically moves to the waters surrounding Florida (Humphrey, 1992). There is a clear trend of increased manatee mortality over time based on mortality data collected since 1974 (NPS, 2009b).

There are currently 14 federally designated manatee refuges and 4 federally designated manatee sanctuaries in Florida (USFWS, 2007), all of which are located well north of BISC. Manatees in BISC are typically found in nearshore waters. Population densities are greatest during winter months when the manatee population in BISC average 100 animals. Nearshore areas with freshwater input (e.g., Black Point and Convoy Point) have the greatest concentration of animals. The Park, in cooperation with the state of Florida and Miami-Dade County, has implemented a manatee slow-speed zone extending 1,000 ft from shore from Turkey Point (south of BISC headquarters) to Black Point (north of BISC headquarters). Slow-speed zones increase the reaction time of boat operators once a manatee is spotted allowing for a greater likelihood of avoiding manatee collisions (DERM, 1995).

The West Indian manatee (*Trichechus manatus*) is the only listed marine mammal T&E species that permanently resides in BISC. The manatee is most closely associated with Biscayne Bay and seagrass habitat, but it occasionally occurs in the reef areas.

3.4.1.5 American Crocodile

The American crocodile inhabits coastal waters of south Florida, the Caribbean, Mexico, Central America, and northern South America. In Florida, American crocodiles historically occurred at least as far north on the Florida east coast as Lake Worth, Palm Beach County (Ogden, 1978), to Tampa Bay on the west coast (Kushlan and Mazzotti, 1989), and as far south as Key West (Allen and Neill, 1952; Neill, 1971). The current distribution of the American crocodile is limited to extreme south Florida, including coastal areas of Miami-Dade, Monroe, Collier, and Lee counties.

Crocodiles were listed as endangered throughout their range in 1975 and critical habitat was established for the species in 1979 (USFWS, 1999). The southernmost tip of south Florida was designated as crocodile critical habitat. This critical habitat extends from easternmost tip of Turkey Point, Miami Dade County to Elliott Key then south along the keys to Long Key then northwest to Cape Sable (USFWS, 1999). In BISC this critical habitat includes all land and water from Turkey

Point, traveling southeast to the southernmost point of Elliott Key, and southwest from that point along the eastern shorelines of the keys to the southern BISC boundary. The species' decline leading to its endangered status was most likely from habitat alterations and direct human disturbances (USFWS, 1984). Subsequent habitat protection efforts resulted in an increase in crocodile population sizes significant enough that the USFWS reclassified the crocodile population in Florida to threatened in 2007.

Today, the greatest concentration of crocodiles near the Park is within the cooling canals of the Turkey Point Nuclear Electrical Generating Facility (adjacent to BISC), where significant nesting activity occurs. Nesting activity has not been documented in BISC. Nevertheless, BISC provides important habitat for sub-adult (2 to 8 years old) and adult crocodiles. The combination of the nesting area at Turkey Point and the refugia of coastal areas of the Park for sub-adults have been essential to the survival of the species in Florida (Mazzotti and Cherkiss, 1998). However, American crocodiles do not directly utilize reef communities in BISC and are therefore were removed from further consideration.

3.4.2 State Listed Species

The only state listed species that is also not federally listed found in the coral reef communities of BISC is pillar coral (*Dendrogyra cylindrus)*. The FWC listed pillar corals as endangered in 1985. Pillar coral is a tropical scleractinian coral species that is rare in south Florida, and is known to occur in BISC's coral reef communities.

3.5 Historical and Cultural Resources

Section 106 of the NHPA, 1966, as amended, requires federal agencies to consider the effects of their actions on historic properties, and to provide state historic preservation officers, tribal historic preservation officers, and, as necessary, the ACHP, a reasonable opportunity to review and comment on these actions.

The NPS recognizes and manages five basic types of cultural resources. These five fundamental categories are listed and defined as follows:

- **Archeological Site:** Physical evidence of past human occupation or activity. The NPS recognizes two basic subcategories: prehistoric and historic archeological sites.

- **Cultural Landscape:** A geographic area associated with a historic event, activity, or person; or landscape that exhibits other cultural or aesthetic values. This category includes designed, vernacular, and ethnographic landscapes. Cultural landscapes encompass both cultural and natural resources, as well as any wildlife or domestic animals that have historic associations with the landscapes.

- **Ethnographic Resource:** A site, structure, object, landscape, or natural feature of traditional importance to a contemporary cultural group.

- **Museum Objects:** A material thing (usually movable by nature or design) possessing scientific, historical, cultural, or aesthetic values.

- **Structure:** A constructed work (usually immovable by nature or design) created to serve some human activity. The work can be prehistoric or historic in significance. Examples include buildings, bridges, earthworks, roads, and rock cairns.

Cultural resources at the Park include prehistoric sites that provide evidence of aboriginal settlement of the Biscayne Bay region; historic shipwrecks; submerged historic non-shipwreck sites (docks, ballast piles, navigation aids, etc.); archeological ruins related to 19th- and early 20th-century homesteading and pioneer settlements; and the buildings and structures from development of the Miami area as a vacation destination during the first half of the 20th century.

The lands and submerged bottomlands of BISC are rich with archeological remains that document the cultural history of southern Florida and the Florida Keys. Submerged archeological sites include shipwrecks and other representations of maritime casualties, demonstrating the international maritime heritage represented within the Park. The archeological remains of many shipwrecks have been found in these waters. The earliest identified shipwreck site dates to the mid-18th century.

Park properties currently listed on the NRHP include Offshore Reefs Archaeological District (1981), Sweeting Homestead Site (1997), and Boca Chita Key Historic District (1997). Since the establishment of the NRHP listings, new archeological sites have been identified.

3.5.1 Archeological Sites

Prehistoric Upland

Humans inhabited Florida as early as 12,000 years ago (EDAW, 2006). When people first came to Biscayne Bay, south Florida was a freshwater marsh or lake that extended from the rocky hills of the present-day keys to the ridge that forms the present-day Florida east coast. As melting glaciers caused a gradual rise in global sea level, the basin became inundated by seawater. The modern-day configuration of the Florida coastline was established about 4,000 years ago (Milanich, 1994), so some of the areas within BISC that are currently inundated and are near submerged keys could contain prehistoric Native American archeological sites. Based on general knowledge of Florida pre-history, sites that may be encountered would be remnants of small nomadic groups from hunting, fishing, and gathering cultures. One prehistoric site has been recorded within the upland area of BISC. It is anticipated that additional sites may be present on the outer reefs, and on the bottom of Biscayne Bay (Leynes and Cullison, 1998). Sites that may be expected within inundated areas of BISC could contain discrete scatters of stone tools and, if inundated prior to degradation of organic materials, remnants of materials such as woven basketry, cloth, and items made of wood. Prehistoric upland resources are not further discussed and analyzed in Chapter 4, because the alternatives will not impact terrestrial resources in BISC.

Historic Upland Sites

Spanish explorers who came to the area during the 16th century encountered local populations whom they called Tequesta. Tequesta may have occupied a wide range of areas in eastern Florida. Within the Park, at least four Tequesta sites have been recorded. These sites, which include artifacts such as ceramics, worked shell, and middens, suggest the presence of intermittent intensive seasonal settlements that may date from about 1000 A.D. (if not earlier) to about 1650 A.D. These sites, and others yet to be discovered, may represent remnants of sites related to the Tequesta. Such local populations, in addition to exploiting shell resources, may have hunted in the water using watercraft of unknown design. Remnants of such watercraft could be among the cultural resources buried within Biscayne Bay. Historic upland resources are not further discussed and analyzed in Chapter 4, because the alternatives will not impact terrestrial resources in BISC.

Shipwrecks

The Straits of Florida, including what is now BISC, provided the fastest route for ships returning to Europe in colonial times, but they were also dangerously narrow. The numerous submerged keys proved repeatedly to be a hazard to navigation. Consequently, numerous archeological remains, some of which are listed in the NRHP, are located on submerged bottomlands of BISC. These remains include an array of shipwrecks, other representations of maritime casualties, and submerged historic non-shipwreck sites (docks, ballast piles, navigation aids, etc.). Forty-three known shipwreck sites representing more than 500 years of maritime heritage are located within the current Park boundary.

3.5.2 Cultural Landscapes

Cultural landscapes in BISC include aboriginal settlement, historical occupation, and maritime use and may be associated with upland and/or submerged (reef) communities. The Park is used by stakeholders for recreation involving appreciation of cultural landscapes. The Offshore Reefs Archaeological District is the only existing NRHP underwater shipwreck district in a NPS unit. It is considered significant for the information that it yields regarding more than 200 years of maritime commerce and transportation. Of the Park's 43 shipwrecks and 16 submerged historic non-shipwreck sites, 28 shipwrecks and 7 submerged non-shipwreck sites are located within the boundaries of the Offshore Reefs Archaeological District. Any terrestrial cultural landscapes would not be affected by the proposed restoration alternatives or actions and therefore are not discussed further.

3.6 Recreation and Visitor Experience

Lands and waters within BISC are utilized mainly for preservation, recreation, and scientific research. BISC is open to the public year-round; most Park visitors are day users. Due to the nature of the Park and its resources, visitors can experience the Park by land or by water. Common activities available within the Park include fishing, snorkeling, Self-Contained Underwater Breathing Apparatus (SCUBA) diving, water skiing, windsurfing, boating, camping, and overnight stays in private boats.

The pristine waters and outstanding underwater features combined with fishing and boating opportunities and numerous archeological sites make BISC a popular recreational fishing, boating, and diving destination for local, national, and international visitors. Recreational fishing has occurred within BISC for over a century. Fishers are usually local residents but also include visitors, especially during tourist season. Three types of recreational fishing occur within BISC: inshore, offshore, and shoreline fishing (EDAW, 2006).

The loss of coral reefs and the biological communities associated with them can compromise the overall ecological function of the nearshore marine/estuarine areas and reduce the biological productivity of the Park. This reduction in productivity coupled with the loss of the injured coral reef's structural framework threatens the public's ability to enjoy a "rare combination of terrestrial, marine, and amphibious life in a tropical setting of great natural beauty…" during the period it takes to re-establish these communities.

Coral reefs are also an important natural resource and provide a major component of the aesthetics of BISC. Scars and injuries left from vessel groundings significantly reduce the aesthetics of the coral reefs within the Park as seen from the air as well as from boats or when diving/snorkeling

3.7 Human Health and Safety

Visitor access to many of the Park's resources is by boat, since 95 percent of the 172,925-acre property is covered by water (NPS, 2005a). As such, the Park is utilized for SCUBA diving, fishing, boating, and swimming. Therefore, boater safety practices and consideration of the marked navigation channels is critical for avoiding injury and/or vessel groundings. Boater safety practices also include monitoring the local weather stations for changing sea state.

3.8 Park Operations

Park staff consists of approximately 63 permanent, temporary, and seasonal employees, organized within the following divisions: Superintendent's Office, Maintenance, Administration, Visitor Protection, Interpretation, and Resource Management. Vessel grounding response and restoration activities fall under the umbrella of the Damage Recovery Program (DRP) in the Division of Resource Management. The DRP manager is full-time, base-funded position. Funding associated with specific projects supports other technical staff in the DRP. Restoration planning and environmental compliance activities resulting from a coral reef grounding incident is the primary responsibility of the program manager. Review and signature responsibilities also affect a limited number of staff from Resource Management and the Superintendent's Office. Contracting, if needed, would require limited involvement from the Resource Management and Administration divisions, as well as the Superintendent's Office.

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4. ENVIRONMENTAL CONSEQUENCES

This chapter describes the impacts that the proposed restoration alternatives are predicted to have on the affected resources. Two alternatives are evaluated, the No Action alternative (Alternative 1) and Restoration Using a Programmatic Approach (Alternative 2). As described in Chapter 2, Alternative 1 would not change the existing approach to coral reef restoration planning and implementation, including NEPA compliance. Currently, BISC resource managers evaluate the impacts of coral reef restoration actions and specific restoration methods when planning and implementing restoration at each grounding incident. In contrast, to address each coral injury under Alternative 2, the most appropriate restoration actions and specific restoration methods would be selected from a "toolbox" that contains restoration actions that have already had their impacts evaluated programmatically. The potential impacts from all proposed restoration actions in the "restoration toolbox" presented for Alternative 2 are analyzed in this chapter of the RP/PEIS so that the required impact analysis for NEPA compliance can be tiered off this programmatic EIS. The timeframe required to evaluate environmental impacts of restoration actions after site-specific injuries have occurred would be minimized substantially under Alternative 2.

This chapter is organized by resource and presents the potential impacts by alternative. This organizational structure was chosen primarily to evaluate in a systematic manner the many resource topics, which are numerous because of the complex coral reef ecosystem at BISC and the programmatic nature of this approach. A secondary consideration was to facilitate interagency consultations and the review of the impact analysis by various stakeholders and other interested parties. Implementing this style of analysis helps to assure that impacts are thoroughly and comprehensively evaluated, but it does lend itself to some overlap and repetition between similar injury types and resource topics.

Three categories of effects, or impacts, are considered and analyzed: (1) direct effects, which occur at the same time and in the same place as the action; (2) indirect effects, which occur later or at a location away from the action; and (3) cumulative effects, which are additive and include those that occur in the past, present, and foreseeable future. Direct, indirect, and cumulative effects are addressed for each affected resource under the proposed alternatives. Global climate change is predicted to affect the coral reef communities in which the direct, indirect, and cumulative effects of restoration activities would be experienced. However, due to the uncertainties and lack of data regarding climate change related impacts to BISC's coral reef communities, the impact analysis does not account for possible climate change related impacts (effects from increasing surface water temperatures and ocean acidification).

Because this RP/PEIS is not site specific, the potential impacts of restoration actions are discussed in general terms. Each resource is introduced with a brief discussion of NPS' guiding regulations and policies, the approach and assumptions used to analyze the effects, and the definitions of impact thresholds used to assess negligible, minor, moderate, and major adverse impacts. The following resources described in Chapter 3, Affected Environment, were evaluated for potential effects:

1. Geology
2. Water Quality

3. Epibenthic Biota
4. Other Invertebrates
5. Ichthyofauna
6. Seagrasses
7. Essential Fish Habitat
8. Threatened and Endangered Species
9. Historical and Cultural Resources
10. Recreation and Visitor Experience
11. Human Health and Safety
12. Aesthetics
13. Park Operations

4.1 Analysis Approach

4.1.1 Scope of Analysis

The potential direct, indirect, and cumulative impacts of the alternatives were analyzed for the coral reef environment within the boundaries of BISC. The resources expected to be affected by the restoration alternatives proposed for vessel-grounding sites are described in Chapter 3. Restoration actions and methods discussed in this RP/PEIS are those currently approved and utilized by BISC staff. Technical information gained from the development and implementation of individual RPs for vessel groundings within the Park over the last 10 years has been incorporated into this RP/PEIS. Most of the restoration methods discussed in this chapter were previously analyzed under the NEPA process during the development of the Allie B and Igloo Moon RPs (NPS, 2007a,b) and subsequently applied during the active restoration of these sites. The impact analysis incorporated information from these completed restoration projects as applicable. The temporal and spatial boundaries of analysis for cumulative impacts are listed by resource in Appendix B.

4.1.2 Approach for Evaluating Across Alternatives

A detailed discussion of the proposed alternatives is provided in Chapter 2, Restoration Alternatives. Under either alternative, emergency restoration activities would follow a grounding incident. These activities would include initial injury assessment, enforcement actions with the responsible party, evaluation of the appropriate restoration method on a case-by-case basis, and implementation of emergency restoration activities. The main difference between Alternative 1 (No Action) and Alternative 2 (Restoration Using a Programmatic Approach) is the NEPA process for determining the appropriate long-term restoration action(s) that would be completed after any emergency restoration activities are conducted to stabilize a grounding site. The existing process under Alternative 1 involves preparing separate environmental review and NEPA documentation (e.g., EA or EIS) for each grounding incident, which takes time and funding to conduct individually. Alternative 2 would adopt an expedited approach to select the appropriate restoration action(s) that tiers the NEPA compliance to the impact analyses that have already been completed programmatically, thereby speeding the implementation process. Under this alternative a programmatic RP/EIS would be the approved NEPA document for coral reef restoration, thereby potentially reducing the level of impact analysis needed for subsequent NEPA compliance. If Alternative 2 were selected, NEPA documentation tiering from this PEIS could include a Memo to File before beginning restoration at each grounding event, so long as the restoration methods, injury types, and resource topics fall within the coverage of the completed PEIS. Restoration methods would be selected from the "restoration toolbox" of pre-approved restoration methods presented under Alternative 2 in Chapter 2. The approach of NEPA compliance through tiering from a PEIS would decrease the potential for additional direct, indirect, and cumulative impacts to resources beyond initial injuries by expediting the restoration planning phase. It would be a more cost-effective approach because both the funding and personnel time for individual NEPA documentation would not be required.

The effects analysis is organized in two steps. The first step evaluates the direct, indirect, and cumulative impacts associated with Alternatives 1 and 2 based on the duration of the restoration planning timeline or "time-lag." This period corresponds to the elapsed time between commencement and completion of the NEPA process. Based on the time to develop EAs for past grounding events, for this PEIS it was estimated that with the No Action alternative the planning time-lag could extend from 6 to 24 months (2 years) depending on the extent of the injury and the restoration methods proposed. It is presumed that with a programmatic approach (Alternative 2) the time-lag could be substantially reduced and would extend for only 1 to 2 months. With a programmatic restoration plan in place, NEPA compliance would already have been conducted as part of this PEIS and only documentation tiering from this PEIS would be necessary (e.g., Memo to File). Alternative 2 assumes all restoration methods proposed for future grounding events are evaluated in this PEIS.

The second step evaluates each restoration action proposed for inclusion in the "restoration toolbox" under a programmatic approach. Because the "restoration toolbox" is part of Alternative 2, the potential impacts from individual restoration actions or specific restoration methods are evaluated under Alternative 2. Under Alternative 1, restoration actions and methods to be selected would be evaluated in on a case-by-case basis in individual EAs or EISs, and therefore their effects are not considered under Alternative 1 in this RP/PEIS.

4.1.3 Impacts or Effects

Under CEQ regulations the terms "effects" and "impacts" are used synonymously (40 CFR §1508.8). Impacts or effects of an action can be beneficial or adverse. Impacts, or effects, also consider spatial and temporal components. For this RP/PEIS, "place" is defined as the injury site, but the meaning of "time" varies. When evaluating the impacts associated with the additional time needed to prepare individual NEPA documents compared with the a programmatic approach, "time" is defined as the period between commencement and completion of the NEPA process, which generally follows emergency restoration activities, or immediately following the grounding incident if emergency restoration does not occur. This planning period (time-lag) to begin restoration would be longer if a programmatic approach was not in place for all coral reef resources in BISC, which would increase the potential for additional adverse direct, indirect, and cumulative impacts (Alternative 1). When evaluating direct impacts from restoration actions and specific methods, "time" is defined as the period of time when the restoration activity is occurring.

Type of Impact

Three categories of effects, or impacts, are considered and analyzed.

Direct Impacts: Impacts from the action that occur at the same time and in the same place as the action.

Indirect Impacts: Impacts from the action that occur later in time or at a location away from the action.

Cumulative Impacts: The CEQ regulations to implement NEPA require an assessment of cumulative impacts. Under CEQ regulations (40 CFR §1508.7), a "cumulative impact is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time."

For the purposes of this RP/PEIS, cumulative impacts include other ongoing or reasonably foreseeable future projects and plans at BISC and the contribution of the action on cumulative effects to the resource. These are presented in Appendix B.

Duration of Impacts

Effects can be characterized by the duration of the effect. Short-term effects include actions that temporarily affect, or have the potential to affect, a resource for 12 months or less, such as disturbance during restoration of areas that are later reclaimed. Long-term effects include actions that affect a resource for greater than 12 months, and may or may not be permanent.

Intensity of Impacts

For all adverse impacts, the intensity of the impact on a given impact topic is described as negligible, minor, moderate, or major. For each impact topic, a distinct set of impact thresholds is used to provide definition of what constitutes an impact of a given intensity. The impact thresholds are aligned to relevant standards based on regulations, scientific literature and research, or best professional judgment. The intensity of an impact on a given topic is determined by comparing the effect to the impact threshold definitions for that topic. Impact thresholds are used for adverse impacts only.

4.1.4 Impairment

The 1916 Organic Act, which established the NPS, states that the purpose of managing park resources is "to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations." The NPS' interpretation of the Organic Act is found in Section 1.4 of the NPS Management Policies 2006 (NPS, 2006b). It sets the standard by which the Service protects park resources and values and establishes the guidelines for evaluating impairment.

According to Section 1.4 (NPS, 2006b), impairment is an impact that, in the professional judgment of the responsible NPS manager, would harm the integrity of park resources or values. An impact to any park resource or value may, but does not necessarily, constitute an impairment. An impact would be more likely to constitute impairment to the extent that it

- affected a resource or value whose conservation was necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park, or

- was key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park, or
- was identified in the park's general management plan or other relevant NPS planning documents as being of significance.

Implementation of either restoration alternative considered in this PEIS would not result in impairment to Park resources. All restoration actions considered would improve reef resources within the Park. An impairment determination is made for each potentially affected resource for the No Action alternative (Alternative 1), the Programmatic Restoration Plan Alternative (Alternative 2), and the restoration actions overall.

4.2 Geology

Regulations and Policies—The Organic Act of 1916, NPS Management Policies (NPS, 2006b), and NPS Reference Manual 77: National Resource Management Guidelines (NPS, 1991) direct NPS managers to provide for the protection of Park resources. These regulations and policies require the NPS to protect and preserve geologic resources and processes.

Approach and Assumptions—The physical environment, including the geology and water quality, was evaluated based on a qualitative assessment of how expected changes to Park marine resources would affect components of the physical environment. Specifically, hard-bottom reef framework and substrate changes were assessed to analyze effects to geology, and the subsequent impacts on water quality (NPS, 2007a,b) as discussed in Section 4.3.

Impact Threshold Definitions—Impacts to geology were evaluated using the following threshold definitions:

Negligible: Hard-bottom structures and substrate would not be affected, or the effects would be below or at levels of detection. No discernable effect on the rate of erosion and/or the ability to support native biota.

Minor: The effects on hard-bottom structures of substrate would be detectable, but effects would be small. Localized and detectable effect on the rates of erosion and/or the ability to support native biota.

Moderate: The effect on hard-bottom structures or substrate would be apparent and would result in a change to the character of the physical environment over a relatively wide area compared to the size of the injury site. The rate of erosion and/or the ability to support native biota would be appreciably changed.

Major: The effect on hard-bottom structures or substrate would be apparent and would substantially change the character of the physical environment over a large area in the Park. Substantial and highly noticeable influences on the rate of erosion and/or the ability to support native biota.

4.2.1 Alternative 1—No Action

This section evaluates the effects on geology associated with the longer time-lag (expected to be 4–22 months longer than with a programmatic restoration plan in place) required to prepare an individual environmental review and NEPA documentation for each vessel-grounding event. Under Alternative 1, restoration methods for each separate grounding event would be evaluated in each individual NEPA document and are therefore not considered under Alternative 1 in this RP/PEIS.

Direct Effects

Minor direct adverse impacts to geology are anticipated under the No Action alternative. Moderate adverse effects would likely occur with more severe grounding injuries. Delays in restoration efforts under the No Action alternative could allow erosional processes from high-energy storm events and water currents to damage and enlarge the impact area, further deteriorating the reef framework. Once the geology of the reef is compromised, it is especially susceptible to further scouring and erosion that can cause adverse affects to underlying layers of the reef matrix. These impacts incurred during the planning time-lag may be either short-term or long-term and are expected to last 4–22 months longer than with a programmatic restoration plan in place.

Indirect Effects

Minor indirect adverse impacts to geology are anticipated under the No Action alternative. Moderate adverse effects would likely occur with more severe grounding injuries. Loose and unstable rubble and boulders dislodged during a grounding event or through the direct impacts discussed above can be re-deposited on adjacent reef communities and cause further damage to reef geology outside the initial injury area. These impacts incurred during the planning time-lag may be either short-term or long-term and are expected to last 4–22 months longer than with a programmatic restoration plan in place.

The longer time-lag under Alternative 1 would allow for more biological and erosional masking that may not be evident during formal restoration. If the reef framework is compromised but not evident because of re-colonization, indirect adverse long-term effects to reef geology (e.g., further fracturing and dislodging of reef substrate) would have the potential to occur sometime in the future.

Cumulative Effects

Existing adverse impacts to geology within BISC include damage caused by storms, improper anchoring of vessels, and vessel groundings. Vessel groundings are frequent within the Park and their occurrence has increased with time. The direct and indirect impacts from Alternative 1 combined with the existing impacts to geology are expected to be minor to moderate and long-term (continue indefinitely).

The Park has established plans to protect the marine resources within its boundaries to address or minimize cumulative impacts. Such plans include the BISC GMP and participation in the federal and state coral reef initiatives sponsored through NOAA's Coral Reef Program and the state of Florida to address or minimize cumulative impacts to geology. Implementation of other BISC management plans (i.e., the Mooring Buoy Plan) is anticipated to further protect BISC's underwater landscape by providing visual notice of reef areas, potentially decreasing further impacts to geology. However, adverse cumulative impacts to geology are still expected to be minor to moderate and long-term (indefinite) even with these protection measures in place.

Conclusion

With the No Action alternative, minor direct and indirect adverse impacts to geology are anticipated. However, moderate adverse effects, both direct and indirect, would likely occur with the more severe grounding injuries. Impacts incurred during the planning time-lag may be either short-term or long-term and are expected to last 4 to 22 months longer than with a programmatic restoration plan in place. The increased timeframe could allow erosional processes from high-energy storm events and water currents to damage and enlarge the impact area, further deteriorating the reef framework. Reef framework damage resulting from high-energy events and vessel groundings is common and often impacts unaffected reef communities. Cumulative effects (impacts from storms, improper anchoring of vessels, and vessel groundings coupled with the direct and indirect effects associated with Alternative 1) are expected to be minor to moderate and long-term (continue indefinitely). No impairment to geology would occur under the No Action alternative because any adverse impacts (direct, indirect, and cumulative) would be moderate or less, meaning that geology within BISC would remain stable.

4.2.2 Alternative 2—Restoration Using a Programmatic Approach

This section evaluates the effects on geology from the reduced time-lag associated with implementation of a programmatic approach to restoration.

Direct and Indirect Effects

Implementation of a programmatic approach (Alternative 2) would have the same direct and indirect adverse effects on geology as under Alternative 1; however, the effects would likely be shorter in duration (2 months or less) and less severe (minor) than with the No Action alternative. The shorter duration of the planning period time-lag would decrease the probability of a severe storm event or strong currents moving dislodged substrate and causing more erosion and further degradation to the reef structure, both within and adjacent to the injured area, before restoration is performed. As a result, impacts to geology (i.e., accelerated erosion rates, fracturing and breaking of reef complex from movement of dislodged substrate) would likely be less severe and less likely to occur. Furthermore, reef structure altered from the grounding event would be restored in a shorter timeframe (months) than under the No Action alternative and the rugosity and complexity of the reef would recover sooner. With a programmatic restoration plan, it is assumed that the planning time-lag could be reduced to several months from the 6-month to 2-year planning time-lag anticipated under Alternative 1.

Cumulative Effects

The existing adverse cumulative effects to geology (from damage caused by storms, improper anchoring of vessels, and vessel groundings) and the intensity and duration of these impacts are the same as under Alternative 1. Adverse impacts from Alternative 2 are anticipated to be short-term and minor, and would contribute negligibly to the adverse impacts to geology from other actions. Overall, cumulative effects are expected to be adverse, minor to moderate, and long-term (indefinite).

Conclusion

The programmatic approach (Alternative 2) would have similar direct, indirect, and cumulative effects on geology as under Alternative 1; however, the effects would likely be shorter in duration and thus less severe (minor). With Alternative 2, restoration activities would likely be implemented within a reduced timeframe and therefore would decrease the probability of high-energy events and erosional processes causing further degradation of the reef matrix. No impairment to geology would occur under Alternative 2 because any adverse impacts (direct, indirect, and cumulative) would be minor or less, meaning that geology within BISC would remain stable.

4.2.3 Alternative 2—Restoration Actions

This section evaluates the effects on geology from restoration actions that would be included in the “restoration toolbox” under Alternative 2. Negligible short-term adverse effects to geology that could occur with all restoration actions are impacts caused by anchoring related to restoration work. This potential impact could be mitigated through appropriate anchoring procedures. This potential impact is not discussed further in the following evaluation of effects from specific restoration actions.

A detailed description of each restoration action is provided in Section 2.3.

4.2.3.1 Geology—Monitor Natural Recovery and Biological Seeding

Direct Effects

Direct adverse impacts to the reef substrate from monitoring natural recovery may occur from the installation of pins/markers used to establish assessment and monitoring transects or stations. This potential negligible impact would be localized and short-term (less than 1 day). No direct effects are anticipated form the biological seeding action.

Indirect Effects

There are no indirect impacts to geology anticipated from monitoring natural recovery or biological seeding actions.

Cumulative Effects

The existing adverse cumulative effects to geology (from damage caused by storms, improper anchoring of vessels, and vessel groundings) and the intensity and duration of these impacts are the same as under Alternative 1. Potential adverse impacts from monitoring natural recovery or biological seeding are anticipated to be short-term and negligible and would not contribute appreciably to existing cumulative impacts; therefore, cumulative impacts to geology are still expected to be adverse, minor to moderate, and long-term (indefinite).

4.2.3.2 Geology—Reattach Biota

Direct Effects

No direct effects are anticipated as a result of this restoration activity.

Indirect Effects

Beneficial long-term (indefinite) indirect impacts are expected as a result of this restoration action. Reattached biota would add rugosity and structural complexity, and in some cases would provide structural support to the reef matrix. In addition, reattaching biota to injured areas of the grounding site could reduce the relative rate of erosion by restoring surficial substrate through reattachment.

The effects of this action would enhance biotal recruitment, which would help stabilize the impact area over the long-term.

Cumulative Effects

The existing adverse cumulative effects to geology (damage caused by storms, improper anchoring of vessels, and vessel groundings) and the intensity and duration of these impacts (minor to moderate and long-term) are the same as under Alternative 1. The beneficial indirect effects of reattaching biota are unlikely to affect the magnitude or duration of the cumulative impacts to geology within BISC.

4.2.3.3 Geology—Abate Fuel/Chemical Spills and Removal of Bottom Paint/Fouling Substance

Direct Effects

Short-term (weeks) and negligible adverse direct impacts to reef geology could occur during these restoration actions. While removing bottom paint, a minimal amount of reef substrate could be removed.

Indirect Effects

A long-term (years) and beneficial, indirect effect could occur from the removal of bottom paint action. Bottom paint inhibits recruitment of biological resources, thereby inhibiting bio-eroders/bio-accreaters from colonizing the area. In addition, physical processes such as flow-driven erosion also would be inhibited if bottom paint were present on the reef. Removal of bottom paint would contribute to restoration of natural long-term geological processes.

Cumulative Effects

The existing adverse cumulative effects to geology (damage caused by storms, improper anchoring of vessels, and vessel groundings) and the intensity and duration of these impacts (minor to moderate and long-term) are the same as under Alternative 1. Direct impacts, associated with removing bottom paint and other chemicals are anticipated to be adverse, negligible, and short-term, and the indirect impacts are anticipated to be beneficial and long-term. These effects are considered to be negligible; therefore, adverse cumulative impacts to geology are still expected to be minor to moderate and long-term (indefinite).

4.2.3.4 Geology—Seal Fractures, Stabilize Displaced Substrate, Stabilize Rubble, Remove Rubble from Injury Site

The following analysis includes those actions that would affect the structural integrity of the reef and therefore would have the greatest effect on the reef geology. Sealing fractures, stabilizing displaced substrate, and removing rubble likely would have similar effects on geologic resources, so these restoration actions are combined in the following effects assessment.

Direct Effects

If mechanical methods (e.g., clamshell bucket) are used to move large quantities of rubble or dislodged substrate, then minor short-term (months) adverse impacts to the reef geology from reef contact with heavy machinery could occur. These impacts would be negligible if lift bags or other manual methods were employed. The potential for these direct effects would last until this restoration method is completed, which could take days to months depending on the extent of the geologic injury from the grounding event.

Indirect Effects

These restoration actions would have long-term (indefinite) beneficial effects on the geologic framework. Further degradation of the reef structure from scouring, erosion, and adverse impacts of unstable rubble in both the injury area and adjacent reef communities would be prevented. Over time, organisms and unconsolidated material would settle in the voids and crevasses of the repaired reef, assisting in further stabilization of the reef substrate.

Using native materials to seal fractures and stabilize displaced rubble and substrate (i.e., limerock or sponge mediated consolidation of rubble) instead of non-native material (revetment mats) is preferred. Native materials are less susceptible to erosion; however, non-native materials may be necessary in some instances and would still have a beneficial effect.

Cumulative Effects

The existing cumulative effects to geology (damage caused by storms, improper anchoring of vessels, and vessel groundings) and the intensity and duration of these adverse impacts (minor to moderate and long-term) are the same as under Alternative 1. The beneficial indirect effects of sealing fractures, stabilizing displaced substrate and rubble and removing rubble from grounding events may reduce scouring, erosion and movement of rubble; however, the magnitude of these effects is not sufficient to change the intensity and duration of cumulative effects, which would be minor to moderate adverse and long-term.

4.2.3.5 Conclusion

Direct adverse impacts to the reef substrate from restoration implementation are anticipated to be negligible to minor. These effects may be incurred during the installation of pins/markers used to establish assessment and monitoring transects or stations, while removing bottom paint, and the use of mechanical methods (e.g., clamshell bucket) to move rubble or dislodged substrate. The duration of these impacts is anticipated to be short-term. Completion of restoration actions would provide long-term (indefinite) beneficial indirect effects. Reattaching biota and substrate and stabilizing/removing rubble would add rugosity, structural complexity, structural support, and stability to the reef matrix. In addition, these actions could reduce degradation of the reef structure from scouring, erosion, and adverse impacts from unstable substrate and rubble by restoration and stabilization of surficial substrate. Both the injury area and the adjacent reef communities would benefit from these actions. Adverse cumulative impacts would be minor to moderate and long-term.

No impairment to geology is anticipated from the restoration actions because any adverse impacts (direct, indirect, and cumulative) would be moderate or less, meaning that geology within BISC would remain stable.

4.3 Water Quality

Regulations and Policies—The CWA (Federal Water Pollution Control Act) is the principal statute governing pollution control and water quality of the nation's waterways. In addition, the Organic Act of 1916, NPS Management Policies (NPS, 2006b), and NPS Reference Manual 77:

National Resource Management Guidelines (NPS, 1991) direct NPS managers to protect and preserve geologic resources and processes as well as water quality.

Approach and Assumptions—The evaluation of water quality was based on a qualitative assessment of increases in turbidity and foreign chemicals in the water column. The impact analysis considered whether the magnitude of changes in water quality would affect biological or physical components of the reef and reef organisms.

Impact Threshold Definitions—Impacts to water quality were evaluated using the following threshold definitions:

Negligible: No discernable effect on water quality.

Minor: Localized short-term effects on biological or physical components of the reef and reef organisms as a result of changes in water quality.

Moderate: Biological or physical components of the reef and reef organisms would be considerably changed as a result of changes in water quality.

Major: Substantial, highly noticeable influence on biological or physical components of the reef and reef organisms as a result of changes in water quality.

4.3.1 Alternative 1—No Action

This section evaluates the effects on water quality associated with the longer time-lag required to prepare an individual environmental assessment and NEPA documentation for each vessel-grounding event. Under Alternative 1, restoration methods would be evaluated in each individual NEPA document and therefore are not considered under Alternative 1 in this RP/PEIS.

Direct Effects

Minor adverse direct effects are anticipated as a result of the longer time-lag associated with Alternative 1. Higher than normal turbidity levels at the injury site could be expected after a grounding event as waves and bottom currents suspend particulate matter generated from both biological and geological impacts. Bottom paint and fouling agents could continuously release toxic chemicals into the water column and degrade water quality at the site. These impacts may either be short-term or long-term (6 months to 2 years). The prolonged presence of fuel or toxic chemicals at the site is also expected to have a minor adverse impact; however, this impact would be short-term as it is anticipated that removal and abatement would occur within days of the grounding incident.

Indirect Effects

Indirect minor adverse effects associated with this alternative may include degradation of water quality adjacent to an injury site. Turbidity levels above ambient conditions may occur in adjacent waters as fine material is re-suspended to the water column as a result of modified current flows, absence of a secure reef structure within and adjacent to the injury area, and wave action from storm events. As discussed above, the presence of toxic chemicals could also degrade water quality adjacent to an injury area. These impacts may be either short-term or long-term and are expected to last from 6 months to 2 years.

Cumulative Effects

Adverse cumulative impacts to water quality in BISC result from increased boating activity, marine pollution, agricultural and urban development, commercial activities, dredge and fill operations, and diversions of freshwater runoff. The adverse direct and indirect impacts from the increased time-lag until restoration would add to these existing impacts. Cumulative water quality impacts would be minor to moderate and long-term (indefinite).

In order to address some of these issues and protect Park resources, BISC works with state and local agencies. In addition, state programs and regulations, such as the FDEP's Environmental Resource Permitting Program and Florida's Department of Agriculture and Consumer Services Agricultural Best Management Practices Program, minimize impacts to water quality from urban and rural development.

Conclusion

Under Alternative 1 direct and indirect effects to water quality are anticipated to be adverse and minor. The duration of these effects are anticipated to be both short-term and long-term. Water quality impacts resulting from releases of fuel or other toxic material are likely short-term following a vessel grounding. Destabilization of the reef matrix resulting in higher than normal turbidity levels during high-energy events could be long-term and continue until the reef matrix is stabilized either naturally or through appropriate restoration actions. Toxic materials deposited or released during a grounding incident generally result in short-term effects, as these substances are dealt with quickly during the initial response or the emergency restoration phase. Water quality impacts, although negligible to minor, are generally not localized and affect adjacent areas of the reef. Cumulative water quality impacts would be minor to moderate and long-term.

No impairment to water quality is anticipated under the No Action alternative because any adverse impacts (direct, indirect, and cumulative) would be moderate or less, meaning that water quality within BISC would not be significantly altered.

4.3.2 Alternative 2—Restoration Using a Programmatic Approach

This section evaluates the effects on water quality from restoration actions to be included in the "restoration toolbox" under Alternative 2. A detailed description of each restoration action is provided in Section 2.3.

Direct and Indirect Effects

Implementation of a programmatic approach (Alternative 2) would have the same adverse direct and indirect effects on water quality as those under Alternative 1; however, the effects would likely be shorter in duration (2 months or less) and less severe (negligible to minor). The shorter duration of the planning period time-lag would decrease the probability of a severe storm event or strong currents generating turbidity from the impact site affecting both areas within and adjacent to the injured area. Furthermore, the removal of bottom paint and other potential chemicals introduced from the grounding would be removed sooner minimizing release of toxic constituents into the water column. With a programmatic restoration plan, it is assumed that the planning time-lag could be reduced to several months from the 6-month to 2-year planning time-lag anticipated under Alternative 1.

Cumulative Effects

The existing cumulative effects to water quality (from increased boating activity, marine pollution, agricultural and urban development, commercial activities, dredge and fill operations, and diversions of freshwater runoff) and the intensity and duration of these adverse impacts are the same as under Alternative 1. Impacts from Alternative 2 are anticipated to be adverse, short-term, and negligible and would likely not contribute appreciably to existing cumulative impacts. Therefore, cumulative adverse impacts to water quality are still expected to be minor to moderate and long-term (indefinite).

Conclusion

Water quality impacts—direct, indirect, and cumulative—under a programmatic approach (Alternative 2) are anticipated to be the same as those under Alternative 1; however, the direct and indirect effects are anticipated to be shorter in duration and thus less severe. Cumulative impacts would be minor to moderate adverse and long-term. No impairment to water quality would occur under the programmatic approach (Alternative 2) because any adverse impacts (direct, indirect, and cumulative) would be moderate or less, meaning that water quality within the Park would not be significantly altered.

4.3.3 Alternative 2—Restoration Actions

This section evaluates the effects on water quality from restoration actions that would be included in the "restoration toolbox" under Alternative 2. A detailed description of each restoration action is provided in Section 2.3.

4.3.3.1 Water Quality—Monitor Natural Recovery

No direct or indirect impacts to water quality are anticipated from monitoring natural recovery. This action is not anticipated to contribute to other factors affecting water quality in the Park.

4.3.3.2 Water Quality—Reattach Biota, Seal Fractures, Biological Seeding, Stabilize Displaced Substrate, Stabilize Rubble, and Remove Rubble from Injury Site

Direct Effects

Minor, short-term (up to 6 months) adverse impacts to water quality could occur during these restoration actions, such as increases in turbidity at the impact site, suspension of bonding agent particulates, and re-suspension of toxic material. Specific activities that could increase turbidity include relocating, mechanically anchoring, and/or preparing displaced corals and substrate for reattachment; fracture sealing during reattachment of biota; installing and preparing an enclosure for biological seeding; and movement and stabilization of rubble and displaced material. Impacts to water quality from increased turbidity could occur from using bonding agents such as cement and/or epoxy for reattachment. Placement of revetment mats to stabilize rubble and electro-accretion to promote mineral accretion would have similar effects on turbidity while workers installed these devices. Additional minor, temporary adverse impacts to water quality may occur during rubble removal activities as toxic materials that may have settled under loose rubble may be re-suspended into the water column. No direct effects would be anticipated with sponge mediated consolidation of rubble.

Indirect Effects

Long-term (indefinite) and beneficial indirect impacts to water quality could occur from the removal and stabilization of loose material, which could otherwise continue to cause increased turbidity in and adjacent to the injury site.

Movement of material during rubble stabilization, rubble removal, and stabilization of displaced substrate could increase turbidity in areas adjacent to the impact area. This would cause minor short-term adverse effects on water quality, expected to last for no more than 6 months.

Cement and epoxy used for reattachment are designed for minimal dispersion in the water column. Any increase in turbidity would be localized and contained within the impact area; therefore, no indirect effects would be anticipated from the use of bonding agents.

Cumulative Effects

The existing cumulative effects to water quality (from increased boating activity, marine pollution, agricultural and urban development, commercial activities, dredge and fill operations, and diversions of freshwater runoff) and the intensity and duration of these adverse impacts are the same as under Alternative 1. Impacts from these restoration actions are anticipated to be both beneficial and adverse and minor and would likely contribute minimally to existing cumulative impacts. Therefore, cumulative adverse impacts to water quality are still expected to be minor to moderate and long-term (indefinite)

4.3.3.3 Water Quality—Abate Fuel/Chemical Spills and Remove Bottom Paint/Fouling Substance from Reef

Direct Effects

Beneficial direct effects on water quality are anticipated from removal of toxic materials from the injury site. These are anticipated to be short-term (weeks to 6 months). It is possible that some of the bottom paint/fouling agents would escape during the scraping efforts and be unintentionally released into the water column. The amount of material released would be minimal and therefore any related adverse effect would be considered negligible and short-term (weeks).

Indirect Effects

The removal of fuels, chemicals, bottom paint, and fouling agents would have a long-term (indefinite) beneficial effect on water quality by reducing water-soluble fractions in the water column.

Cumulative Effects

The existing cumulative effects to water quality (from increased boating activity, marine pollution, agricultural and urban development, commercial activities, dredge and fill operations, and diversions of freshwater runoff) and the intensity and duration of these adverse impacts are the same as under Alternative 1. Impacts from these restoration actions are anticipated to be both beneficial and adverse and minor and would likely contribute minimally to existing long-term cumulative impacts; therefore, cumulative adverse impacts to water quality are still expected to be minor to moderate and long-term (indefinite).

4.3.3.4 Conclusion

Restoration actions are anticipated to have both beneficial and adverse direct and indirect effects on water quality. During the implementation of restoration activities minor, short-term adverse effects could occur, such as increases in turbidity at the impact site, re-suspension of bonding agent particulates, and re-suspension of toxic material. During the implementation of reef stabilization actions, such as rubble stabilization, rubble removal, and stabilization of displaced substrate, short-term direct and indirect effects to water quality are anticipated. Although designed for minimal dispersion in the water column, bonding agents used for reef stabilization actions and for reattaching biota could become suspended during use. These effects are generally localized and contained within the impact area. Beneficial effects would be both short-term and long-term. Cumulative effects to water quality within BISC are expected to be minor to moderate adverse and long-term.

No impairment to water quality would occur with the restoration actions, because any adverse impacts (direct, indirect, and cumulative) would be minor or less, meaning that water quality within the Park would not be significantly altered.

4.4 Epibenthic Biota

Regulations and Policies—The Organic Act of 1916, NPS Management Policies (NPS, 2006b), and NPS Reference Manual 77: Natural Resource Management Guideline (NPS, 1991) direct NPS managers to provide for the protection of Park resources. The act requires that wildlife be conserved unimpaired for future generations, which has been interpreted to mean that native animal life is to be protected and perpetuated as part of a park unit's natural ecosystem. Parks rely on natural processes to sustain populations of native species to the greatest extent possible; otherwise, they are protected from harvest, harassment, or harm by human activities. The NPS Management Policies (NPS, 2006b) make restoration of native species a high priority. Management goals include maintaining components and processes of naturally evolving park ecosystems, including natural abundance, diversity, and ecological integrity of plants and animals (NPS, 2000, Section 4.1). Policies in the NPS Natural Resource Management Guideline state, "the National Park Service will seek to perpetuate the native animal life as part of the natural ecosystem of parks" and that "native animal populations will be protected against… destruction… or harm through human actions." The purpose of BISC is "to preserve and protect for education, inspiration, recreation, and enjoyment of present and future generations a rare combination of terrestrial, marine, and amphibious life in a tropical setting of great natural beauty."

Approach and Assumptions—The evaluation of epibenthic biota includes stony corals (scleractinian corals), soft corals (octocorals), sponges (porifera), macroalgae, and other epibiotic sessile reef inhabitants (i.e., bryozoans and tunicates) and was based on a qualitative assessment of how expected changes to Park marine resources (specifically reef structures) would affect the reef system biota. The Park's marine biological resources are directly affected by the natural abundance, biodiversity, and the ecological integrity of the reef system habitat (NPS, 2007a,b).

Impact Threshold Definitions—Fractured reef structure, displacement of reef material, burial of the reef, altered topography, and removal of three-dimensional topographic reef features are all direct impacts to coral reefs that would result in a loss of reef habitat. Biological resources associated with the reef system also would be affected. Impacts to the biological communities include crushing, scraping, displacement, burial, and tissue toxicity.

Available information on known biota from literature, previous restoration plans, and the Allie B/Igloo Moon Completion Report (NPS, 2009d) was compiled and used to analyze the restoration actions and alternatives. The thresholds for the intensity of an impact to the coral environment for epibenthic biota are summarized below:

Negligible: No observable or measurable impacts to coral reefs, coral reef resources and their habitat, or the natural processes sustaining them. Impacts would occur at levels characteristic of natural variation.

Minor: Impacts would be detectable, but would not be outside the natural range of variability. Small changes to population numbers, population structure, and other demographic factors might occur. Sufficient habitat and resources would remain functional to maintain viability of all species.

Moderate: Impacts on coral reefs, coral reef resources and their habitat, or the natural processes sustaining them would be detectable and could be outside the natural range of variability. Changes to population numbers, population structure, and other demographic factors would occur, but species would remain stable and viable. Sufficient habitat would remain functional to maintain the viability of all native species.

Major: Impacts on coral reefs, coral reef resources and their habitat, or the natural processes sustaining them would be detectable, expected to be outside the natural range of variability, and permanent. Population numbers, population structure, and other demographic factors might experience large declines. Frequent responses to disturbance by some individuals would be expected, with adverse impacts resulting in a decrease in population levels. Loss of habitat might affect the viability of at least some native species.

4.4.1 Alternative 1—No Action

Impacts to epibenthic biota include the potential effects associated with the longer planning period (time-lag) required to prepare an individual environmental review and NEPA documentation for each vessel-grounding event. The magnitude of the impacts would depend on the scale of the injury and the duration of the planning period (time-lag). Although these same effects could occur under Alternative 2, the duration of the impacts and potential severity would be greater under Alternative 1 due to the longer planning period (time-lag).

Direct Effects

Direct effects to epibenthic biota would likely occur under Alternative 1 and are expected to be adverse, moderate, and short-term or long-term (6 months to 2 years). Impacts to epibenthic biota could include burial from movement or displacement of loose rubble, exposure to toxic chemicals (bottom paint), and decreased substrate area available for biological recruitment. Scouring, erosion, and burial would be especially prevalent during severe weather events and could decrease colonization rates or adversely affect organisms that survived a grounding incident. Bottom paint and other toxic materials present in the injury area could prevent the colonization of epibenthic biota. Injured corals (generally stressed, dislodged, scraped, or broken) could experience a higher prevalence of diseases or even death. Longer planning periods (time-lags) would decrease the likelihood of survival of dislodged organisms and their viability for re-attachment.

Indirect Effects

Indirect adverse effects to epibenthic biota in adjacent areas under Alternative 1 could include abrasions, crushing, and burial from loose and unstable rubble/boulders. Loose and unstable rubble/boulders are especially prevalent with severe injury and following severe weather events. In addition, areas adjacent to the injury site could become unsuitable for sessile organisms if water quality is degraded substantially. The magnitude of the impacts (minor/moderate) would depend on the scale of the injury and the duration of the planning period (time-lag). The increased planning period (time-lag) anticipated under Alternative 1 would likely result in short-term to long-term impacts occurring for 6 months to 2 years.

Immediately following a grounding incident, algae and other primary recruiting biota begin colonizing injured substrate, including newly exposed reef substrate within the impacted area. Though essential to marine environments and normally found in healthy coral reef communities, increased abundance of benthic macroalgae can have detrimental effects on coral reefs. Increases in macroalgae populations and biomass have been shown to directly impact coral growth through coral tissue mortality as a result of overgrowth, and indirectly impact coral growth and limit coral recruitment as a result of spatial competition (Lirman and Biber, 2000). Such increases in macroalgae biomass have been linked to decreases in grazing intensity by reef fishes and urchins (Lirman and Biber, 2000; Lapointe, 1997).

It is possible that the longer planning period time-lag under Alternative 1 allows time for establishment of a macroalgae and soft coral dominant community. The resulting community structure may be different from pre-impact condition, but still considered a functioning reef or marine system. The extent of re-colonization prior to restoration could influence which restoration method is deemed suitable. Based on grounding-specific circumstances (i.e., post-restoration condition of the injury site, available funding, etc.), NPS staff may determine that performing restoration methods to restore the reef to its pre-impacted condition may not be feasible or desirable. Depending on the pre- and post-injury conditions of the reef, the result may be a localized shift in species and change in the biological diversity within the impacted area.

Cumulative Effects

Epibenthic biota within BISC is susceptible to a variety of stressors as a result of overfishing, marine pollution, urbanization, runoff, recreational activities, and other stressors. An overabundance of macroalgae have been linked to increases in nutrient availability, as a result of anthropogenic factors or coastal eutrophication, resulting in decreases in grazing intensity by reef fishes and urchins (Lirman and Biber, 2000; Lapointe, 1997). Natural recovery of reef communities impacted by human activities is highly variable (Endean, 1976; Pearson, 1981). The delay in restoration under Alternative 1 would contribute to these cumulative impacts to epibenthic biota within the Park.

BISC has established plans to protect the Park's marine resources, including the BISC GMP, and the Park participates in the federal and state coral reef initiatives sponsored through NOAA's Coral Reef Program and the state of Florida. The park also enforces Florida Saltwater Recreational and Commercial Fishing Regulations. Cumulative impacts to epibenthic biota are expected to be adverse, minor to moderate, and long-term (indefinite) even with these protection measures in place.

Conclusion

Both direct and indirect adverse effects to epibenthic biota are expected from Alternative 1. The magnitude of these effects ranges from minor to moderate and is directly related to the scale of the injury and the duration of the planning period. Direct effects are considered to be more severe (moderate) as the epibenthic biota within the vicinity of the grounding site generally sustains the most severe damage. The duration of these effects can be either short-term or long-term. Direct effects to epibenthic biota include scouring, erosion, scraping, burial, displacement, and exposure to toxic materials. Epibenthic biota exposed to these types of stressors can become susceptible to disease or death. Indirect effects are similar and may be caused by loose and unstable rubble/boulders. Loose and unstable rubble/boulders are especially prevalent with severe injury and following severe weather events. Colonization of primary recruiting species, although natural and important for succession following a disturbance, may be detrimental for decolonization of the slower growing climatic species such as scleractinian corals.

Epibenthic biota are adversely affected on a daily basis by stressors such as overfishing, marine pollution, urbanization, runoff, recreational activities, and other stressors. Delay in restoration under Alternative 1 would contribute to these stressors. Cumulative impacts to epibenthic biota are expected to be adverse, minor to moderate, and long-term (indefinite).

No impairment to epibenthic biota within BISC is anticipated under the No Action alternative, because any adverse impacts (direct, indirect, and cumulative) would be moderate or less, meaning that epibenthic biota populations would remain stable and viable.

4.4.2 Alternative 2—Restoration Using a Programmatic Approach

This section evaluates the effects on epibenthic biota from the reduced planning period (time-lag) associated with implementation of a programmatic approach under Alternative 2 for restoration.

Direct and Indirect Effects

Implementation of a programmatic approach (Alternative 2) would have the same direct and indirect adverse effects on epibenthic biota as under Alternative 1; however, the effects likely would be shorter in duration (2 months or less) and less severe (minor). The shorter duration of the planning period time-lag would decrease the probability of a severe storm event or strong currents moving dislodged substrate and rubble within and adjacent to the injured area before restoration is performed. As a result, impacts to epibenthic biota (i.e., crushing, abrasions, smothering of organisms, and reduction of habitat) would likely be less severe and less likely to occur. Furthermore, habitat that was altered or removed from the grounding event would be restored in a shorter timeframe (months) than under the No Action alternative and the rugosity and complexity of the reef would recover sooner and would also reduce the potential for a community shift. With a programmatic restoration plan, it is assumed that the planning time-lag could be reduced to several months from the 6-month to 2-year planning time-lag anticipated under Alternative 1.

Cumulative Effects

The existing cumulative effects to epibenthic biota (from overfishing, marine pollution, urbanization, runoff, recreational activities, and other stressors) and the intensity and duration of these adverse impacts are the same as under Alternative 1. Impacts from Alternative 2 are anticipated to be adverse, short-term and minor and would contribute minimally to the existing cumulative impacts. Therefore, cumulative impacts to epibenthic biota are still expected to be adverse, minor to moderate, and long-term (indefinite).

Conclusion

Epibenthic biota impacts under a programmatic approach (Alternative 2) are anticipated to be the same adverse impacts as those of Alternative 1 (i.e., burial from movement or displacement of loose rubble, exposure to toxic chemicals, and decreased substrate area available/suitable for biological recruitment). The reduced time-lag under programmatic restoration would likely shorten the period of time when these effects could occur; therefore, the impacts are anticipated to be adverse, shorter in duration (6 months or less), and less severe (minor) than under Alternative 1. Cumulative impacts are expected to be adverse, minor to moderate, and long-term.

No impairment to epibenthic biota within BISC is anticipated under the programmatic approach (Alternative 2), because any adverse impacts (direct, indirect, and cumulative) would be minor or less, meaning that epibenthic biota populations would remain stable and viable.

4.4.3 Alternative 2—Restoration Actions

This section evaluates the effects on epibenthic biota from restoration actions that would be included in the "restoration toolbox" under Alternative 2. Short-term, negligible adverse effects (crushing, surficial scaring, dislodging, etc.) from anchoring could occur during the performance of the restoration actions. These potential effects could be mitigated through appropriate anchoring procedures or the installation of mooring system, and are not discussed further in the following evaluation of effects from specific restoration actions.

A detailed description of each restoration action is provided in Section 2.3.

4.4.3.1 Epibenthic Biota—Monitor Natural Recovery

Direct Effects

Negligible, short-term (hours to days) adverse localized impacts to the reef community could occur during set up of monitoring stations (i.e., the installation of pins/markers), or divers could inadvertently scrape or abrade epibenthic biota, specifically sessile invertebrates, during monitoring activities.

Indirect Effects

The altered reef community, which could lack the same complexity, structure, and diversity as the pre-injured reef community, would remain. Substrate available for biological recruitment of corals and sponges could be less than that of the un-impacted reef community, and could potentially result in a community shift. These impacts are considered short-term, adverse, and negligible to minor because this restoration action alone likely would be chosen only for small-scale injuries.

Cumulative Effects

Existing cumulative effects to epibenthic biota in the Park would be the same as under Alternative 1 (burial from movement or displacement of loose rubble, exposure to toxic chemicals, and decreased substrate area available/suitable for biological recruitment). Effects of monitoring natural recovery would not be of a magnitude to change the existing cumulative effects to epibenthic biota within

BISC. Therefore, cumulative impacts to epibenthic biota are still expected to be adverse, minor to moderate, and long-term (indefinite).

4.4.3.2 Epibenthic Biota—Reattach Biota

Direct Effects

Negligible, short-term (several hours for each day restoration occurs) adverse effects to the epibenthic biota are anticipated from this action. Impacts to biota could occur from handling during the reattachment process, handling during transport from cache site, inadvertent releases or spills of cement and/or epoxy, or by mechanical anchors causing scrapes and abrasions. In addition, inadvertent diver contact with epibenthic biota may result during implementation of this restoration action. These potential adverse effects could be mitigated by taking precautions during restoration activities and are expected to last for weeks to months.

Increased turbidity and sedimentation could occur from using bonding agents (although they are designed for minimal dispersion) and from installing anchoring devices (i.e., rebar). Depending on the severity of the stressor, hard corals may exhibit stress responses such as increased mucus production, polyp expansion, partial bleaching, and temporary extrusion of mesenterial filaments (Rogers, 1990, Telesnicki and Goldberg, 1995; P. Zuloaga, NPS Contractor, personal observation).

Live tissue of the biota being reattached could be damaged by handling during the reattachment process, inadvertent releases or spills of cement and/or epoxy or by mechanical anchors causing scrapes and abrasions. In addition, wave action could stretch mechanical anchors (i.e., wire or cable ties) resulting in failure of properly anchoring biota to the substrate (SEFCRI, 2007). These potential adverse effects could be mitigated by taking precautions during restoration activities and are expected to last for weeks to months.

Indirect Effects

Long-term (years), beneficial effects on the reef community would be expected from reattaching biota, which would increase community complexity and function of the injury site and enhance re-colonization and settlement of epibenthic biota and help restore the natural diversity of the reef. Reattaching biota to fractures or stabilized rubble would promote biotal recruitment and accretion, thereby enhancing long-term stabilization at the site.

Cumulative Effects

The existing cumulative effects to epibenthic biota and the intensity and duration of these impacts are the same as under Alternative 1 (from overfishing, marine pollution, urbanization, runoff, recreational activities, and other stressors). Impacts from the reattach biota action are anticipated to be both beneficial and adverse (minor). Reattaching biota would contribute to the long-term beneficial efforts aimed at minimizing these adverse cumulative effects to the epibenthic biota. The beneficial nature of the indirect effects associated with reattaching biota would offset some of the adverse cumulative effects to epibenthic biota in the Park. However, the benefits would likely contribute minimally to existing cumulative impacts; therefore, overall cumulative impacts to epibenthic biota are still expected to be adverse, minor to moderate, and long-term (indefinite).

4.4.3.3 Epibenthic Biota—Biological Seeding

Direct Effects

It is anticipated that adverse, negligible, and short-term, localized impacts to epibenthic biota could occur from divers inadvertently scraping or abrading biota, specifically sessile invertebrates, during biological seeding activities. Ensuring proper diving techniques (i.e., effective buoyancy, awareness of surrounding biota) are used during restoration could minimize these impacts. These adverse impacts would be localized and short-term with an anticipated duration of several hours for each day that the monitoring activities occur.

Indirect Effects

Long-term beneficial effects from biological seeding are anticipated and expected to last for several years, but this would be expected to be site dependent. It is expected that biological seeding would enhance juvenile coral recruitment, which would in turn promote the re-colonization of other epibenthic biota at the injury site.

The effect of biological seeding at an injured site depends on the survival, growth, and reproduction of juveniles. Miller and Barimo (2001) found that the success of coral recruits also relies on the structure design, orientation, integrity, and morphology of the substrate. Heyward et al. (2002) collected coral gametes and embryos during a mass spawning event in Australia. The results of this experiment determined that 1) wild-caught coral larvae are a viable source for mass culture, 2) on a small spatial scale, biological seeding of coral larvae enhances natural coral recruitment, and 3) recruitment density is dependent on the larval supply.

Other factors that contribute to coral recruitment include spawning style (brooding versus broadcasting), surface roughness, orientation, depth (light and wave energy), and herbivorous fish community composition (Miller and Barimo, 2001). Despite these factors, the deployment of mass-reared larvae can artificially enhance coral recruitment *in situ*.

Cumulative Effect

The existing cumulative effects to epibenthic biota (from overfishing, marine pollution, urbanization, runoff, recreational activities, and other stressors) and the intensity and duration of these adverse impacts are the same as under Alternative 1. Impacts from the biological seeding action are anticipated to be both beneficial and adverse (negligible). Biological seeding would contribute to the long-term beneficial efforts aimed at minimizing cumulative effects to the epibenthic biota. The beneficial nature of the indirect effects associated with biological seeding may offset some of the adverse cumulative effects to epibenthic biota in the Park. However the benefits would likely contribute minimally to existing cumulative impacts; therefore, cumulative impacts to epibenthic biota are still expected to be adverse, minor to moderate, and long-term (indefinite).

4.4.3.4 Epibenthic Biota—Abate Fuel/Chemical Spills

Direct Effects

No direct effects are anticipated as a result of this restoration action.

Indirect Effects

Indirect impacts resulting from this restoration action are anticipated to be short- and long-term (years) beneficial effects. Removing fuel and chemicals can allow for re-colonization, prevent or reduce mortality of impacted organisms, and re-establish short- and long-term natural erosional processes.

Cumulative Effects

The existing cumulative effects to epibenthic biota (from overfishing, marine pollution, urbanization, runoff, recreational activities, and other stressors) and the intensity and duration of these adverse impacts are the same as under Alternative 1. Impacts from removing toxic chemicals are anticipated to be beneficial. This action would contribute to the long-term beneficial efforts aimed at minimizing adverse cumulative effects to the epibenthic biota. The beneficial nature of the indirect effects associated with this action would offset some of the adverse cumulative effects to epibenthic biota in the Park. However, the benefits would likely contribute minimally to existing cumulative impacts; therefore, cumulative impacts to epibenthic biota are still expected to be adverse, minor to moderate and long-term (indefinite).

4.4.3.5 Epibenthic Biota—Remove Bottom Paint/Fouling Substance from Reef

Direct Effects

Removal of bottom paint or fouling substances could have a short-term (weeks), negligible adverse effect from suspension of toxic material during the removal process. Small particles not captured during the removal process could remain and move about the reef, in which case they could be ingested by sessile organisms. In addition, impacts to epibenthic biota could occur from divers inadvertently scraping or abrading biota, during activities associated with removal of bottom paint.

Indirect Effects

Beneficial short- and long-term (years) effects would be anticipated from the removal of bottom paint and/or fouling substances. Affected substrate would become immediately available for re-colonization, as was evident in the recent restoration of the Igloo Moon site. There, bottom paint remained on the reef substrate for greater than 10 years, and no biological recruitment had occurred in the affected areas (NPS, 2007b).

Cumulative Effects

The existing cumulative effects to epibenthic biota (from overfishing, marine pollution, urbanization, runoff, recreational activities, and other stressors) and the intensity and duration of these adverse impacts are the same as under Alternative 1. Impacts from removing bottom paint are anticipated to be both beneficial and adverse (negligible). This action would contribute to the long-term beneficial efforts aimed at minimizing cumulative effects to the epibenthic biota. The beneficial nature of the indirect effects associated with this action would offset some of the adverse cumulative effects to epibenthic biota in the Park. However, the benefits would likely contribute minimally to existing cumulative impacts; therefore, cumulative impacts to epibenthic biota are still expected to be adverse, minor to moderate and long-term (indefinite).

4.4.3.6 Epibenthic Biota—Seal Fractures, Stabilize Displaced Substrate, Stabilize Rubble, Remove Rubble from Injury Site

Direct Effects

Beneficial direct effects would be anticipated from these restoration actions. Performance of these actions would promote stability of the reef matrix, and reestablish three-dimensional complexity to the reef at the grounding site, thereby providing suitable stable substrate for the epibenthic biota.

Minor adverse direct impacts to epibenthic biota may occur during sealing fractures, stabilizing displaced substrate, stabilizing rubble, and removing rubble from the injury site. Impacts could include the inadvertent crushing or other injury to organisms associated with incidental diver contact or from machinery used to move rubble, incidental contact of organisms with cement or other bonding agents (which could be toxic to biota such as gorgonians, zooanthids, and other invertebrates and could burn living tissue), and stress responses from increased turbidity and suspended bonding agent particulates. These impacts would be expected to be short-term; however, the duration is directly related to the extent of the injury to the reef geology which is being restored. Implementing proper diving techniques and BMPs (i.e., turbidity monitoring, using lift bags versus mechanical movement of rubble/substrate) could minimize some of these adverse impacts. No direct effects would be anticipated with sponge mediated consolidation of rubble.

Indirect Effects

Long-term beneficial effects on epibenthic biota from these restoration actions are expected to last for years or indefinitely depending on the extent of the injury to the reef structure. Stabilizing substrate and removing loose rubble would increase community complexity and function of the injury site and provide stable substrate for the re-colonization and settlement of epibenthic biota. Stabilizing the reef framework would reduce the likelihood that rubble or displaced substrate could move about the reef causing injury to the epibenthic biota.

Cumulative Effects

The existing cumulative effects to epibenthic biota (from overfishing, marine pollution, urbanization, runoff, recreational activities, and other stressors) and the intensity and duration of these adverse impacts are the same as under Alternative 1. Impacts from these actions are anticipated to be both beneficial and adverse (minor). This action would contribute to the long-term beneficial efforts aimed at minimizing cumulative effects to the epibenthic biota. The beneficial nature of the indirect effects associated with this action would offset some of the adverse cumulative effects to epibenthic biota in the Park. However, the benefits would likely contribute minimally to existing cumulative impacts; therefore, cumulative impacts to epibenthic biota are still expected to be adverse, minor to moderate, and long-term (indefinite).

4.4.3.7 Conclusion

Beneficial and adverse direct and indirect effects are anticipated from the performance of restoration actions. The intensity of adverse effects are anticipated to be negligible to minor and short-term. Localized adverse impacts to the reef community could occur as a result of diver contact and/or restoration equipment contact during implementation of the restoration actions. Additionally, turbidity caused during site preparation, bottom paint removal, and/or use of bonding agents can cause negligible to minor direct and indirect effects. However, the beneficial effects resulting from the performance of restoration actions are anticipated to be long-term as restoration actions are aimed for stabilization of a resource or its substrate thereby adding complexity and structure and would enhance re-colonization and settlement of corals and sponges and help restore the natural diversity of the reef. Cumulative impacts are expected to be adverse, minor to moderate, and long-term.

No impairment to epibenthic biota would occur from restoration activities, because any adverse impacts (direct, indirect, and cumulative) would be negligible, meaning that epibenthic biota populations within BISC would remain stable and viable.

4.5 Other Invertebrates

This section includes an assessment of motile invertebrates known to inhabit reef communities that could be affected by the alternatives. Information about regulations and policies applicable to other invertebrates is provided in Section 4.4, Epibenthic Biota.

Approach and Assumptions—The evaluation of motile (other) invertebrates was based on a qualitative assessment of how expected changes to Park marine resources (specifically reef structures) would affect the reef system biota. The Park's marine biological resources are directly affected by the natural abundance, biodiversity, and the ecological integrity of the reef system habitat (NPS, 2007a,b). Species include the commercially and recreationally important Florida spiny lobster (*Panulirus argus*), along with other crustaceans such as hermit crabs and shrimp; echinoderms such as brittle stars, basket stars, sea cucumbers; and the keystone species long spined sea urchin (*Diadema antillarum*); cnidarians such as anemones and zooanthids; mollusks such as octopuses, bivalves, and gastropods; and fireworms and spaghetti worms.

Impact Threshold Definitions—Impacts to other invertebrates were evaluated using the following threshold definitions:

> **Negligible:** No observable or measurable impacts to other invertebrates, their habitat, or the natural processes sustaining them. Impacts would occur at levels characteristic of natural variation.
>
> **Minor**: Impacts would be detectable, but would not be outside the natural range of variability. Small changes to population numbers, population structure, and other demographic factors might occur. Occasional responses to disturbance by some individuals could be expected, but without interference to factors affecting population levels. Sufficient habitat would remain functional to maintain viability of all species.
>
> **Moderate:** Impacts on other invertebrates, their habitat, or the natural processes sustaining them, would be detectable and could occur outside the natural range of variability. Changes to population numbers, population structure, and other demographic factors would occur, but species would remain stable and viable. Frequent responses to disturbance by some individuals could be expected, with some negative impacts to factors affecting population levels. Sufficient habitat would remain functional to maintain the viability of all native species.
>
> **Major:** Impacts on other invertebrates, their habitat, or the natural processes sustaining them would be detectable, expected to occur outside the natural range of variability, and permanent.

Population numbers, population structure, and other demographic factors might experience large declines. Frequent responses to disturbance by some individuals would be expected, with adverse impacts resulting in a decrease in population levels. Loss of habitat might affect the viability of at least some native species.

4.5.1 Alternative 1—No Action

This section evaluates the effects on other invertebrates associated with the longer planning period (time-lag) required to prepare an individual environmental review and NEPA documentation for each vessel-grounding event. Under Alternative 1, restoration methods would be evaluated in each individual NEPA document and therefore their impacts are not considered under Alternative 1 in this RP/PEIS.

Direct Effects

Moderate direct adverse impacts to motile invertebrates would likely occur under Alternative 1. These effects include additional loss of habitat and crushing or other injury resulting from the continual shifting of loose substrate and rubble. Tidal energy and stronger surge associated with storm events could cause the previously destabilized substrate to topple and roll about the reef, thus filling in or completely burying the voids and crevasses where motile fauna would otherwise take refuge. In addition, the shifting rubble could fatally crush or injure organisms. Sedimentation and increased turbidity arising from unconsolidated rubble fields (such as in "blowholes") could further reduce food- and shelter-providing habitat for these invertebrates. Motile organisms could avoid injury areas where bottom paint was present. The impacts during the planning period time-lag would be both short-term and long-term, with an anticipated duration of 6 months to 2 years

Indirect Effects

Many motile invertebrates tend to seek refuge in the cracks and crevasses of the reef. Vessel-grounding injury features such as rubble berms, displaced substrate, and fractures and fissures in the reef matrix provide artificial short-term habitat for many motile invertebrates. The planning period (time-lag) associated with Alternative 1 allows for colonization in these unstable artificial features. Adverse short-term effects could occur because movement of unstable substrate, during storm events, can result in loss of habitat and prolonged periods of exposure of the motile invertebrates to predators. The longer planning time-lag under Alternative 1 would allow for increased colonization of invertebrates and therefore cause greater disturbance to other invertebrates during restoration. An organism exposed to the elements in this manner would remain vulnerable until another source of refuge was found. The availability of alternate refugia would depend largely on the initial extent of damage sustained during the vessel grounding and degree of post-grounding erosion. The impacts during the planning period time-lag would be both short-term and long-term and minor to moderate, with an anticipated duration of 6 months to 2 years.

Cumulative Effects

Other invertebrates within BISC are susceptible to a variety of stressors such as overfishing, marine pollution, urbanization, runoff, recreational activities, and others. The adverse direct and indirect impacts from the increased time-lag until restoration would contribute to these other cumulative impacts. Cumulative impacts to other invertebrates would be adverse, minor to moderate, and long-term (indefinite). Potential adverse impacts to motile invertebrates during the increased planning time-lag under Alternative 1 would likely make contributions to these other cumulative impacts. The impacts during the planning period time-lag would be both short-term and long-term, with anticipated duration of 6 months to 2 years.

BISC has established plans to protect the Park's marine resources, including the BISC GMP, and the Park participates in the federal and state coral reef initiatives sponsored through NOAA's Coral Reef Program and the state of Florida. In addition to the BISC GMP and the coral reef initiatives, BISC presently utilizes the Manatee Protection Plan and enforces Florida Saltwater Recreational and Commercial Fishing Regulations. Even with these protection measures in place, impacts to invertebrates are still expected to be adverse, minor to moderate, and long-term (indefinite).

Conclusion

Both direct and indirect short-term to long-term adverse effects to other invertebrates are expected under Alternative 1. The magnitude of these effects would likely be minor to moderate and would relate directly to the scale of the injury and the duration of the planning period. Direct effects are considered to be more severe (moderate), as other invertebrates within the vicinity of the grounding site generally sustain the most severe damage. In addition, unstable and temporary habitat often results from vessel groundings (e.g., rubble berm), which is quickly colonized by motile invertebrate species. The degree of colonization is directly related to the time-lag associated with the planning process. The longer these artificial injury features remain, the larger the population of other invertebrates that would utilize the habitat. Thus, restoration implementation conducted long after the vessel grounding would adversely affect a larger population of other invertebrates, resulting in a greater magnitude of effect.

Other invertebrates are adversely affected on a daily basis by stressors such as overfishing, marine pollution, urbanization, runoff, recreational activities, climate change, and other stressors. Delay in restoration under Alternative 1 would contribute to these stressors, thus contributing to anticipated minor to moderate, long-term cumulative adverse effects to other invertebrates.

No impairment to motile invertebrates is anticipated under the No Action alternative, because any adverse impacts (direct, indirect, and cumulative) would be moderate or less, meaning that motile invertebrate populations within BISC would remain stable and viable.

4.5.2 Alternative 2—Restoration Using a Programmatic Approach

This section evaluates the effects on other invertebrates from the reduced planning period (time-lag) associated with implementation of a programmatic approach under Alternative 2.

Direct and Indirect Effects

Implementation of a programmatic approach (Alternative 2) could have the same direct and indirect effects on motile invertebrates as under Alternative 1. The shorter duration of the planning period time-lag would decrease the probability of a severe storm event or strong currents moving dislodged substrate and rubble within and adjacent to the injured area before restoration is performed; therefore, impacts to other invertebrates (i.e., crushing of organisms or reduction of habitat) would likely be minor. Furthermore, the shorter planning period may result in fewer invertebrates establishing/colonizing rubble mounds or other grounding injury features and therefore minimize the disturbance to invertebrates when the rubble is removed or stabilized. With a programmatic restoration plan, it is assumed that the planning time-lag could be reduced to several months from the 6-month to 2-year planning time-lag anticipated under Alternative 1.

Cumulative Effects

The existing cumulative impacts to other invertebrates (from overfishing, marine pollution, urbanization, runoff, recreational activities) and the intensity and duration of these adverse impacts are the same as under Alternative 1. Impacts from Alternative 2 are anticipated to be adverse, short-term, and minor and would contribute minimally to the existing cumulative impacts. Therefore, cumulative impacts to other invertebrates are still expected to be adverse, minor to moderate, and long-term (indefinite).

Conclusion

Direct and indirect impacts to other invertebrates under Alternative 2 are anticipated to be the same as those of Alternative 1; however, the effects are anticipated to be shorter in duration and thus potentially less severe (minor). Cumulative impacts are expected to be adverse, minor to moderate, and long-term.

No impairment to motile invertebrates is anticipated with Alternative 2, because any adverse impacts (direct, indirect, and cumulative) would be moderate or less, meaning that motile invertebrate populations within BISC would remain viable.

4.5.3 Alternative 2—Restoration Actions

This section evaluates the effects on motile invertebrates from restoration actions that would be included in the “restoration toolbox” under Alternative 2. Negligible short-term adverse effects to motile invertebrates could occur with all restoration actions from anchoring related to restoration work. This potential impact would be mitigated through appropriate anchoring procedures such as using mooring buoys or sand anchors to avoid contact with the reef surface. This potential impact is not discussed further in the following evaluation of effects from specific restoration actions.

A detailed description of each restoration action is provided in Section 2.3.

4.5.3.1 Other Invertebrates—Monitor Natural Recovery

Direct Effects

Negligible adverse direct impacts to motile invertebrates could occur from the monitoring natural recovery restoration action. Motile invertebrates could be disturbed and temporarily leave the work area when workers are present and from other monitoring activities (i.e., the installation of pins/markers). While seeking alternative shelter, the organisms would be more exposed to predation. In addition divers could inadvertently crush or cause injury to other invertebrates while working. These adverse impacts would be localized and short-term with anticipated duration of several hours for each day that the monitoring activities occur. Motile invertebrates would likely return to the affected area once the workers leave.

Indirect Effects

No indirect effects are anticipated from monitoring natural recovery.

Cumulative Effects

Existing cumulative effects to other motile invertebrates in the Park (from overfishing, marine pollution, urbanization, runoff, recreational activities) would be the same as under Alternative 1. These adverse cumulative impacts to other invertebrates are minor to moderate and long-term (indefinite). Considered as an individual action, monitoring natural recovery alone would not be expected to contribute to these cumulative impacts (beneficial or adverse) to other invertebrates within BISC. Cumulative impacts to other invertebrates are still expected to be adverse, minor to moderate, and long-term (indefinite).

4.5.3.2 Other Invertebrates—Reattach Biota

Direct Effects

Negligible adverse direct impacts to motile invertebrates could occur from reattaching biota. Motile invertebrates could be disturbed by the reattachment activities and temporarily leave the work area while workers are present. While seeking alternative shelter, the organisms would be more exposed to predation. In addition divers could inadvertently crush or cause injury to other invertebrates while working. These adverse impacts would be localized and short-term with anticipated duration of several hours for each day that the restoration activities occur. Motile invertebrates would likely return to the affected area once the workers leave.

Indirect Effects

Both short-term (less than 12 months) and long-term (years) beneficial effects on the reef community would be expected from reattaching biota. This restoration action would increase the complexity, rugosity, and stability of the reef, which is essential for foraging and shelter of other invertebrate species. The duration of these direct beneficial effects was considered to be the time period it would take for an injured reef without biota attached to reach the same biotal complexity, which could take many years.

When transplanting biota from offsite locations it is important to consider genetic composition. Genotypic diversity of corals is essential for reef community success because there is a potential for lower survival and adaptation rates in relocated biota if genetic diversity is lacking (Baums, 2008). It is important that transplanted corals are genetically similar to onsite corals in order to increase adaptation success (Baums, 2008). The origin of reattached biota may vary (i.e., recovered from injury site, or attained from a nursery) and would be determined on a case-by-case basis.

Cumulative Effects

Existing adverse cumulative effects to other invertebrates in the Park (from overfishing, marine pollution, urbanization, runoff, recreational activities) would be the same as under Alternative 1. Adverse cumulative impacts to other invertebrates are minor to moderate and long-term (indefinite). Considered as an individual action, reattaching biota would minimize the cumulative effects on other invertebrates following a grounding event, but not enough to change the intensity or duration of existing cumulative impacts Therefore, cumulative impacts to other invertebrates are still expected to be adverse, minor to moderate, and long-term (indefinite),

4.5.3.3 Other Invertebrates—Biological Seeding

Direct Effects

Negligible adverse direct impacts to motile invertebrates could occur from divers performing biological seeding activities. Motile invertebrates could be disturbed and temporarily leave the work area while workers are present. While seeking alternative shelter, the organisms would be more exposed to predation. In addition divers could inadvertently crush or cause injury to other invertebrates while working. These adverse impacts would be localized and short-term with anticipated duration of several hours for each day that the restoration activities occur. Motile invertebrates would likely return to the affected area once the workers leave.

Indirect Effects

Long-term (years) beneficial effects on the reef community would be expected from biological seeding. This restoration action is expected to increase the density and diversity of corals, creating additional habitat (shelter, foraging, and feeding) for other invertebrates. The duration of these beneficial effects was considered to be the time period it would take for an injured reef without biological seeding to reach the same biotal complexity, which could take many years.

Cumulative Effect

Existing cumulative effects to other invertebrates in the Park (from overfishing, marine pollution, urbanization, runoff, recreational activities) would be the same as under Alternative 1. These adverse cumulative impacts to other invertebrates are minor to moderate and long-term (indefinite). Considered as an individual action, biological seeding would minimize the cumulative effects on other invertebrates following a grounding event, but not enough to alter the intensity or duration of existing cumulative impacts. Therefore, cumulative impacts to other invertebrates are still expected to be adverse, minor to moderate, and long-term (indefinite).

4.5.3.4 Other Invertebrates—Abate Fuel/Chemical Spills

Direct Effects

No direct effects are anticipated with this restoration action.

Indirect Effects

The abatement of fuel and chemical spills would have short-term (less than 6 months) and a long-term (years) beneficial effect by removing the potential for water-soluble contaminant fractions in the water column from entering the reef system and effecting habitat and foraging areas of other invertebrate species.

Cumulative Effects

Existing cumulative effects to other invertebrates in the Park (from overfishing, marine pollution, urbanization, runoff, recreational activities) would be the same as under Alternative 1. These adverse cumulative impacts to other invertebrates are considered minor to moderate and long-term (indefinite). The abatement of fuel and chemical spills would be a long-term beneficial effect on invertebrates in the Park and would contribute to efforts aimed at minimizing effects to reef communities within the Park. However, it is not anticipated to change overall cumulative impacts to invertebrates. Therefore, cumulative impacts to other invertebrates are still expected to be adverse, minor to moderate, and long-term (indefinite).

4.5.3.5 Other Invertebrates—Remove Bottom Paint/Fouling Substance from Reef

Direct Effects

Negligible adverse direct impacts could occur to motile invertebrates during removal of bottom paint. Impacts potentially include the inadvertent crushing or other injury to organisms from divers and during the chiseling/scraping of the reef substrate to remove toxic materials. Motile invertebrates could be disturbed and temporarily leave the work area while workers are present. While seeking alternative shelter, the organisms would be more exposed to predation. Another potential effect on this assemblage would be the ingestion of paint chips during removal of bottom paint. These adverse impacts would be localized and short-term with anticipated duration of several hours for each day that the restoration activities occur. Motile invertebrates would likely return to the affected area once the workers leave.

Indirect Effects

Beneficial long-term impacts to motile invertebrates could occur for years following removal of bottom paint, which allows for the subsequent re-colonization of sessile biota. The removal of inhibiting paint or fouling substances would expose fouled areas of the reef community, thereby re-establishing it as a suitable substrate for the attachment of reef-building organisms and resulting natural processes. Increasing the density and diversity of corals would create additional habitat (shelter, foraging, and feeding) for other motile invertebrates.

A potential negligible adverse indirect impact from bottom paint removal activities could occur if organisms ingest paint chips that were not recovered during removal and settled on the reef. It is anticipated that the duration of this potential effect could extend until the paint chips are no longer present in the reef community (i.e., displaced from wave action/currents), which could take several years.

Cumulative Effects

Existing cumulative effects to other invertebrates in the Park (from overfishing, marine pollution, urbanization, runoff, recreational activities) would be the same as under Alternative 1. Adverse cumulative impacts to other invertebrates are minor to moderate and long-term (indefinite). Considered as an individual action, removing bottom paint and fouling substances from a grounding event would minimize impacts on other invertebrates, but would not change the intensity or duration of existing cumulative impacts. Therefore, cumulative impacts to other invertebrates are still expected to be adverse, minor to moderate, and long-term (indefinite).

4.5.3.6 Other Invertebrates—Seal fractures

Direct Effects

Negligible adverse direct impacts to motile invertebrates could occur from divers sealing fractures. Motile invertebrates could be disturbed and temporarily leave the work area while workers are present. While seeking alternative shelter, the organisms would be more exposed to predation. In addition divers could inadvertently crush or cause injury to other invertebrates while working. Additionally, fallout from cement transport containers could be detrimental if consumed by or comes in contact with organisms. Contact with organisms can often be avoided by flushing or herding the organisms away from the area prior to preparing and filling fractures. If disturbed, motile invertebrates would take shelter at the nearest suitable location; however, the total result of impacts would be moderate due to the deleterious effects associated with coming into contact with the cement mixture. These adverse impacts would be localized and short-term with anticipated duration of several hours for each day that the restoration activities occur. Motile invertebrates would likely return to the affected area once the workers leave.

Indirect Effects

Beneficial long-term impacts to the motile invertebrates would be anticipated through habitat stabilization resulting from the seal fractures action. Long-term beneficial impacts would include securing the exposed substrate fractures and preventing further erosional degradation. This action would result in a gradual increase in community complexity and function over time within the restored site, which would in turn increase habitat for motile fauna. Sealing fractures within injury areas would further stabilize the site and enhance re-colonization by motile invertebrates. It is anticipated that the duration of this potential effect could extend until the reef fractures stabilize without sealing which could take several years or may never occur based on the extent of the injury.

Cumulative Effects

Existing cumulative effects to other invertebrates in the Park (from overfishing, marine pollution, urbanization, runoff, recreational activities) would be the same as under Alternative 1 and are considered minor to moderate and long-term (indefinite). Sealing fractures following grounding events would benefit other invertebrates and help negate some of these adverse cumulative impacts. However, it is not anticipated to change overall cumulative impacts. Therefore, cumulative impacts to other invertebrates are still expected to be adverse, minor to moderate, and long-term (indefinite).

4.5.3.7 Other Invertebrates—Stabilize Displaced Substrate, Stabilize Rubble

Direct Effects

Negligible to minor, adverse direct impacts to motile invertebrates could result from stabilizing displaced substrate/rubble. These adverse impacts would be localized and short-term with anticipated duration of several hours for each day that the restoration activities occur.

Adverse impacts from this restoration method include impacts from divers, increased predation, degraded water quality (increased turbidity), and fallout from cement buckets/tubes being transported to and from the stabilized site. Motile invertebrates could be disturbed and temporarily leave the work area and rubble mounds while workers are present. While seeking alternative shelter, the organisms would be more exposed to predation. In addition divers could inadvertently crush or cause injury to other invertebrates while working. If disturbed, motile invertebrates would take shelter at the nearest suitable location; however, the total result of impacts would be moderate due to the deleterious effects associated with coming into contact with the cement mixture. Motile invertebrates would likely return to the affected area once the workers leave.

In addition, although cement and epoxy is designed for minimal dispersion, inadvertent releases during substrate stabilization could adversely impact biota. Fallout from cement transport containers could be detrimental if consumed by or comes in contact with organisms. Contact with organisms can often be avoided by fanning the area prior to stabilizing displaced substrate/rubble.

No direct effects are anticipated with sponge mediated consolidation of rubble.

Indirect Effects

Long-term (years) beneficial impacts to motile invertebrates would be expected from this restoration action. Stabilizing substrate and removing loose rubble would increase community complexity and function of the injury site and improve foraging habitat and shelter for motile invertebrates.

Cumulative Effects

Existing adverse cumulative effects to other invertebrates in the Park (from overfishing, marine pollution, urbanization, runoff, recreational activities) would be the same as under Alternative 1 and are considered minor to moderate and long-term (indefinite). The long-term (years) and beneficial indirect effects from this restoration action would help negate some of these negative cumulative impacts. The beneficial nature of the indirect effects associated with stabilizing displaced substrate and rubble would depend on the extent of the displaced substrate and rubble. However, it is not anticipated to change the overall severity and duration of cumulative impacts to other invertebrates. Therefore, cumulative impacts to other invertebrates are still expected to be adverse, minor to moderate, and long-term (indefinite).

4.5.3.8 Other Invertebrates—Remove Rubble from Injury Site

Direct Effects

Minor adverse direct impacts to motile invertebrates could occur during removal activities. Vessel-grounding injury features such as rubble berms, displaced substrate, and fractures and fissures in the reef matrix provide artificial short-term habitat for many motile invertebrates. Motile invertebrates within rubble berms would be displaced when the rubble is removed and would seek alternative shelter. During this time the organisms would be exposed to predation. In addition divers or equipment used to remove rubble could crush or cause injury to motile invertebrates. It is anticipated that these adverse impacts would be localized and short-term with anticipated duration of several hours for each day that this restoration activity occurs. Implementing proper diving techniques and BMPs (i.e., turbidity monitoring, using lift bags versus mechanical movement of rubble/substrate) would minimize these short-term localized adverse impacts.

Indirect Effects

Long-term (years) beneficial impacts to motile invertebrates would be expected to last for several years from this restoration action. Removing loose rubble from the injury site would stabilize the injured area and prevent potential injury to adjacent areas (i.e., burial, scouring, etc.). This would protect habitat for motile invertebrates in adjacent areas and within the injury area itself.

Cumulative Effects

Existing cumulative effects to other invertebrates in the Park (from overfishing, marine pollution, urbanization, runoff, recreational activities) would be the same as under Alternative 1 and are considered minor to moderate and long-term (indefinite). The long-term (years) and beneficial indirect effects from this restoration action will help prevent further damage to the resource, but will not change the overall severity and duration of cumulative impacts to other invertebrates. Therefore, cumulative impacts to other invertebrates are still expected to be adverse, minor to moderate, and long-term (indefinite).

4.5.3.9 Conclusion

Beneficial and adverse direct and indirect effects are anticipated from the performance of restoration actions. The intensity of adverse effects are anticipated to be negligible to minor and short-term. Localized adverse impacts to the reef community could occur as a result of diver contact and/or restoration equipment contact during implementation of the restoration actions. Additionally, turbidity caused during site preparation, bottom paint removal, and/or use of bonding agents can cause negligible to minor direct and indirect effects. The beneficial effects resulting from the performance of restoration actions are anticipated to be long-term as restoration actions are aimed for stabilization of a resource or its substrate, thereby adding complexity and structure, and would enhance re-colonization and settlement of corals and sponges and help restore the natural diversity of the reef. Cumulative impacts are expected to be adverse, minor to moderate, and long-term.

No impairment to motile invertebrates would occur as a result of restoration activities, because any adverse impacts (direct, indirect, and cumulative) would be moderate or less, meaning that motile invertebrate populations within BISC would remain stable and viable.

4.6 Ichthyofauna

This section includes an assessment of commercially and recreationally important fish species and reef fish within BISC that may be affected by the proposed restoration alternatives.

Regulations and Policies—The Magnuson-Stevens fisheries Conservation and Management Act provides for the conservation and management of marine fisheries. The Organic Act of 1916, NPS Management Policies (NPS, 2006b), requires that wildlife be conserved unimpaired for future generations. In addition, the NPS Reference Manual 77: Natural Resource Management Guideline (NPS, 1991) directs NPS managers to provide for the protection of Park resources. The park enforces Florida Recreational and Commercial Saltwater Fishing Regulations. The park is currently in the process of developing a Fishery Management Plan which will guide management of fisheries resources for the next 5 to 10 years.

Approach and Assumptions—The evaluation of ichthyofauna was based on a qualitative assessment of how expected changes to Park marine resources (specifically reef structures) would affect the reef system biota. The Park's marine biological resources are directly affected by the natural abundance, biodiversity, and the ecological integrity of the reef system habitat (NPS, 2007a,b). Ichthyofaunal resources in the Park are already recognized as in decline as a result of extensive fishing, reduced habitat, and water quality, thus making them particularly sensitive to additional stressors.

Impact Threshold Definitions—Impacts to ichthyofauna were evaluated using the following threshold definitions:

> **Negligible:** No observable or measurable impacts to ichthyofauna and their habitat or the natural processes sustaining them. Impacts would occur at levels characteristic of natural variation.
>
> **Minor:** Impacts would be detectable, but would not occur outside the natural range of variability. Small changes to population numbers, population structure, and other demographic

factors might occur. Sufficient habitat would remain functional to maintain viability of all species.

Moderate: Impacts on ichthyofauna and their habitat, or the natural processes sustaining them, would be detectable and could occur outside the natural range of variability. Changes to population numbers, population structure, and other demographic factors would occur, but species would remain stable and viable. Sufficient habitat would remain functional to maintain the viability of all native species.

Major—Impacts on ichthyofauna and their habitat, or the natural processes sustaining them, would be detectable, expected to occur outside the natural range of variability, and permanent. Population numbers, population structure, and other demographic factors might experience large declines. Frequent responses to disturbance by some individuals would be expected, with adverse impacts resulting in a decrease in population levels. Loss of habitat could affect the viability of at least some native species.

4.6.1 Alternative 1—No Action

This section evaluates the effects associated with the longer planning period (time-lag) required to prepare individual environmental review and NEPA documentation for each vessel-grounding event. Under Alternative 1, restoration methods would be evaluated in each individual NEPA document and therefore their impacts are not considered under Alternative 1 in this RP/PEIS.

Direct Effects

The No Action alternative would have minor adverse direct effects on fish populations. These effects could be short-term or long-term and are expected to last 6 months to 2 years. Inability to restore the reef framework shortly after an impact could lead to a loss of rugosity and biotal cover and diversity. As a result native fish populations could be adversely impacted as the structural complexity of coral reefs dictates fish assemblage and abundance (Ebersole, 2001). Fish could temporarily abandon the injured site due to decreases in food sources and availability of habitat. Though impacts from groundings are localized, they could have a greater, more permanent, impact on fish assemblages if there was slow recovery of the reef community and/or if fragmentation of the reef framework affected keystone species essential to reef structure and function. Delaying restoration efforts could impede the recovery of the injured reef.

The increased planning period (time-lag) under Alternative 1 until restoration activities could be performed to mitigate these effects would likely result in these direct impacts occurring for longer periods of time and resulting in a greater potential impact.

Indirect Effect

The No Action alternative would have minor long-term (months to years) adverse effects on fish species. Rubble or unconsolidated substrate/biota are highly dynamic and can be re-suspended and moved as a result of currents or storm wave action causing secondary damage to fish habitat or their food sources. In addition, re-suspended unconsolidated substrate could decrease water quality in the area, further affecting fish habitat and foraging grounds.

Additional impacts to fish would be anticipated if highly disturbed or injured sites undergo a phase shift. Phase shifts are often characterized by a lack of relief and rugosity, abundant soft corals and macroalgae, and absence of hard corals and other invertebrates, especially large reef-building coral species (Fox, 2003). In some instances, phase shift affected areas may still have relief and rugosity, provided by coral skeletons (not living corals) overgrown with macroalgae. These invertebrates are essential to providing food and shelter for key, reef-dependent fish species. If a site undergoes a phase shift, this delay could permanently affect, to some degree, the fish assemblages at the injury site even if restoration activities are implemented. Such impacts would decrease the likelihood of achieving pre-impact conditions during reef restoration. This impact is anticipated to be long-term (indefinite) and moderate.

Cumulative Effects

Existing impacts to ichthyofauna include overfishing and decreased habitat, foraging grounds, and food sources resulting from degraded reef communities experiencing coral bleaching, marine pollution, introduction of non-native marine species, and increased commercial activities. These adverse effects are considered minor to moderate and long-term (indefinite). The longer restoration time-lag with Alternative 1 would increase the probability of adverse impacts to ichthyofauna occurring at and adjacent to the injury site and therefore contribute more to the cumulative effects, but this is not expected to change the overall intensity of cumulative impacts to ichthyofauna.

To most effectively protect the Park's reef communities, BISC has established management plans including the BISC GMP, and participates in the federal and state coral reef initiatives sponsored through NOAA's Coral Reef Program and the state of Florida. In addition, BISC now uses the Manatee Protection Plan and is currently developing a Fishery Management Plan as well as an updated GMP.

Conclusion

The No Action alternative would have short-term and long-term minor to moderate adverse direct and indirect impacts on fish populations. The increased planning period would likely result in these impacts occurring for longer periods of time with potentially greater impacts. Greater loss of structural complexity and biotal cover could result from the lag-time associated with Alternative 1. Cumulative impacts on ichthyofauna are considered to be long-term, minor to moderate adverse. Impacts from Alternative 1 would contribute minimally to these effects.

No impairment to ichthyofauna is anticipated under the No Action alternative, because any adverse impacts (direct, indirect, and cumulative) would be moderate or less, meaning that fish species within BISC would remain viable.

4.6.2 Alternative 2—Restoration Using a Programmatic Approach

This section evaluates the effects on ichthyofauna from the reduced planning period (time-lag) associated with implementation of a programmatic approach under Alternative 2.

Direct and Indirect Effects

Direct and indirect impacts to ichthyofauna under this alternative are expected to be the same as for Alternative 1; however, these impacts are anticipated to be short-term in duration (weeks to months). Altered or removed habitat would be restored in a shorter timeframe, reducing the severity of damage caused to fish habitat and foraging grounds. In addition, the shorter duration of the planning period associated with this alternative would decrease the exposure to fuel and other toxic chemicals. Furthermore, a shorter time-lag would decrease the probability of wave energy from a severe storm event or strong currents moving dislodged substrate and rubble before the implementation of restoration activities. Potential physical damage and damages to seagrasses in and around the injured site caused by increased turbidity would be reduced.

Cumulative Effects

Implementation of a programmatic approach (Alternative 2) would have the same cumulative effects on ichthyofauna (from overfishing and decreased habitat, foraging grounds, and food sources resulting from degraded reef communities experiencing coral bleaching, marine pollution, introduction of non-native marine species and increased commercial activities) as under Alternative 1. These effects are considered minor to moderate and long-term (indefinite). A shorter restoration time-lag would reduce the probability of adverse impacts to ichthyofauna and therefore contribute less to the cumulative effects, but is not expected to change the overall intensity of cumulative impacts to ichthyofauna. Therefore, cumulative impacts are still expected to be adverse, minor to moderate, and long-term (indefinite).

Conclusion

Adverse direct and indirect impacts to ichthyofauna under a programmatic approach (Alternative 2) are anticipated to be the same as those of Alternative 1; however, the effects are anticipated to be shorter in duration and less likely due to the decreased planning time-lag. Cumulative impacts are expected to be adverse, minor to moderate, and long-term.

No impairment to ichthyofauna would occur with the programmatic approach (Alternative 2), because any adverse impacts (direct, indirect, and cumulative) would be moderate or less, meaning that fish species within BISC would remain viable.

4.6.3 Alternative 2—Restoration Actions

This section evaluates the effects of restoration actions on ichthyofauna that would be included in the "restoration toolbox" under Alternative 2. A detailed description of each restoration action is provided in Section 2.3.

4.6.3.1 Ichthyofauna—Monitor Natural Recovery

Direct Effects

Direct impacts to fish as a result of the monitor natural recovery action could include the temporary disturbance or displacement of native reef species as a result of worker presence. However, these adverse impacts would be anticipated to be short-term (hours or days) and negligible as fish would be expected to return to the injury site once workers vacated the area.

Indirect Effects

No indirect effects are anticipated from the monitor natural recovery action.

Cumulative Effects

Existing impacts to ichthyofauna include overfishing and decreased foraging grounds and food sources resulting from degraded reef communities experiencing coral bleaching, introduction of non-native fish species, marine pollution, and increased commercial activities. These adverse effects are considered minor to moderate and long-term (indefinite). Impacts resulting from monitoring activities under Alternative 2 are not anticipated to contribute appreciably to cumulative effects.

4.6.3.2 Ichthyofauna—Reattach Biota, Seal Fractures/ Stabilize Displaced Substrate, Stabilize Rubble

Direct Effects

Negligible adverse effects to ichthyofauna are anticipated as a result of this restoration activity as fish could be disturbed and temporarily leave the work area when workers are present. While seeking alternative shelter, fish could be exposed to predation. These adverse impacts would be localized and short-term with anticipated duration of several hours for each day that the monitoring activities occur. It is anticipated that fish would likely return to the affected area once the workers leave.

Additional adverse impacts from this restoration activity include the temporary exposure to toxic adhesives. Injury or even death could result from the ingestion of bonding agents. These impacts are anticipated to be short-term lasting several hours for each day activities occur. No direct effects are anticipated with sponge mediated consolidation of rubble.

A potential localized short-term beneficial effect to ichthyofauna may occur as these actions (e.g., site prep) would provide feeding opportunities to many fish species. Site preparation and relocation of biota could temporarily expose or suspend food sources, which would provide a feeding opportunity to fish.

Indirect Effects

Long-term (indefinite) beneficial indirect effects to ichthyofauna are anticipated from these restoration activities. Re-establishing topography and repairing the three-dimensional framework of the injured reef could restore complexity and diversity in the injured site providing suitable habitat and foraging grounds.

Cumulative Effects

Existing adverse cumulative effects to ichthyofauna (from overfishing and decreased habitat, foraging grounds, and food sources resulting from degraded reef communities experiencing coral bleaching, marine pollution, introduction of non-native marine species and increased commercial activities) are the same as under Alternative 1. These adverse effects are considered minor to moderate and long-term (indefinite). Reattaching biota, sealing fractures, and stabilizing displaced substrates and rubble would benefit ichthyofauna in BISC and any adverse impacts to ichthyofauna resulting from these restoration actions would be negligible and short-term. The effects of these restoration actions alone would not change the intensity and duration of existing cumulative impacts to ichthyofauna. Cumulative impacts are expected to be adverse, minor to moderate, and long-term (indefinite).

4.6.3.3 Ichthyofauna—Biological Seeding

Direct Effects

A short-term (several hours for each day biological seeding activities occur) adverse negligible effect on fish from the presence of workers at and in the vicinity of the grounding site would be expected. These impacts would be negligible since the fish would likely seek temporary refuge during restoration activities and would be expected to return when workers left the area.

A potential localized short-term beneficial effect to ichthyofauna may occur as these actions could provide temporary feeding opportunities to many fish species.

Indirect Effects

No indirect effects to ichthyofauna are anticipated because of this restoration action.

Cumulative Effect

Existing adverse cumulative effects to ichthyofauna (from overfishing and decreased habitat, foraging grounds, and food sources resulting from degraded reef communities experiencing coral bleaching, marine pollution, introduction of non-native marine species and increased commercial activities) are the same as under Alternative 1. These effects are considered minor to moderate and long-term (indefinite). Impacts to ichthyofauna resulting from this restoration action are negligible and short-term and would not affect the intensity or duration of existing cumulative impacts to ichthyofauna. Therefore, cumulative impacts are still expected to be adverse, minor to moderate, and long-term (indefinite).

4.6.3.4 Ichthyofauna—Abate Fuel/Chemical Spills, Remove Bottom Paint/Fouling Substance from Reef

Direct Effects

These restoration actions would be expected to have short-term (days), adverse effects on fish populations by increasing exposure to bottom paint and other potentially toxic substances during removal. During removal of bottom paint, it is common for a small fraction of the paint being removed to enter the water column.

In addition, the presence of workers at and in the vicinity of the grounding site would be expected contribute to adverse effects. These impacts are anticipated to be negligible as fish would seek temporary refuge away from the site during restoration activities and would be expected to return when workers left the area.

Indirect Effects

Long-term, beneficial effects to ichthyofauna would be expected by reducing exposure to fuel, bottom paint, and other potentially toxic substances by abatement and removal of substances from the area. Ingesting toxic substances is frequently fatal to most fish species, and fuel and chemical spills could lead to localized fish mortality. Toxic substances could decimate or alter fish populations over time if not removed. Ingesting toxic substances would be expected to be fatal to most fish species, and fuel and chemical spills could lead to localized fish mortality.

Cumulative Effects

Existing adverse cumulative effects to ichthyofauna (from overfishing and decreased habitat, foraging grounds, and food sources resulting from degraded reef communities experiencing coral bleaching, marine pollution, introduction of non-native marine species and increased commercial activities) are the same as under Alternative 1. These effects are considered minor to moderate and long-term (indefinite). Abating fuel and chemical spills and removing bottom paint/fouling substances would benefit ichthyofauna in BISC and any adverse impacts to ichthyofauna resulting from these restoration actions would be negligible and short-term. The effects of these restoration actions alone are not expected to alter the intensity and duration of existing cumulative impacts to ichthyofauna; therefore, cumulative impacts are still expected to be adverse, minor to moderate, and long-term (indefinite).

4.6.3.5 Ichthyofauna—Remove Rubble from Injury Site

Direct Effects

Negligible adverse effects to ichthyofauna are anticipated as a result of this restoration activity as fish could be disturbed and temporarily leave the work area while workers are present. While seeking alternative shelter, fish could be exposed to predation. These adverse impacts would be localized and short-term with anticipated duration of several hours for each day that the monitoring activities occur. It is anticipated that fish would likely return to the affected area once the workers leave.

Indirect Effects

The stabilization or removal of rubble would be expected to have beneficial effects on ichthyofauna. The removal of loose rubble from the injury site would minimize secondary damage to fish habitat in and around the injury site. Reattaching biota would increase complexity, rugosity, and stability of the reef, which is essential for foraging and shelter of reef fish. These beneficial impacts are expected to be both short-term (less than 12 months) and long-term (more than 12 months), depending on how long it would take for an injured reef to achieve similar complexity and rugosity if no restoration activities were implemented.

Cumulative Effects

Existing adverse cumulative effects to ichthyofauna (from overfishing and decreased habitat, foraging grounds, and food sources resulting from degraded reef communities experiencing coral bleaching, marine pollution, introduction of non-native marine species and increased commercial activities) are the same as under Alternative 1 and are considered minor to moderate and long-term (indefinite). Removing rubble would benefit ichthyofauna in BISC and any adverse impacts to ichthyofauna resulting from these restoration actions would be negligible and short-term; however the effects of these restoration actions alone are not expected to alter the intensity and duration of existing cumulative impacts to ichthyofauna. Therefore, cumulative impacts are still expected to be adverse, minor to moderate, and long-term (indefinite).

4.6.3.6 Conclusion

Implementation of restoration actions would have negligible adverse and beneficial direct and indirect impacts to ichthyofauna. Restoration actions are aimed to stabilize and restore lost structural and biological complexity of the reef. Ichthyofauna is beneficially affected with the application of these actions by providing stable and complex habitat. However, during implementation, negligible impacts to ichthyofauna are associated with the performance of these actions, whereby diver presence, restoration equipment, and materials may cause short-term, localized disturbances that cause fish to temporarily leave the area. As some species leave the area during restoration action implementation, others remain and are beneficially affected. Feeding opportunities often occur when cryptic species are exposed during implementation of restoration actions. These effects would provide a negligible contribution to the existing cumulative effects, which are expected to be minor to moderate adverse and long-term.

No impairment to ichthyofauna would occur with the implementation of restoration actions, because any adverse impacts (direct, indirect, and cumulative) would be moderate or less, meaning that fish species within BISC would remain viable.

4.7 Seagrasses

This section includes an assessment of seagrass communities that may be affected by the proposed restoration alternatives. A description of applicable regulations and policies is provided in Section 4.4, Epibenthic Biota.

Approach and Assumptions—The evaluation of seagrass communities within BISC was based on a qualitative assessment of how expected changes to Park marine resources (specifically reef structures) would affect the reef system biota. The Park's marine biological resources are directly affected by the natural abundance, biodiversity, and the ecological integrity of the reef system habitat (NPS, 2007a,b). Dominant species in the Park include turtle grass (*Thalassia testudinum*), shoal grass (*Halodule wrightii*), and manatee grass (*Syringodium filiforme*).

Impact Threshold Definitions**—**Impacts to seagrasses were evaluated using the following threshold definitions:

Negligible: No observable or measurable impacts to seagrasses. Impacts would occur at levels characteristic of natural variation.

Minor: Impacts would be detectable, but would not be outside the natural range of variability. Small changes to seagrass spatial cover, density, and diversity might occur; however, sufficient habitat would remain functional to maintain viability.

Moderate: Impacts on seagrasses would be detectable and could be outside the natural range of variability. Changes to seagrass spatial cover, density, and diversity would occur but sufficient habitat would still remain functional to maintain viability.

Major: Impacts on seagrasses would be detectable and are expected to be permanent and outside the natural range of variability. Seagrass spatial cover, density, and diversity might experience significant declines. Loss of habitat might affect the viability.

4.7.1 Alternative 1—No Action

This section evaluates the effects on seagrasses associated with the longer planning period (time-lag) required to prepare individual environmental review and NEPA documentation for each grounding-grounding event. With Alternative 1, restoration methods would be evaluated in each individual

NEPA document and therefore their impacts are not considered under Alternative 1 in this RP/PEIS.

Direct Effects

Moderate adverse direct effects from the increased time-lag associated with this alternative include burial from the movement or displacement of unconsolidated rubble, exposure to toxic chemicals, and increased turbidity. Burial of seagrasses and exposure to toxic chemicals for a prolonged period of time may cause damage or even death to seagrasses and associated resources occurring within an injury site. Increased turbidity resulting from re-suspended sediment caused by the movement of loose rubble in an injury site may reduce or inhibit photosynthetic activity and can interfere with biological processes and deter organisms sustained by seagrasses. These direct impacts may be short-term or long-term and are expected to last 6 months to 2 years.

Indirect Effects

Long-term (months to years) minor to moderate adverse indirect impacts to seagrasses around the injury site may occur from movement of displaced/dislodged rubble. Wave energy, especially during storm events, could re-deposit rubble to surrounding areas and lead to seagrass burial. In addition, increased turbidity may interfere with biological processes and trophic interactions that may be essential for the survival of surrounding seagrasses.

Cumulative Effects

Seagrasses are commonly adversely impacted from boat groundings in shallow waters and pollution (i.e., runoff and discharge, increases in coastal construction, siltation, and the construction of boating facilities). These adverse effects are considered minor to moderate and long-term (indefinite). The longer planning time-lag with Alternative 1 would increase the probability that adverse impacts to seagrass would occur at and adjacent to the injury site and, therefore, contribute to the cumulative effects. However, this is not expected to change the overall intensity of cumulative impacts to seagrass.

Conclusion

The No Action alternative would have short-term to long-term minor to moderate adverse direct and indirect impacts on seagrasses. The increased planning period would likely result on impacts occurring for longer periods of time which could lead to potentially greater impacts. Greater loss of seagrass cover could result from the lag-time associated with Alternative 1. Cumulative impacts on seagrasses are considered to be long-term, minor to moderate, and adverse. Impacts from Alternative 1 would contribute minimally to these effects.

No impairment to seagrasses would occur under the No Action alternative, because any adverse impacts (direct, indirect, and cumulative) would be moderate or less, meaning that seagrasses within BISC would remain viable.

4.7.2 Alternative 2—Restoration Using a Programmatic Approach

This section evaluates the effects of the reduced planning period (time-lag) associated with implementation of a programmatic approach under Alternative 2.

Direct and Indirect Effects

Direct and indirect impacts to seagrasses under this alternative are expected to be the same as for Alternative 1; however, these impacts are anticipated to be short-term in duration (weeks to months). The shorter duration of the planning period associated with this alternative would decrease the amount of time that seagrass are impacted by burial, increased turbidity, unstable substrates, and exposure to toxic chemicals thereby reducing the severity of the impact. In addition, a shorter time-lag would decrease the probability of wave energy from a severe storm event or strong currents moving dislodged substrate and rubble occurring before the implementation of restoration activities. Potential physical damage (i.e., burial) and damages to seagrasses caused by increased turbidity in and around the injured site would be reduced.

Cumulative Effects

Implementation of a programmatic approach (Alternative 2) would have the same cumulative effects on seagrass communities (from boat groundings in shallow waters, pollution, and nutrient loading) as under Alternative 1. These impacts are considered adverse, minor to moderate, and long-term (indefinite). A shorter restoration time-lag would reduce the probability of adverse impacts to seagrass and thus contribute less to the cumulative effects than under Alternative 1, but the magnitude of these effects is not expected to change the overall intensity of cumulative impacts to seagrass. Therefore, cumulative impacts are still expected to be adverse, minor to moderate, and long-term (indefinite).

Conclusion

Seagrass impacts—direct, indirect, and cumulative—under a programmatic approach (Alternative 2) are anticipated to be the same as those of Alternative 1; however, direct and indirect effects are anticipated to be short-term in duration.

No impairment to seagrasses would occur with the programmatic approach (Alternative 2), because any adverse impacts (direct, indirect, and cumulative) would be minor or less, meaning that seagrasses within BISC would remain viable.

4.7.3 Alternative 2—Restoration Actions

This section evaluates the effects on seagrasses from restoration actions that would be included in the "restoration toolbox" under Alternative 2. The impacts to seagrasses from the proposed restoration actions are described together in the following sections. A detailed description of each restoration action is provided in Section 2.3.

4.7.3.1 Seagrasses—Monitor Natural Recovery

Direct Effects

Negligible adverse localized impacts to the seagrasses could occur during set up of monitoring stations (i.e., the installation of pins/markers), or divers could inadvertently impact seagrasses during monitoring activities. However, these impacts are unlikely, and therefore negligible, as those performing this action would be biologists with experience working in and around seagrasses. Impacts associated with this restoration activity are anticipated be short-term, lasting several hours for each day the monitoring activities occur.

Indirect Impacts

No indirect impacts are anticipated as a result of this restoration activity.

Cumulative Impacts

Seagrass beds are commonly adversely impacted from boat groundings in shallow waters, high nutrient loads in runoff and discharge, increases in coastal construction, siltation, and the construction of boating facilities. Any impacts associated with this restoration action are anticipated to be negligible and would therefore not contribute to cumulative impacts to seagrasses. Cumulative impacts are expected to be adverse, minor to moderate, and long-term (indefinite).

4.7.3.2 Seagrasses—Reattach Biota, Seal Fractures, Biological Seeding, Stabilize Displaced Substrate, Stabilize Rubble, and Remove Rubble from Injury Site

Direct Effects

Minor, short-term adverse impacts to seagrasses could occur during these restoration actions, including increases in turbidity at the impact site, injuries from mechanical anchoring devices, inadvertent injuries caused by workers at the site, and exposure to bonding agents such as cement and/or epoxy.

The inadvertent excavation, smothering, crushing, or other injuries to seagrasses may occur from anchoring vessels and incidental diver contact while performing restoration activities (e.g., turbidity associated with relocating/removing rubble berms/fields and restoration actions requiring the use of cement and the temporary placement of cement buckets/tubes adjacent to work area,). Although designed for minimal dispersion, inadvertent release of cement and/or epoxy used for substrate stabilization could adversely impact seagrasses. Increased turbidity and sedimentation could interfere with biological processes and adversely impact seagrasses at the injury site. These impacts may last several minutes to a few hours following reattachment and sealing activities. The duration of these impacts is expected to be short-term, lasting several hours each day these activities are implemented.

Certain species of seagrass are able to maintain viability while smothered or covered with rubble or sediments (berms) for an extended period of time. If restoration actions are conducted with this critical time period, direct beneficial effects to the seagrasses would occur from exposure to sunlight.

Indirect Effects

Long-term (indefinite) beneficial indirect impacts to seagrasses could occur from the removal and stabilization of loose material, which could otherwise continue to cause turbidity or physically injure seagrasses in and around the injury site.

Movement of material during rubble stabilization, rubble removal, and stabilization of displaced substrate could increase turbidity in areas adjacent to the impact area. These short-term adverse impacts would be negligible and are expected to last for several hours each day that restoration activities occur.

Cement and epoxy used for reattachment are designed for minimal dispersion into the water column. Any increase in turbidity would be localized and contained within the impact area; therefore, no indirect effects would be anticipated from the use of bonding agents.

Cumulative Effects

Existing impacts to seagrasses in the Park (from boat groundings in shallow waters, pollution, and nutrient loading) would be the same as under Alternative 1. These effects are considered minor to moderate and long-term (indefinite). Reattaching biota, sealing fractures, biological seeding, stabilizing displaced substrate and rubble, and removing rubble would benefit seagrasses in BISC, and any adverse impacts resulting from these restoration actions would be negligible to minor and short-term. However, the effects of these restoration actions alone would not change the intensity and duration of existing cumulative impacts to seagrass; therefore, cumulative impacts are still expected to be adverse, minor to moderate, and long-term (indefinite).

4.7.3.3 Seagrasses—Abate Fuel/Chemical Spills and Remove Bottom Paint/Fouling Substances

Direct Effects

No direct adverse impacts would be anticipated from this restoration action. Short-term (weeks to months), beneficial effects are anticipated as a result of this restoration action as fuel, bottom paint, fouling substances, and other chemicals can interfere with biological processes and damage or even cause mortality of impacted seagrasses.

Indirect Effects

No indirect adverse impacts on seagrasses would be anticipated with this restoration action. The removal of fuel, bottom paint, fouling substances, and chemical spills would have a long-term (indefinite) beneficial effect on seagrasses in and around the injured site.

Cumulative Effects

Existing cumulative impacts to seagrasses (from boat groundings in shallow waters, pollution, and nutrient loading) are the same as under Alternative 1. These effects are considered minor to moderate and long-term (indefinite). Abating fuel and chemical spills and removing bottom paint/fouling substances would benefit seagrasses in BISC and any adverse impacts resulting from these restoration actions would be negligible and short-term; however, the effects of these restoration actions alone would not change the intensity and duration of existing cumulative impacts to seagrass. Therefore, cumulative impacts are still expected to be adverse, minor to moderate, and long-term (indefinite).

4.7.3.4 Conclusion

Implementation of restoration actions would have short-term negligible to minor adverse and short-term to long-term beneficial direct and indirect impacts to seagrasses. Direct adverse effects associated with performance of restoration actions include diver contact and turbidity caused during restoration implementation. However, direct beneficial effects associated with restoration implementation include re-exposure of buried seagrasses. Indirect beneficial effects result from stabilization of the site which reduces both the potential for burial by movement of rubble and the turbidity caused by the high-energy events. Impacts associated with the implementation of restoration actions would not make an appreciable contribution to cumulative effects, which are expected to be minor to moderate adverse and long-term.

No impairment to seagrasses would occur with the implementation of restoration activities, because any adverse impacts (direct, indirect, and cumulative) would be moderate or less, meaning that seagrasses within BISC would remain viable.

4.8 Essential Fish Habitat

This section includes an assessment of Essential Fish Habitat (EFH) that could be affected by the alternatives.

Regulations and Policies—The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act directed NMFS and the Fisheries Management Council to include identification and protection of EFH in all federal fishery management plans. NMFS implements and enforces the Magnuson-Stevens Act through consultation with federal agencies, which is required for any federally funded, permitted, or proposed work that may affect EFH. The act defines EFH as "those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity" (NMFS, 1999). Essential Fish Habitat-Habitat Areas of Special Concern (EFH-HAPC) is a subset of the EFH designation for areas that are rare, considered particularly vulnerable to degradation by human activities, environmentally stressed, or especially ecologically important (NMFS, 1999). In general, EFH-HAPCs include high value intertidal and estuarine habitats, offshore areas of high habitat value or vertical relief, and habitats used for migration, spawning, and rearing of fish and invertebrates.

Approach and Assumptions—The potential impacts to EFH are disclosed in previous sections, including geology, water quality, epibenthic biota, other invertebrates, and ichthyofauna. The following sections briefly summarize the overall impacts to EFH. The impact threshold definitions are presented under each of those sections.

***Impact Threshold Definitions*—**Impacts to EFH in BISC were evaluated using the following threshold definitions:

Negligible: No observable or measureable impacts to EFH. Impacts would occur at levels characteristic of natural variation.

Minor: Impacts would be detectable, but would not be outside the natural range of variability. Small changes to EFH might occur, however, sufficient habitat would remain functional to maintain viability.

Moderate: Impacts to EFH would be detectable and could be outside the natural range of variability. Changes to EFH would occur but sufficient habitat would still remain functional to maintain viability.

Major: Impacts to EFH would be detectable and are expected to be permanent and outside the natural range of variability. Loss of significant habitat might affect viability.

4.8.1 Alternative 1—No Action

This section evaluates the effects of the longer planning period (time-lag) associated with preparing an individual NEPA document for each grounding event. Under Alternative 1, restoration methods would be evaluated in each individual NEPA document and therefore their impacts are not considered under Alternative 1 in this RP/PEIS. Ecologically, reef habitat would be directly, indirectly, and cumulatively affected by impacts to geology, water quality, sessile organisms, other invertebrates, and ichthyofauna, as discussed previously. The extended planning period (time-lag) associated with Alternative 1 could adversely affect EFH.

Direct Effects

Adverse direct effects to EFH may occur with the extended time-lag associated with Alternative 1; however, these effects are anticipated to be negligible. Minor adverse effects may occur with more severe groundings. Delays in restoration efforts under the No Action alternative could allow erosional processes from high-energy storm events and water currents to damage and enlarge the impact area further deteriorating EFH. Decreases in habitat may cause fish to abandon the injured site possibly reducing the number of keystone species essential to reef structure and function. These impacts incurred during the planning time-lag associated with Alternative 1 may be either short-term or long-term, depending on the severity of the grounding, and are expected to last 4 to 22 months longer than with a programmatic approach.

Indirect Effects

The No Action alternative could have minor to moderate long-term (indefinite) adverse effects on EFH. Unconsolidated substrate/biota and loose rubble are highly dynamic and can be re-suspended as a result of high-energy storm events and strong currents causing secondary damage to EFH in the injury site or its surrounding areas. In addition, re-suspended substrate/biota could decrease water quality in the impact site and adjacent areas further deteriorating EFH.

Cumulative Effects

EFH within BISC is susceptible to a variety of stressors such as overfishing, marine pollution, urbanization, runoff, vessel groundings, recreational activities, and others. The adverse direct and indirect impacts to EFH associated with Alternative 1 contribute to these cumulative impacts. To effectively protect the Park's EFH and reef communities, BISC has established management plans, including the BISC GMP, and is in the process of developing both a Fishery Management Plan and an updated GMP. However, cumulative impacts to EFH are still anticipated to be adverse, minor to moderate, and long-term (indefinite).

Conclusion

The No Action alternative is anticipated to have negligible to minor adverse direct effects and minor to moderate adverse indirect effects on EFH. These impacts may be short-term or long-term depending on the severity of the grounding and the duration of the time-lag associated with this alternative. Cumulative impacts to EFH are expected to be adverse, minor to moderate, and long-term.

No impairment to EFH is anticipated under the No Action alternative, because adverse impacts (direct, indirect, and cumulative) would be moderate or less, meaning that EFH within BISC would remain viable.

4.8.2 Alternative 2—Restoration Using a Programmatic Approach and Restoration Actions

This section evaluates the effects of the reduced planning period (time-lag) and restoration actions with implementation of a programmatic approach under Alternative 2. The impacts to EFH from a longer planning period (time-lag) associated with Alternative 2 would be similar to that of Alternative 1, but likely smaller in magnitude. The restoration actions would improve EFH.

Direct Effects

Direct impacts to EFH under this alternative are expected to be the same as with Alternative 1; however, these impacts are anticipated to be short-term in duration (weeks to months). Altered habitat would be restored in a shorter timeframe, reducing the severity of damage caused to EFH. In addition, the shorter time-lag associated with this alternative would reduce the possibility of exposure to fuel and other toxic chemicals.

Restoration activities may affect EFH; however, these impacts are expected to be negligible. Direct impacts may include the temporary displacement fish species from EFH due to the presence of divers and vessels and turbidity from restoration activities. The duration of these impacts is expected to be short-term lasting several hours for each day that restoration activities are implemented.

Indirect Effects

Indirect impacts to EFH under Alternative 2 are expected to be the same as with Alternative 1; however, these impacts are anticipated to be short-term in duration (weeks to months). Injured habitat would be restored in a shorter timeframe, reducing the severity and duration of damage caused to EFH in and around the injury site. Potential physical damage to habitat in and around the injured site caused by extended exposure to fuel, toxic chemicals, and increased turbidity from re-suspended substrate would be reduced under this alternative. Furthermore, a shorter time-lag would decrease the possibility of further damage from re-suspended unconsolidated substrate/biota caused by high wave energy events.

Restoration activities are not likely to adversely affect EFH. Indirect impacts are expected to be beneficial as restoration methods would likely result in the reef complexity and diversity returning to near pre-impacts conditions making the injury site more suitable fish habitat. Indirect benefits to EFH are expected to be long-term (indefinite).

Cumulative Effects

Implementation of a programmatic approach (Alternative 2) would have the same cumulative effects on EFH (from overfishing, marine pollution, urbanization, runoff, vessel groundings, recreational activities, and others) as under Alternative 1. These impacts are anticipated to be adverse, minor to moderate, and long-term. Beneficial indirect effects resulting from the implementation of restoration actions and from the implementation of management plans established by BISC, such as the BISC GMP and the Fishery Management Plan, are not expected to change the intensity of cumulative effects; therefore, cumulative impacts are still expected to be adverse, minor to moderate, and long-term (indefinite).

Conclusion

Adverse direct and indirect impacts to EFH under this alternative and resulting from restoration activities are anticipated to be negligible to moderate. Beneficial indirect effects are expected as a result of the implementation of restoration activities. Adverse cumulative impacts are expected to be minor to moderate and long-term. No impairment to EFH would occur, because any adverse impacts would be moderate or less, meaning that EFH within BISC would remain viable.

4.9 Threatened and Endangered Species

***Regulations and Policies*—**The Endangered Species Act [ESA (16 USC 1531 et seq.)] mandates that all federal agencies consider the potential effects of their actions on species listed as threatened or endangered. If the NPS determines that an action may adversely affect a federally listed species, consultation with NOAA and USFWS is required to ensure that the action would not jeopardize the species' continued existence or result in the destruction or adverse modification of critical habitat. The NPS Management Policies (NPS, 2006b) state that potential effects of agency actions will also be considered on state or locally listed species. NPS is required to control access to important habitat for such species and to perpetuate the natural distribution and abundance of these species and the ecosystems upon which they depend. The Epibenthic Biota, Other Invertebrates, Ichthyofauna, and Seagrass sections above include some of the analysis of the potential impacts to listed species.

Approach and Assumptions—To assess impacts on listed species, the following process was followed:

- Identification of which species are in areas likely to be affected by restoration actions described in the alternatives.
- Evaluation of habitat loss or alteration caused by the alternatives.
- Assessment of disturbance potential of the actions and the species' potential to be affected by the actions.

The information in this analysis was obtained through the best professional judgment of Park staff and experts in the marine biology field, and through literature reviews. The thresholds listed below were used to determine impacts to listed species. Potential effects to a listed species are considered to provide maximum protection. Long-range effects of seemingly beneficial actions must be evaluated for potential impacts on listed species. For example, restoration of reef structures would likely result in long-term beneficial impact; however, the short-term impacts related to implementing restoration actions may result in unintended adverse impacts (NPS, 2007a,b).

Impact Threshold Definitions—For purposes of analyzing T&E species using ESA Section 7 terminology, the following thresholds of change for intensity levels are used:

> **No effect:** The alternatives would have no effect on any listed species or designated critical habitat. "No effect" is the appropriate conclusion when a listed species will not be affected, either because the species will not be present or because the project does not have any elements with the potential to affect the species.

May affect/Is not likely to adversely affect: The alternatives may pose effects on the listed species or designated critical habitat; however, all of those effects are expected to be discountable, insignificant, or completely beneficial. **Beneficial effects** are concurrent beneficial effects without any adverse effects to the species. **Insignificant effects** relate to the magnitude or extent of the impact and should never reach the scale where "take" occurs. **Discountable effects** are those extremely unlikely to occur. (Note: Take is defined as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct; may include significant habitat modification or degradation if it kills or injures wildlife by significantly impairing essential behavioral patterns including breeding, feeding, or sheltering.")

May affect/Is likely to adversely affect: The alternative may pose unavoidable adverse effects on the listed species or designated critical habitat, and those effects are not expected to be discountable, insignificant, or completely beneficial.

4.9.1 Sea Turtles

Five sea turtle species have been documented to occur within the Park's boundaries: loggerhead (*Caretta caretta*), hawksbill (*Eretmochelys imbricata*), Kemp's Ridley (*Lepidochelys kempii*), green (*Chelonia mydas*), and leatherback (*Dermochelys coriacea*). Occurrences of Kemp's Ridley and leatherbacks are extremely rare. The five species are known to use similar habitats in BISC and they will therefore be grouped for further consideration.

4.9.1.1 Alternative 1—No Action

This section evaluates the effects on sea turtles associated with the longer planning period (time-lag) required to prepare individual environmental review and NEPA documentation for each vessel-grounding event. The magnitude of the impact would depend on the severity of the injury and the duration of the planning period (time-lag). Under Alternative 1, restoration methods would be evaluated in each individual NEPA document according to the existing management approach and therefore their impacts are not considered under Alternative 1 in this RP/PEIS.

Direct Effects

Direct effects to sea turtles may occur under Alternative 1, but these effects are considered insignificant; therefore the No Action alternative may affect, but is unlikely to adversely affect sea turtles. The immediate impacts to the reef could lead to a reduction in available foraging areas and food resources for sea turtles. This impact is directly related to the magnitude of injury to the reef. Degradation of reef habitat (e.g., erosional processes, unstable substrate and reef complex, movement of loose rubble) may result in loss of turtle foraging grounds.

Additionally, changes to their primary food sources or habitat upon which they rely could occur. The different listed turtle species feed on a variety of organisms including jellyfish, sea grass, crustaceans, mollusks, and sponges. Impacts to these food sources could include their temporary disturbance or displacement as a result of loss of suitable habitat for sedentary prey species and mortality of sessile prey species in the injury site. These impacts may be either short-term or long-term and are expected to last 6 months to 2 years.

Indirect Effects

The No Action alternative may affect, but is unlikely to adversely affect sea turtles as a result of potential effects to foraging grounds and reduced prey species. Indirect impacts to sea turtles under this alternative are expected to be long-term (indefinite). Delayed restoration efforts may lead to permanent loss of reef habitat and a reduction in density and diversity of reef community organisms, including sea turtle prey species. It may also result in fewer seagrass foraging areas adjacent to the impact site if impacts from scouring and erosion and/or burial from loose rubble occurred. This typically occurs following storm events. Due to the anticipated small area of sea turtle habitat affected in comparison to the size of the Park, these impacts are considered insignificant.

Cumulative Effects

BISC has established plans to protect the marine resources within its boundaries, including the BISC GMP. The Park also participates in the federal and state coral reef initiatives sponsored through NOAA's Coral Reef Program and the state of Florida. In addition to the existing BISC GMP and the coral reef initiatives, BISC is currently developing a Fishery Management Plan as well as an updated GMP for the Park.

Threats to sea turtles as a species include incidental take during commercial fishing operations, marine pollution, boat collisions, and loss, degradation, and destruction of nesting and foraging habitat. In addition, those species that nest along most Florida beaches are subject to beach vehicle collisions; nest predation, especially by raccoons; interference from onshore lighting which disorients hatchlings upon emerging from the nest; and exotic invasive vegetation on beaches. Of the above threats, nest predation by raccoons, as well as loss of sandy beaches due to geomorphological actions, appear to be the biggest threats to sea turtles within the Park. These long-term cumulative effects may affect and are likely to adversely affect sea turtles.

The minimal potential direct and indirect effects from the No Action alternative discussed above are unlikely to affect the magnitude or duration of the cumulative impacts facing sea turtles.

Conclusion

Potential direct impacts with Alternative 1 include reduced foraging areas and changes in food sources and availability. Due to the small area of sea turtle habitat affected within BISC, these impacts were determined to be insignificant and not likely to adversely affect sea turtle populations within BISC. Alternative 1 would make no appreciable contribution to the cumulative impacts to sea turtles as a species. No impairment to sea turtles is expected with the No Action alternative.

4.9.1.2 Alternative 2—Restoration Using a Programmatic Approach

This section evaluates the effects to sea turtles from the reduced planning period (time-lag) associated with implementation of a programmatic approach under Alternative 2.

Direct and Indirect Effects

Implementation of a programmatic approach (Alternative 2) could potentially have the same direct and indirect effects on sea turtles as under Alternative 1; however, the effects would be less likely to occur and are anticipated to be shorter in duration (weeks to months) since the programmatic approach would shorten the overall time before commencement of restoration. The reduced time-lag associated with this alternative would decrease the probability of a severe storm event or strong currents occurring before restoration is performed, thereby reducing damage to reef habitat from dislodged substrates and rubble. Furthermore, habitat that was altered or removed from the grounding site would be restored in a shorter timeframe than under Alternative 1 reducing the loss of potential foraging habitat and increasing the likelihood that sea turtles could return to the area. These direct and indirect impacts to sea turtles are considered insignificant and therefore may affect, but are not likely to adversely affect turtles.

Cumulative Effects

The cumulative long-term threats to sea turtles as a species (from commercial fishing operations, marine pollution, boat collisions, and destruction/modification of nesting and foraging habitat) are the same as those discussed with Alternative 1 above. These adverse, long-term cumulative effects may affect and are likely to adversely affect sea turtles. The minimal potential direct and indirect effects from Alternative 2 discussed above are unlikely to affect the magnitude or duration of the cumulative impacts facing sea turtles; however, the reduced time-lag with Alternative 2 would help restore sea turtle habitat sooner.

Conclusion

Potential direct and indirect impacts with Alternative 2 include reduced foraging areas and changes in food sources and availability. Due to the small area of sea turtle habitat affected within BISC and the short duration of effects, these impacts were determined to be insignificant and are not likely to adversely affect sea turtle populations within BISC. Additionally, Alternative 2 would make no appreciable contribution to the cumulative impacts to sea turtles as a species. No impairment to sea turtles is expected with Alternative 2.

4.9.1.3 Alternative 2—Restoration Actions

This section evaluates the effects of restoration actions that would be included in the "restoration toolbox" under Alternative 2. The impacts to turtles from the proposed restoration actions are described together in the following sections. A detailed description of each restoration action is provided in Section 2.3.

Direct Effects

Restoration activities for any of the action alternatives may affect, but are not likely to adversely affect turtles. Direct impacts to turtles would include their temporary disturbance from the monitoring only or active restoration alternatives. Turtles could avoid an area or change their behavior due to the presence of divers or boats. A T&E species monitor would be placed onboard the work boat to survey for the presence of turtles that could be affected in the project area.

The presence of divers and vessels at the project area would likely result in temporary disturbance of any turtle in the immediate area. However, the impact is expected to be no different than that caused by any other diver or vessel in the water. This disturbance could temporarily alter their behavior and result in their avoiding the area while work was being performed. Therefore, impacts to turtle species would be insignificant. The duration of these impacts is expected to be of several hours for each day restoration activities are implemented.

Indirect Effects

Indirect impacts may affect, but are not likely to adversely affect turtles. The most apparent affect to sea turtles from restoration action(s) is the improved habitat for many of the prey species resulting in long-term beneficial effects. The appropriate restoration method would likely result in the reef complexity and diversity returning to or near the pre-impact condition making the injury area more suitable habitat for sea turtle prey species such as Florida spiny lobster, sponges, crustaceans, and mollusks. Indirect beneficial impacts to sea turtles as a result of restoration activities are expected to be long-term (indefinite).

Cumulative Effects

The cumulative long-term threats to sea turtles as a species (from commercial fishing operations, marine pollution, boat collisions, and destruction/modification of nesting and foraging habitat) are the same as those discussed with Alternative 1 above. These long-term cumulative effects may affect and are likely to adversely affect sea turtles. The potential direct and indirect effects from the restoration actions under Alternative 2 discussed above are considered insignificant and are unlikely to affect the magnitude or duration of the cumulative impacts facing sea turtles. Additionally, it is important to note that restoring sea turtle habitat affected from multiple grounding events could have a long-term beneficial effect to sea turtle habitat within BISC.

Conclusion

Direct impacts to sea turtles from restoration activities are insignificant and include avoidance of the area during restoration.   Indirect effects from restoration actions are beneficial and include enhanced habitat for species on which sea turtles forage. Restoration activities associated with Alternative 2 may affect, but are not likely to adversely affect sea turtles. Alternative 2 would make no appreciable contribution to the adverse cumulative impacts to sea turtles as a species. No impairment to sea turtles is expected with Alternative 2.

4.9.2 Smalltooth Sawfish (*Pristis pectinata*)

Smalltooth sawfish have been documented to occur within BISC. They have been observed primarily in shallow coastal waters and estuaries characterized by their proximity to shore and muddy or sandy bottoms. Sawfish generally subsist on locally abundant schooling fish, such as mullet and the smaller members of the herring family that may be found in the Park's reef environments. Due to its rarity and habitat preference, it is highly unlikely that smalltooth sawfish would be found in the area of the restoration activities; however, in the event that they are onsite, the impacts to the species are assessed below (NPS, 2007b).

4.9.2.1 Alternative 1—No Action

This section evaluates the effects on the smalltooth sawfish associated with the longer planning period (time-lag) required to prepare individual environmental assessment and NEPA documentation for each vessel-grounding event. The magnitude of the impact would depend on the severity of the injury and the duration of the planning period (time-lag). Under Alternative 1, restoration methods would be evaluated in each individual NEPA document according to the existing management approach, and therefore their impacts are not considered under Alternative 1 in this RP/PEIS.

Direct Effects

The increased time-lag under the No Action alternative may affect, but is not likely to adversely affect smalltooth sawfish. The potential direct impacts to smalltooth sawfish include changes in population and distribution of primary food sources (small schooling reef fish) that rely on reef habitat. These impacts would be localized and short-term (days to weeks) and not anticipated to significantly impact smalltooth sawfish.

Indirect Effects

The potential for the injury area to increase in size from movement of loose rubble could indirectly affect adjacent habitat and distribution for the primary prey of the smalltooth sawfish. These impacts would be localized and may be either short-term (months) or long-term (up to 2 years) until restoration occurred. These impacts may affect, but are not likely to adversely affect the smalltooth sawfish.

Cumulative Effects

Existing impacts to the smalltooth sawfish as a species include bycatch in various commercial and recreational fisheries and habitat loss and degradation, which are attributed to agricultural and urban development, commercial activities, dredge and fill operations, boating, erosion, and diversions of freshwater runoff. These long-term cumulative impacts to the smalltooth sawfish may affect and are likely to adversely affect sawfish. The direct and indirect effects of the No Action alternative are considered insignificant and unlikely to affect the magnitude or duration cumulative impacts to the species.

Conclusion

The direct and indirect potential for changes in population and distribution of their primary food source (small schooling reef fish that rely on reef habitat) would be localized and temporary. These impacts are considered insignificant and are not likely to adversely affect smalltooth sawfish. The direct and indirect effects of the No Action alternative would make no appreciable contribution to the cumulative impacts to the species. No impairment to smalltooth sawfish would occur with the No Action alternative.

4.9.2.2 Alternative 2—Restoration Using a Programmatic Approach

This section evaluates the effects to smalltooth sawfish from the reduced planning period (time-lag) associated with implementation of a programmatic approach under Alternative 2.

Direct and Indirect Effects

Implementation of a programmatic approach (Alternative 2) could potentially have the same direct and indirect effects on sawfish (changes in population and distribution of primary food sources) as under Alternative 1; however, the effects would be less likely to occur and are anticipated to be shorter in duration since the programmatic approach would shorten the overall time before commencement of restoration. The shortened duration of the planning period time-lag (2 months verses 6 months to 2 years) would decrease the probability of a severe storm event or strong currents occurring before restoration activities are implemented, thereby reducing damage to habitat of potential prey species from dislodged substrates and rubble. Furthermore, habitat that was altered or removed from the grounding site would be restored in a shorter timeframe than under

Alternative 1 reducing the loss of potential prey items. These adverse short-term impacts to sawfish may affect, but are not likely to adversely affect the species.

Cumulative Effects

The long-term cumulative impacts to smalltooth sawfish as a species (from bycatch in various commercial and recreational fisheries and habitat loss and degradation) are the same as those discussed under Alternative 1 above. These long-term cumulative impacts to the smalltooth sawfish may affect and are likely to adversely affect sawfish. The direct and indirect effects of Alternative 2 are considered insignificant and unlikely to affect the magnitude or duration of cumulative impacts to the species. The reduced time-lag with Alternative 2 would help restore populations and densities of smalltooth sawfish prey items sooner.

Conclusion

Potential direct and indirect impacts associated with the programmatic approach (changes in population and distribution of primary prey) are considered insignificant and are not likely to adversely affect smalltooth sawfish. Additionally, a programmatic approach would make no appreciable contribution to the cumulative impacts to smalltooth sawfish as a species. No impairment to smalltooth sawfish would occur with Alternative 2.

4.9.2.3 Alternative 2—Restoration Actions

This section evaluates the effects of restoration actions that would be included in the "restoration toolbox" under Alternative 2. The impacts to smalltooth sawfish from the proposed restoration actions are described together in the following sections. A detailed description of each restoration action is provided in Section 2.3.

Direct Effects

The direct impacts to the sawfish would be the same as described for the sea turtle, primarily short-term disturbance and site avoidance. If the fish were present, restoration activities may affect, but are not likely to adversely affect sawfish. Any effects would be short-term (days to weeks), extremely unlikely, and therefore discountable.

Indirect Effects

A potential beneficial impact associated with restoration activities would be the recovery of fish prey species to their localized pre-vessel grounding populations and distributions; therefore, restoration activities are expected to be localized and short-term and may affect, but are not likely to adversely affect sawfish.

Cumulative Effects

The long-term cumulative impacts to smalltooth sawfish as a species (from bycatch in various commercial and recreational fisheries and habitat loss and degradation) are the same as those discussed under Alternative 1 above. These long-term cumulative impacts to the smalltooth sawfish may affect and are likely to adversely affect sawfish. The direct and indirect effects of restoration actions are considered insignificant and unlikely to affect the magnitude or duration of cumulative impacts to the species. Additionally, it is important to note that restoring habitat from multiple grounding events could have a long-term beneficial effect on the prey of smalltooth sawfish within BISC.

Conclusion

Potential direct impacts associated with restoration activities (avoidance of the area during restoration) are insignificant and not likely to adversely affect smalltooth sawfish.   Indirect benefits of restoration actions include the recovery of distributions and populations of the prey of smalltooth sawfish. Restoration actions would make no appreciable contribution to the cumulative impacts to smalltooth sawfish as a species. No impairment to smalltooth sawfish would occur as a result of restoration activities.

4.9.3 Elkhorn Coral (Acropora Palmata) and Staghorn Coral (Acropora Cervicornis)

Two species of coral that occur within BISC were listed in 2006 as threatened under the ESA. These species include the staghorn (*Acropora cervicornis)* and elkhorn (*Acropora palmata)* corals. These corals are fast-growing branching corals. Their primary mode of reproduction is colony fragmentation. Fusion to the substrate and continued growth of fragments play a significant role in species recovery after an injury (Bruckner and Bruckner, 2001). Acropora species would likely be restored to the greatest extent possible as part of the emergency restoration.

4.9.3.1 Alternative 1—No Action

This section evaluates the effects on elkhorn and staghorn corals associated with the longer planning period (time-lag) required to prepare individual environmental review and NEPA documentation for each grounding event. The magnitude of the impact would depend on the severity of the injury and the duration of the planning period (time-lag). Under Alternative 1, restoration methods would be evaluated in each individual NEPA document according to the existing management approach, and therefore their impacts are not considered under Alternative 1 in this RP/PEIS.

Direct Effect

The No Action alternative may affect, but is not likely to adversely affect elkhorn and staghorn corals. Potential impacts under this alternative include damage to dislodged corals that are not immediately salvaged from the injury site. Acroporid species would likely be restored as part of the emergency restoration to the greatest extent possible, and the direct effect is therefore considered discountable or insignificant. Any direct impacts to elkhorn and staghorn corals not immediately restored may be short-term or long-term and are expected to last 6 months to 2 years until the commencement of restoration activities.

Indirect Effect

Indirect effects under this alternative may affect, but are not likely to adversely affect elkhorn and staghorn corals. Following a major disturbance on a reef without implementation of restoration efforts, natural recovery of the reef commences with the recruitment of algae (Jaap, 2000). Increased algae recruitment could lead to coral mortality or reduced suitable substrate for coral recruitment. Strong wave action or currents could cause loose material to move and increase the amount of suspended particles in the water column. An increase in suspended particles in the water column can make the environment unsuitable for recovery, could cause further damage to injured corals, and could affect future survival of reattached corals. Acroporids are especially susceptible to sedimentation (NOAA, 2008a).

Continued erosion of fractured substrate at the injury site could lead to further degradation of Acroporid colonies that may be present near or on fractured substrate. Delaying restoration efforts increases the chances that a storm event could cause additional damage as crushed rubble could cause physical damage (abrasions, smothering) to coral colonies, both at and around the injury site. In addition, loose rubble left on an injury site could reduce the amount of suitable substrate available on which Acroporid fragments could attach.

Indirect impacts under this alternative may be short-term or long-term and are expected to last 6 months to 2 years. These effects are considered discountable since emergency restoration is expected to substantially reduce the probability of these impacts occurring.

Cumulative Effect

The long-term cumulative impacts to both Acroporid coral species include hurricanes, bleaching, disease, sea urchins, overfishing, nutrient loading, sedimentation, increased temperatures, hyper- and hypothermic stress, pollution, harvesting of reef invertebrates, and abrasions and crushing from snorkelers and divers, ship groundings and anchors (Precht et al., 2001). These impacts are may affect and are likely to adversely affect elkhorn and staghorn corals. The effects of the increased time-lag anticipated with the No Action alternative are unlikely to affect the magnitude or duration of adverse cumulative effects to Acroporid coral as species.

Conclusion

Potential direct impacts include damage to dislodged corals that are not immediately salvaged from the injury site and potential indirect impacts include increased coral mortality/injury or reduced substrate suitable for colonization. These effects are considered localized and insignificant or discountable and therefore not likely to adversely affect the species. The No Action alternative would make no appreciable contribution to the cumulative impacts to the species. No impairment to elkhorn and staghorn corals would occur under Alternative 1.

4.9.3.2 Alternative 2—Restoration Under a Programmatic Approach

This section evaluates the effects to elkhorn and staghorn corals from the reduced planning period (time-lag) associated with implementation of a programmatic approach under Alternative 2.

Direct and Indirect Effects

Alternative 2 may affect, but is not likely to adversely affect elkhorn and staghorn corals. Implementation of a programmatic approach (Alternative 2) could have the same direct and indirect effects on elkhorn and staghorn corals as under Alternative 1. The shorter duration of the planning period (time-lag) would decrease the probability of algae recruiting on the injured site, thus preventing potential coral mortality. In addition, the likelihood that wave energy from severe storm events or strong currents could move dislodged substrate and rubble before restoration was performed is minimized, and impacts to elkhorn and staghorn corals (i.e., crushing and burial) would likely be less severe. Furthermore, exposure to fuel, toxic chemicals, and increased turbidity would be shorter in duration (days to weeks) than under the No Action alternative.

Cumulative Effects

Implementation of a programmatic approach (Alternative 2) would potentially have the same cumulative effects on elkhorn and staghorn corals (from hurricanes, bleaching, disease, sea urchins, overfishing, nutrient loading, sedimentation, increased temperatures, hyper- and hypothermic stress, pollution, harvesting of reef invertebrates, and abrasions and crushing from snorkelers and divers, ship groundings and anchors) as under Alternative 1. These impacts may affect and are likely to adversely affect Acroporid corals as species. Due to the shorter time-lag with a programmatic approach and the shorter period of time until restoration was completed, Alternative 2 would contribute less to the cumulative effects on Acroporid species than Alternative 1.

Conclusion

Potential direct impacts include damage to dislodged corals that are not immediately salvaged from the injury site and potential indirect impacts include increased coral mortality/injury or reduced substrate suitable for colonization. These effects are considered localized and insignificant or discountable and would be less likely with a programmatic approach. Therefore, they are not likely to adversely affect the species. Alternative 2 would make no appreciable contribution to the cumulative impacts to the species. No impairment to elkhorn and staghorn corals would occur with Alternative 2.

4.9.3.3 Alternative 2—Restoration Actions

This section evaluates the effects of restoration actions that would be included in the "restoration toolbox" under Alternative 2. The impacts to elkhorn and staghorn corals from the proposed restoration actions are described together in the following sections. A detailed description of each restoration action is provided in Section 2.3.

Direct Effects

There is a potential for short-term direct impacts to Acroporid corals from abrasions caused by workers during restoration activities and increased sedimentation. Workers would be highly skilled divers with experience in reef restoration. Additionally, in the event that work must occur near or around elkhorn, staghorn, and pillar corals, extreme care will be taken to ensure damage to these resources does not occur during restoration activities. These impacts are considered discountable and may affect, but are unlikely to adversely affect Acroporid corals.

Beneficial long-term (months) direct impacts are expected from the implementation of restoration activities under Alternative 2. Caching and reattaching displaced or broken corals sooner would increase the probability of survival and allow for quicker re-establishment of elkhorn and staghorn corals at the injury site. Biological seeding of elkhorn and staghorn corals would also accelerate recovery. Fuel abatement and removal of paint and fouling substances may restore water quality at the injury site and support coral recovery. Sealing fractures and removing rubble would stabilize substrate for coral colonization and prevent further damage from movement of loose rubble material.

Indirect Effects

Beneficial indirect effects to elkhorn and staghorn coral are expected from the implementation of restoration activities. These impacts may be short-term (months) or long-term (indefinite).

Restoration activities after injury allows for the re-colonization of elkhorn and staghorn corals by providing suitable substrate for recruitment and settlement. Reattached cached corals would have an increased survival rate and a decreased likelihood of disease. Restoration activities would reduce the likelihood of abrasions to corals outside the injury area by stabilizing loose rubble material. In addition, genetic diversity and increased coral density resulting from coral seeding activities would potentially provide beneficial effects to the listed species. Removing fuel, paint, or other fouling substances could improve water quality, which would enhance conditions for coral recovery. Sealing fractures, restoring reef framework, and stabilizing rubble would provide suitable substrate to which coral fragments from the grounding site injury may be reattached; reduce the amount of suspended sediment in the water column at the injury site; support biota recovery and future coral recruitment; restore coral habitat for reef-dependent organisms; and reduce future damage caused by movement of rubble during storm events. These beneficial effects may affect, but are unlikely to adversely affect Acroporid corals.

Cumulative Effects

Implementation of a restoration activities would potentially have the same cumulative effects on elkhorn and staghorn corals (from hurricanes, bleaching, disease, sea urchins, overfishing, nutrient loading, sedimentation, increased temperatures, hyper- and hypothermic stress, pollution, harvesting of reef invertebrates, and abrasions and crushing from snorkelers and divers, ship groundings and anchors) as under Alternative 1. These impacts may affect and are likely to adversely affect Acroporid corals as species. The direct and indirect impacts from implementing restoration activities are expected to alleviate cumulative effects on the species, but not appreciably enough to change their duration or magnitude because of the generally small size and localized nature of grounding events.

Conclusion

Restoration actions associated with Alternative 2 may affect, but are not likely to adversely affect elkhorn and staghorn corals. There are discountable impacts associated with restoration work, and beneficial impacts through providing suitable substrate for recruitment and settlement, increased survival rate, a decreased likelihood of disease, and increased genetic diversity and density. Restoration actions will alleviate adverse cumulative effects on the corals as species. No impairment to elkhorn and staghorn corals would occur with implementation of restoration activities.

4.9.4 West Indian Manatee (Trichechus manatus)

The West Indian manatee is the only listed marine mammal species that permanently resides within BISC. The manatee is most closely associated with Biscayne Bay and seagrass habitat, and is commonly observed in the channels and marinas that are used for staging and transport to and from restoration sites. Manatees are only occasionally observed near the reef environments within the Park. In addition, critical habitat was designated for the species in the coastal waters around BISC. The manatee is found in both fresh and salt water and feeds on submerged aquatic vegetation.

4.9.4.1 Alternative 1—No Action

This section evaluates the effects on the West Indian manatee associated with the longer planning period (time-lag) required to prepare individual environmental review and NEPA documentation for each vessel-grounding event. The magnitude of the impact would depend on the severity of the injury and the duration of the planning period (time-lag). Under Alternative 1, restoration methods would be evaluated in each individual NEPA document according to the existing management approach, and therefore their impacts are not considered under Alternative 1 in this RP/PEIS.

Direct Effects

There are no direct impacts anticipated under the No Action alternative.

Indirect Effects

Indirect impacts to the West Indian manatee may be a loss of seagrass foraging areas adjacent to the impact site if scouring and erosion and/or burial of these seagrass beds from loose rubble movement from the injury site occur. This may affect, but is not likely to adversely affect the West Indian manatees since this impact is considered insignificant and would not result in a take of the species. These indirect impacts may be short-term or long-term and are expected to last 6 months to 2 years.

Cumulative Effects

The most significant source of manatee mortality is caused by collisions with watercraft. This problem has recently been exacerbated by increased commercial and recreational vessel traffic. The second most significant threat to manatees is the loss and degradation of habitat due to increases in coastal construction, pollution from runoff and discharge, siltation, and eutrophication. The destruction of seagrass beds by boating activities has also contributed to the decline of the species. These cumulative impacts may affect and are likely to adversely affect manatees as a species. The impacts resulting from Alternative 1 are considered insignificant and unlikely to affect the magnitude or duration of cumulative impacts to the species.

Conclusion

No direct impacts are anticipated under Alternative 1. Indirect impacts include loss or alteration of foraging area. Impacts are considered insignificant due to the small area affected compared to the remaining foraging habitat in BISC. Therefore, Alternative 1 may affect, but is not likely to adversely affect the species. Alternative 1 would make no appreciable contribution to the cumulative impacts to the West Indian manatee as a species. No impairment to the West Indian manatee would occur under the No Action alternative.

4.9.4.2 Alternative 2—Restoration Using a Programmatic Approach

This section evaluates the effects on West Indian manatee from the reduced planning period (time-lag) associated with implementation of a programmatic approach under Alternative 2.

Direct Effects

There are no direct effects anticipated under Alternative 2.

Indirect Effects

Implementation of a programmatic approach (Alternative 2) would have the same indirect effects on West Indian manatees as under Alternative 1; however, the effects would likely be shorter in duration (2 months or less). The reduced time-lag under this alternative reduces the probability of wave energy from a severe storm event or strong current moving dislodged substrate or rubble to adjacent areas before restoration is performed. Therefore, impacts to the West Indian manatee would be less severe and may affect, but are not likely to adversely affect the species.

Cumulative Effects

Cumulative impacts to the West Indian manatee (mortality from collisions with watercraft, loss and degradation of habitat) would be the same as under Alternative 1. These cumulative impacts may affect and are likely to adversely affect manatees as a species. The impacts resulting from a programmatic approach (Alternative 2) are considered insignificant and unlikely to affect the magnitude or duration of cumulative impacts to the species.

Conclusion

No direct impacts are anticipated under Alternative 2. Indirect impacts include loss or alteration of foraging area. The reduced time-lag associated with a programmatic approach would reduce the period of time that indirect impacts could occur compared to Alternative 1. Impacts are considered insignificant due to the small area affected compared to the remaining foraging habitat in BISC. Therefore, Alternative 2 may affect, but is not likely to adversely affect the species. Alternative 2 would make no appreciable contribution to the cumulative impacts to the West Indian manatee as a species. No impairment to the West Indian manatee would occur under Alternative 2

4.9.4.3 Alternative 2—Restoration Actions

This section evaluates the effects of restoration actions that would be included in the "restoration toolbox" under Alternative 2. The impacts to manatees from the proposed restoration actions are described in the following sections. A detailed description of each restoration action is provided in Section 2.3.

Direct Effects

Restoration activities for any of the action alternatives may affect, but are not likely to adversely affect the West Indian manatee. Manatees may avoid an area or change their behavior due to the presence of divers or boats. Boats have been documented to hit manatees that are at or near the surface. A collision with a boat could result in injury or death to a manatee. However, the chance of a manatee being struck during coral reef restoration boating operations is extremely unlikely and therefore discountable, especially given that the NPS and contractors will implement standard conditions for the protection of the species (see Appendix C). A T&E species observer would be onboard the work boat monitoring for the presence of manatees while in transit and while restoration is underway (NPS, 2007b). Impacts to manatees are expected to be short-term and last several hours for each day restoration activities occur.

Indirect Effects

Restoration activities for any of the action alternatives may affect, but are unlikely to adversely affect manatees. Indirect beneficial impacts of restoration activities to the West Indian manatee may prevent loss of seagrass foraging areas adjacent to the impact site from scouring and erosion, and/or burial from loose rubble moved from the injury site. These beneficial effects are anticipated to be long-term.

Cumulative Effects

Cumulative impacts to the West Indian manatee (mortality from collisions with watercraft, loss and degradation of habitat) would be the same as under Alternative 1. These cumulative impacts may affect and are likely to adversely affect manatees as a species. The impacts resulting from restoration activities are considered discountable and beneficial and unlikely to affect the magnitude or duration of cumulative impacts to the species.

Conclusion

Potential direct impacts associated with restoration activities include changes in behavior from the presence of divers or boats, or collisions with restoration vessels. These impacts are extremely unlikely and are considered discountable. Anticipated indirect effects of restoration activities to the West Indian manatee are beneficial and include preventing the loss of seagrass foraging habitat. Therefore, restoration activities may affect, but are not likely to adversely affect the species. Restoration activities would make no appreciable contribution to the cumulative impacts to the West Indian manatee as a species. No impairment to the West Indian manatee would occur with the implementation of restoration activities.

4.9.5 Pillar Coral (Dendrogyra cylindrus)

Pillar coral is the only coral species found within BISC that is state listed, but not federally listed. The NPS Management Policies (NPS, 2006b) state that potential effects of agency actions will also be considered on state or locally listed species. NPS is required to control access to important habitat for such species and to perpetuate the natural distribution and abundance of these species and the ecosystems upon which they depend.

4.9.5.1 Alternative 1— No Action

This section evaluates the effects on pillar corals associated with the longer planning period (time-lag) required to prepare individual environmental review and NEPA documentation for each vessel-grounding event. Under Alternative 1, restoration methods would be evaluated in each individual NEPA document, and therefore their impacts are not considered under Alternative 1 in this RP/PEIS.

Direct, Indirect, and Cumulative Effects

Direct, indirect, and cumulative effects to pillar corals under Alternative 1 are anticipated to be the same as described for staghorn and elkhorn corals in Section 4.9.3.

Conclusion

Potential direct impacts include damage to dislodged corals that are not immediately salvaged from the injury site and potential indirect impacts include increased coral mortality/injury or reduced substrate suitable for colonization. These effects are considered localized and insignificant or discountable and therefore not likely to adversely affect the species. The No Action alternative would make no appreciable contribution to the cumulative impacts to the species. No impairment to pillar corals would occur under Alternative 1.

4.9.5.2 Alternative 2—Restoration Using a Programmatic Approach and Restoration Actions

This section evaluates the effects to pillar corals from the reduced planning period (time-lag) associated with implementation of a programmatic approach and from restoration actions that could be implemented under Alternative 2. A detailed description of each restoration action is provided in Section 2.3.

Direct, Indirect, and Cumulative Effects

Direct, indirect, and cumulative effects to pillar corals under Alternative 2 are anticipated to be the same as those described for staghorn and elkhorn corals in Section 4.9.3.

Conclusion

Potential direct impacts of the programmatic approach include damage to dislodged corals that are not immediately salvaged from the injury site and potential indirect impacts include increased coral mortality/injury or reduced substrate suitable for colonization. These effects are considered localized and insignificant or discountable and would be less likely with a programmatic approach. Therefore, they are not likely to adversely affect the species. Restoration actions associated with Alternative 2 may affect, but are not likely to adversely affect pillar corals. There are discountable impacts associated with restoration work, and beneficial impacts through providing suitable substrate for recruitment and settlement, increased survival rate, a decreased likelihood of disease, and increased genetic diversity and density. Alternative 2 would make no appreciable contribution to the cumulative impacts to the species. No impairment to pillar corals would occur with Alternative 2.

4.10 Historical and Cultural Resources

BISC resource managers recognize and manage five categories of historical and cultural resources within the Park: archeological resources, cultural landscapes, ethnographic resources, museum objects (e.g., artifacts or man-made items), and structures. As described in Chapters 1 and 3, terrestrial archeological sites, ethnographic resources, museum objects, and structures would not be affected by implementation of coral reef restoration alternatives and are not included in this effects analysis.

Under either alternative, during initial site assessment the BISC Archeologist/Cultural Resources Manager would determine whether coral reef restoration actions present a risk of direct, indirect, or cumulative impacts to submerged archeological sites or cultural landscapes. Analyses would be conducted to determine potential effects. If it was determined during restoration planning, implementation, and/or monitoring activities that cultural resources were present at the injury site that could not be avoided during restoration, BISC staff would consult with Park and/or regional cultural resources specialists to determine an appropriate restoration strategy taking into account both natural and cultural resources. BISC staff would consult with the State Historic Preservation Officer (SHPO) and others, as needed. If proposed actions would result in adverse effects to cultural resources that substantially contribute to park values or qualify as eligible to the National Register of Historic Places (NRHP), then mitigative measures would be developed and implemented prior to initiation of coral reef restoration work in that area.

Regulations and Policies—Federal actions that have the potential to affect historical or cultural resources are subject to a variety of laws. The National Historic Preservation Act (NHPA) of 1966, as amended, is the principal legislative authority for managing cultural resources associated with NPS projects. Generally, Section 106 of the act requires all federal agencies to consider the effects of their actions on cultural resources listed in or determined eligible for listing in the NRHP. Such resources are termed historic properties. Agreement on how to mitigate effects to historic properties is reached through consultation with the state historic preservation officer; the tribal historic preservation officer, if applicable; and the Advisory Council on Historic Preservation (ACHP), as necessary. In addition, federal agencies must minimize harm to historic properties that would be adversely affected by a federal undertaking. Section 110 of the act requires federal agencies to establish preservation programs for the identification, evaluation, and nomination of historic properties to the NRHP. Other important laws designed to protect cultural resources include the following:

- Archaeological Resources Protection Act, 1979
- Abandoned Shipwreck Act, 1987
- Native American Graves Protection and Repatriation Act, 1990
- National Environmental Policy Act, 1969
- Sunken Military Craft Act of 2005 (applies to sovereign vessels inside Park boundaries such as HMS *Fowey*)

Through legislation the NPS is charged with the protection and management of cultural resources in its custody. This is further implemented through NPS-28: Cultural Resource Management Guideline (NPS, 1997), NPS Management Policies (NPS, 2006b), and the 2008 Servicewide Programmatic Agreement among the NPS, the ACHP, and the National Conference of State Historic Preservation Officers (NPS, 2008c). These documents charge NPS managers with avoiding, or minimizing to the greatest degree practicable, adverse impacts on Park resources and values. Although the NPS has the discretion to allow certain impacts in parks, that discretion is limited by the statutory requirement that Park resources and values remain unimpaired, unless a specific law directly provides otherwise.

Approach and Assumptions—The NPS categorizes cultural resources as archeological resources, cultural landscapes, ethnographic resources, museum objects, and structures. The descriptions of effects on cultural resources that are presented in this section are intended to comply with the requirements of both NEPA and Section 106 of the NHPA. In accordance with the ACHP regulations implementing Section 106 (36 CFR Part 800, Protection of Historic Properties), impacts to cultural resources are identified and evaluated through the following steps: (1) determine the area of potential effects; (2) identify cultural resources present in the area of potential effects that are either listed in or eligible to be listed in the NRHP; (3) apply the criteria of adverse effect to affected cultural resources either listed in or eligible to be listed in the NRHP; and (4) consider ways to avoid, minimize, or mitigate adverse effects. Under the ACHP's regulations, a determination of either *adverse effect* or *no adverse effect* must also be made for affected cultural resources eligible for listing in the NRHP. An *adverse effect* occurs whenever an impact alters, directly or indirectly, any of the characteristics that qualify the resource for inclusion on the NRHP (for example, diminishing the integrity of the resource's location, design, setting, materials, workmanship, feeling, or association). Adverse effects also include reasonably foreseeable effects caused by the proposal that would occur later in time, be farther removed in distance, or be cumulative (36 CFR 800.5, Assessment of Adverse Effects). A determination of *no adverse effect* means there would either be no effect or that the effect would not diminish in any way the characteristics that qualify the cultural resource for inclusion in the NRHP. CEQ regulations and DO-12 also call for a discussion of the appropriateness of mitigation, as well as an analysis of how effective the mitigation would be in reducing the intensity of a potential impact, e.g., reducing the intensity of an impact from major to moderate or minor. Any resultant reduction in the intensity of an impact due to mitigation, however, is an estimate of the effectiveness of mitigation under NEPA only. Cultural resources are non-renewable resources, and adverse effects generally consume, diminish, or destroy the original historic materials or form, resulting in a loss in the integrity of the resource that can never be recovered. Therefore, although actions determined to have an adverse effect under Section 106 of the NHPA may be mitigated, the effect remains adverse as the resource would be permanently affected.

Impact Threshold Definitions—Various thresholds of impact to cultural resources may result from implementation of a proposed action. The thresholds of identified impact will be assessed for affected cultural resources based on the perceived potential for the proposed action to result in a loss of the qualities that qualify the respective affected cultural resources as eligible to the NRHP.

Negligible: The impact would be at the lowest level of detection with neither adverse nor beneficial consequences. For purposes of Section 106 of the NHPA, the determination of effect would be no adverse effect.

Minor: A minor adverse impact would result if a cultural resource would be disturbed in a manner that would result in little, if any, loss of the qualities that qualify the cultural resource as eligible to the NRHP. Applying the NHPA Section 106 process, determination of effect would be no adverse effect.

A beneficial impact would result if a cultural resource would be maintained and preserved without loss of the qualities that qualify the cultural resource as eligible to the NRHP. Applying the NHPA Section 106 process, the determination of effect would be a no adverse effect.

Moderate: An adverse impact would result if the proposed action would cause disturbance to a cultural resource in a manner that would result in a loss of the qualities that qualify the cultural resource as eligible to the NRHP. Applying the NHPA Section 106 process, the determination of effect would be an adverse effect. If an adverse effect to a cultural resource that is listed in or is determined eligible to the NRHP will result from implementation of a proposed action, a Memorandum of Agreement (MOA) would be executed among the NPS, SHPO, possibly THPO (if the cultural resource is of concern to a Native American tribe), and, possibly, the ACHP, in accordance with 36 CFR 800.6(b). Measures identified in the MOA to minimize or mitigate adverse impacts would reduce the intensity of impact under NEPA from major to moderate.

A beneficial impact would result if the proposed action would stabilize a cultural resource and consequently benefit the cultural resource. For purposes of Section 106, the determination of effect would be no adverse effect.

Major: An adverse impact would result if a cultural resource that is listed in or is determined eligible to the NRHP would be disturbed causing a loss of the qualities that qualify it to the NRHP. For purposes of Section 106 of the NHPA, the determination of effect would be an adverse effect. Further, if measures to minimize or mitigate adverse impacts could not be agreed upon, and the NPS, SHPO, and THPO (if a consulted) are unable to negotiate and execute a MOA in accordance with 36 CFR 800.6(b), then NPS would consult with ACHP about the proposed action and assessed adverse impact. A beneficial impact would result if active intervention would be taken to preserve the NRHP listed or eligible cultural resource without causing a loss of the qualities that qualify the cultural resource to the NRHP. For purposes of Section 106, the determination of effect would be a no adverse effect.

4.10.1 Alternative 1—No Action

Direct Effects

Alternative 1 considers the potential effects to historic and cultural resources during the extended planning period (time-lag) without a programmatic restoration plan and does not consider the effects to resources from the grounding event itself. No direct effects to cultural resources would be expected under the No Action alternative. If cultural resources were determined to be located at the injury site, appropriate consultation would occur during planning of future restoration.

Indirect Effects

Cultural resources, such as shipwrecks, typically trend towards equilibrium with the surrounding environment over time. As this equilibrium is approached, the rate of decay of the cultural resource diminishes, with relatively large amounts of decay occurring initially then decreasing as the site ages. Oftentimes when a site is disturbed it restarts the curve of decay and then trends towards a secondary equilibrium after additional decay. In a dynamic marine environment, the effects of small impacts (such as minor destabilization) may be magnified by natural forces such as storms and currents resulting in a net effect that is disproportionate to the initial disturbance of a cultural resource. Under the No Action alternative additional scouring and erosion could occur during the increased planning period (time-lag) associated with site-specific environmental review and NEPA documentation that results in further degradation of the injury site. This could potentially result in a loss of the qualities that qualify the cultural resource as eligible to the NRHP. Depending on the duration of the planning period (time-lag), magnitude of site degradation, and degree of exposure of cultural resources until restoration activities are performed to mitigate these effects, the impact could vary from negligible to moderate adverse; major adverse impacts would be prevented through emergency restoration.

Cumulative Effects

The indirect effects of Alternative 1 could interact with other existing and future impacts to cultural resources to create cumulative impacts. The severity of the cumulative effects would depend upon the duration of the planning period (time-lag), magnitude of site degradation, and degree of exposure. The severity of the cumulative effects would also depend upon the severity of the natural forces such as storms and currents as described in "Indirect Effects," above.

Conclusion

Potential indirect, negligible to moderate adverse impacts identified under Alternative 1 include additional scouring and erosion during the increased planning period (time-lag) that could cause loss of the qualities that qualify the cultural resource as eligible to the NRHP. For purposes of Section 106 of the NHPA, the determination would be *adverse affect*. Major adverse impacts would be prevented through emergency restoration. No impairment to historical and cultural resources is anticipated under the No Action alternative because historical and cultural resources within BISC will not be significantly impacted.

4.10.2 Alternative 2—Restoration Using a Programmatic Approach and Restoration Actions

To address the unique characteristics of cultural resources compared to other resource topics, the analysis of impacts for the programmatic approach and each restoration action are combined into a single section. Management of cultural resources and consultation with Park, regional, and national NPS specialists as well as the SHPO are independent from, but can be simultaneous with the NEPA process, and are therefore suitable for a combined approach to impacts analysis.

Direct Effects

Under Alternative 2, Section 106 consultation would occur if cultural resources that are listed or determined eligible for listing in the NRHP were determined to be present in the injury area. Effects on cultural resources would be expected to be beneficial because restoration activities could occur more expeditiously than under the No Action alternative, avoiding long-term exposure of cultural resources to newly introduced conditions that may cause degradation of the qualities that contribute to Park values or qualify the cultural resources as eligible to the NRHP. If it was determined that restoration implementation and/or monitoring activities would adversely impact cultural resources that are eligible to the NRHP, then appropriate consultation would take place and mitigative measures would be identified and implemented prior to initiation of coral reef restoration work in that area. The BISC Archeologist/Cultural Resources Manager would determine the preferred method of treatment of NRHP listed or eligible cultural resources if they were present at the injury site and if these could not be avoided by the selected coral reef restoration methods.

Indirect Effects

Should there be impacts to cultural resources at an injury site, the necessary Section 106 consultation would result in a slight time-lag, but this time-lag would be much reduced compared to that of Alternative 1. During this shortened time-lag, the decay of cultural resources, as well as the magnifying effects of natural forces, would be similar to those described in Alternative 1; however, due to the reduced length of time-lag, these effects would be reduced in severity and duration. Therefore, the impact would vary (similar to Alternative 1) from negligible to minor adverse effects.

Cumulative Effects

As with the Alternative 1, the indirect effects of Alternative 2 could interact with other existing and future impacts to cultural resources to create cumulative impacts. The severity of the cumulative effects would depend upon the magnitude of site degradation, and degree of exposure. The severity of the cumulative effects would also depend upon the severity of the natural forces such as storms and currents as described in “Indirect Effects,” above.

Conclusion

Beneficial and negligible to minor adverse were identified under this alternative because restoration could be implemented in a timely manner. Potential indirect, negligible to moderate adverse impacts identified under Alternative 2 include scouring and erosion during the shortened time-lag that could cause loss of the qualities that qualify the cultural resource as eligible to the NRHP. Benefits would occur by means of the more expeditious nature of restoration activities under Alternative 2 relative to the No Action alternative. For purposes of Section 106 of the NHPA, the determination would be *no adverse affect*. No impairment to historical and cultural resources is anticipated under Alternative 2.

4.11 Recreation and Visitor Experience

Regulations and Policies—The Organic Act of 1916 created the NPS. The act promotes and regulates the use of federal areas including national parks and directs the NPS to protect park resources. The act directs that park resources should be left unimpaired for the enjoyment of future generations. The NPS Management Policies (NPS, 2006b) state:

> "Enjoyment of park resources and values by the people of the United States is part of the fundamental purpose of all parks. The Service is committed to providing appropriate, high quality opportunities for visitors to enjoy the parks, and would maintain within the parks an atmosphere that is open, inviting, and accessible to every segment of American society. However, many forms of recreation enjoyed by the public do not require a national park setting, and are more appropriate to other venues. The Service will therefore:
>
> - Provide opportunities for forms of enjoyment that are uniquely suited and appropriate to the superlative natural and cultural resources found in the parks.
> - Defer to local, state, and other federal agencies; private industry; and non-governmental organizations to meet the broader spectrum of recreational needs and demands.
>
> To provide for enjoyment of the parks, NPS will encourage visitor activities that:
>
> - are appropriate to the purpose for which the park was established; and
> - are inspirational, educational, or healthful, and otherwise appropriate to the park environment; and
> - will foster an understanding of, and appreciation for, park resources and values, or will promote enjoyment through a direct association with, interaction with, or relation to park resources; and
> - can be sustained without causing unacceptable impacts to park resources or values.

Injuries to coral reef and associated coral resources can impact the visual landscape of the site. The visitor experience can be affected by the aesthetics of the site, depending on the type of restoration needed based on the extent of the injuries at a site.

Approach and Assumptions—Evaluation of impacts to recreation and visitor experience, and aesthetics was based on a qualitative assessment of how a programmatic approach and restoration actions would impact the Park's visitor use. Effects on recreation and visitor use associated with coral reef resources from restoration actions performed in response to previous vessel groundings located within BISC and outside of the Park in the Florida Keys National Marine Sanctuary (FKNMS) were assessed (NPS, 2007a,b).

Impact Threshold Definitions—Impacts to recreation and visitor experience were evaluated using the following threshold definitions:

Negligible: No discernable effect to recreation activities or visitor experience would occur.

Minor: Impacts would only affect some visitors, and would be detectible, but localized. Changes to recreation activities or visitor experience would be slight.

Moderate: Impacts would affect many visitors, would be readily detectable, and would considerably change recreation activities or visitor experience.

Major: Impacts would affect the majority of visitors, bringing substantial, highly noticeable changes to recreation activities or visitor experience on a park-wide scale.

4.11.1 Alternative 1—No Action

This section evaluates the effects on recreation and visitor experience associated with the longer planning period (time-lag) required to prepare individual environmental review and NEPA documentation for each vessel-grounding event. Under Alternative 1, restoration methods would be evaluated in each individual NEPA document and are therefore not considered under Alternative 1 in this RP/PEIS.

Direct Effects

Minor, direct, short- to long-term adverse effects on recreation and visitor experience are anticipated under the No Action alternative. Depending upon the magnitude of a grounding incident, the area could be closed to recreational boaters, divers, and fisherman until restoration was completed. For example, following the Allie B grounding in July 1998, a 2-square-mile buffer was imposed around the injury site for 10 months (July 1998 to May 1999). The closure occurred 2 days before the 2-day spiny lobster season and an estimated 100 lobster fishers were excluded from the area (NPS, 2007a). Furthermore, the quality of fishing and diving at the injury site was diminished until restoration was completed. Such periods of closure and diminished recreational experience likely would persist longer under Alternative 1 than under a programmatic approach. Injuries to the coral reef and coral reef resources would not be restored until the non-programmatic NEPA process was completed, which would potentially leave the site degraded, thereby causing either a short-term or long-term minor adverse impact on the aesthetic experience.

Indirect Effects

The No Action alternative also could cause minor indirect effects on fishing and diving in areas surrounding the injury site. There is the potential for increased biological injury from movement of rubble or further destabilization of reef. These effects would adversely affect the aesthetics of the reef, therefore adversely affecting the visitor experience. The duration of this effect could be short-term (12 months or less) or long-term (greater than 12 months) depending upon the duration of the NEPA planning process, causing a long-term, minor, adverse indirect impact.

Cumulative Effects

Adverse impacts to recreation and visitor experience within BISC include degraded water quality resulting from private and commercial development, overfishing, marine pollution, and vessel groundings. Since 1995, BISC staff has recorded over 700 vessel groundings, which is estimated to account for 10 to 20 percent of the total groundings in the Park (NPS, 2006a). Forthcoming BISC management plans such as the updated GMP and the Mooring Buoy Plan would be anticipated to make beneficial contributions to cumulative impacts. Under Alternative 1 the extended planning period (time-lag) between grounding and the implementation of restoration activities may contribute to minor, long-term cumulative adverse impacts on BISC recreation and visitor experience and the aesthetics of the viewscape.

Conclusion

Under the No Action alternative, minor, direct and indirect, short- to long-term adverse effects could include closure of the area to recreational boaters, divers, and fisherman until restoration was completed and biological injury from movement of rubble or further destabilization of reef. Adverse cumulative impacts would be minor, adverse, and long-term.

4.11.2 Alternative 2—Restoration Using a Programmatic Approach

This section evaluates the effects on recreation and visitor experience from the reduced planning period (time-lag) associated with implementation of a programmatic approach to restoration.

Direct and Indirect Effects

Implementation of a programmatic approach (Alternative 2) would have the same direct and indirect effects on recreation and visitor experience resources as under Alternative 1. However, the effects would likely be shorter in duration because the programmatic approach would expedite the restoration planning phase and shorten the overall period of time until restoration was completed. Alternative 2 would allow the Park to conduct restoration sooner. Therefore, adverse impacts would be short-term and minor.

Cumulative Effects

Implementation of a programmatic approach (Alternative 2) would have the same cumulative effects (adverse impacts from degraded water quality resulting from private and commercial development, overfishing, marine pollution, and vessel groundings; and beneficial impacts from forthcoming BISC management plans such as the updated GMP and the Mooring Buoy Plan) as under Alternative 1. Cumulatively, these impacts are expected to be adverse, long-term, and minor. Under Alternative 2, however, the planning period (time-lag) between the initial injury and the commencement of restoration activities would be substantially reduced because grounding sites would be restored within a shorter timeframe than under the No Action alternative, meaning that the programmatic approach (Alternative 2) would contribute minimally to adverse cumulative impacts.

Conclusion

Under a programmatic approach (Alternative 2), minor, direct and indirect, short-term adverse effects could include closure of the area to recreational boaters, divers, and fisherman until restoration was completed and biological injury from movement of rubble or further destabilization of reef. Effects would likely be shorter in duration than under Alternative 1. Cumulative impacts would be minor, long-term, and adverse.

4.11.3 Alternative 2—Restoration Actions

This section evaluates the effects on recreation and visitor experience from restoration actions that would be included in the "restoration toolbox" under Alternative 2. The impacts on recreation and visitor experience from the proposed restoration actions are described together in the following sections.

Direct Effects

The restoration actions would have minor direct short-term adverse effects on aesthetics, recreation, and visitor experience. Impacts to recreation and visitor experience include potential closure of the site to provide for access to and safety at the injury site. However, under the monitoring only restoration action direct effects would be negligible for recreation activities. Temporary closure of the site may be necessary for placement of monitoring stakes, but this impact would be short-term and negligible. Monitoring may require the use of permanent pins or stakes that could cause adverse effects to the aesthetics of the site; however, these long-term adverse effects would be negligible to minor.

Indirect Effects

The indirect effects of the restoration actions would be primarily beneficial and long-term, and expected to improve visitor experience. The restoration actions would improve reef complexity and habitat for all marine species that utilize the reef for feeding and refugia during all or some life stages. This in turn would make restored areas attractive to snorkelers and divers, and help sustain fisheries within BISC.

Specific boat ramps and upland staging areas could potentially be temporarily and intermittently closed during restoration activities and utilized for mobilization of vessels and equipment staging causing minor short-term indirect adverse effects on recreation and visitor experience. These closures could temporarily impact public accessibility and usage of these areas. Not all facilities are expected to be utilized or affected during restoration activities. Another minor indirect effect from the restoration actions could include an elevated public interest in the restored area and an increase in divers to the restored area. Although restoration actions would not be expected to return the injury site to pre-impact conditions immediately, diver interest in the site could be increased.

Cumulative Effects

Restoration actions under Alternative 2 would have the same cumulative effects (adverse impacts from degraded water quality resulting from private and commercial development, overfishing, marine pollution, and vessel groundings; and beneficial impacts from forthcoming BISC management plans such as the updated GMP and the Mooring Buoy Plan) as under Alternative 1. Cumulatively, these impacts are expected to be adverse, long-term, and minor. Under Alternative 2, however, the planning period (time-lag) between the initial injury and the commencement of restoration activities would be substantially reduced because grounding sites would be restored within a shorter timeframe than under the No Action alternative, meaning that Alternative 2 would contribute minimally to adverse cumulative impacts.

Conclusion

Restoration actions under Alternative 2 would have negligible to minor, short-term to long-term adverse impacts on recreation and visitor experience through potential temporary site closure, use of permanent pins or stakes for monitoring, and temporary closure of boat ramps and upland staging areas. Restoration actions would impact recreation and visitor experience beneficially through improved reef complexity and habitat. Cumulative impacts would be minor, long-term, and adverse.

4.12 Human Health and Safety

This section evaluates the effects of the longer planning period (time-lag) associated with preparing an individual NEPA document for each grounding event. Under Alternative 1, restoration methods would be evaluated in each individual NEPA document, and therefore their impacts are not considered under Alternative 1 in this RP/PEIS.

Regulations and Policies—CEQ regulations (§1508.27) and NPS DO-12 (NPS, 2001) require any federal actions to address public health and safety. The Organic Act of 1916 directs the NPS to conserve scenery, wildlife, and natural and historic properties/objects and provide for the enjoyment of these resources in a manner that leaves them unimpaired for future generations. The NPS Management Policies (NPS, 2006b) (Section 8.2) guide the parks to impose management restrictions in order to ensure the protection of the parks' resources and values. The policies state that the superintendent of a park may:

- Temporarily or permanently close a specific area;
- Prohibit a particular use; or
- Otherwise place limitations on the use to ensure that impairment does not occur.

These measures require written determination by the park superintendent to ensure the following actions (NPS, 2000):

- Protect public health and safety;
- Prevent unacceptable impacts to park resources or values;
- Carry out scientific research;
- Minimize visitor use conflicts; or
- Otherwise implement management responsibilities.

Impacts to human health and safety are expected to be negligible to minor under both of the alternatives.

Approach and Assumptions—Evaluation of impacts to human health and safety was based on a qualitative assessment of how a programmatic approach and restoration actions would impact the safety issues.

Impact Threshold Definitions—Impacts to human health and safety were evaluated using the following threshold definitions:

Negligible: No discernable effects to human health and safety.

Minor: Impacts could create localized short-term risks related to human health and safety. Potential injuries would likely require first aid provided by park staff.

Moderate: Impacts could create human health and safety risk, with potential for injuries that may require further medical attention beyond what was available at the park and may result in time off.

Major: Substantial, highly noticeable influence on human health and safety. There would be a likelihood for injuries may result in permanent disability or death.

4.12.1 Alternative 1—No Action

Direct Effects

No direct effects to human health and safety are expected under the No Action alternative.

Indirect Effects

The No Action alternative could cause minor adverse long-term or short-term indirect effects on boater safety in areas surrounding the injury site. These areas could be closed for an extended period of time depending on the injury type, and may need to be marked by BISC staff with temporary navigation signs, which could cause boater confusion and lead to poor judgment in vessel operation.

In addition, chemical or paint material released during the vessel grounding may need further removal after the Park conducts initial emergency triage to the site. There is a potential for divers to come in contact with paint or chemicals from spills that may carry over and settle on adjacent sites. The duration and degree of this adverse impact would be dependent upon the properties of the chemical itself and would need to be evaluated on a case-by-case basis. It is anticipated that the effects could range from negligible to minor and be either short-term or long-term. Furthermore, chemical or paint material could carry over to adjacent sites causing ongoing degradation to organisms or habitat utilized by the public. This adverse impact is considered negligible to minor and long-term (6 months to several years).

Cumulative Effects

Under the No Action alternative, injury sites would not be restored and remain closed to the public until NEPA documentation was prepared. This process could potentially take several years to finalize. If boaters who were using the coral reef resource to fish, dive, snorkel, or enjoy other reef-related activities were excluded from the site, they could potentially crowd into other areas, thereby causing boater congestion and increasing the potential for boater accidents resulting in adverse cumulative impacts would be long-term and minor. However, this potential for such impacts is small.

Conclusion

Adverse impacts to human health and safety from the No Action alternative would be short-term to long-term and negligible to minor. Such impacts would include boater confusion caused by closures and potential exposure of divers to paint or chemicals. Cumulative effects would be adverse, long-term, and minor.

4.12.2 Alternative 2—Restoration Using a Programmatic Approach

This section evaluates the effects to the reduced planning period (time-lag) associated with the implementation of a programmatic approach under Alternative 2.

Direct Effects

Under a programmatic approach (Alternative 2), BISC staff would have the ability to conduct restoration activities shortly after a vessel grounding occurred, potentially reducing the need to close the site to the public for an extended period of time and thereby reducing exposure of boaters to confusion. Therefore, adverse impacts would be short-term and negligible to minor.

Indirect Effects

Under a programmatic approach (Alternative 2), the public would have the opportunity to access the site sooner under Alternative 2 than under Alternative 1, potentially causing less pressure and increased boater traffic to other un-injured sites. The reduced time-lag associated with Alternative 2 would reduce the likelihood that paint or chemical materials could cause adverse impacts. These indirect adverse effects are considered minor and short-term.

Cumulative Effects

Under a programmatic approach (Alternative 2), injury sites would be restored re-opened to the public more quickly, substantially reducing the potential for cumulative impacts as described for Alternative 1.

Conclusion

Any potential adverse impacts (direct, indirect, and cumulative) identified under this alternative would be less than with Alternative 1 because of the reduced time-lag associated with the programmatic approach. Adverse impacts would be negligible to minor and short-term.

4.12.3 Alternative 2—Restoration Actions

This section evaluates the effects of restoration actions that would be included in the "restoration toolbox" under Alternative 2 on human health and safety.

Direct Effects

The implementation of restoration actions could present health and safety risks to NPS staff or contractors conducting restoration. However, these risks would be mitigated by use of BMPs and project-specific safety plans, resulting in short-term, negligible to minor, adverse impacts. Under all restoration actions, the public would be restricted from the site while restoration was being conducted. Direct beneficial effects to human health and safety would be expected under all restoration actions. For example, removing or stabilizing rubble and debris and restoring the site's topography would prevent the public from being injured or harmed from loose debris or rubble or the removal of toxic chemicals or paint from the site.

Indirect Effects

Under all restoration actions, the public would have the opportunity to access the site once restoration was completed, potentially causing less pressure and boater traffic to other un-injured sites.

Cumulative Effects

Under a programmatic approach (Alternative 2), injury sites would be restored re-opened to the public more quickly, substantially reducing the potential for cumulative impacts as described for Alternative 1.

Conclusion

Potential adverse direct impacts to NPS staff or contractors would be short-term and negligible to minor. Human health and safety within BISC would benefit from actions such as removal and stabilization of rubble and from reduction in boater traffic to un-injured sites.

4.13 Park Operations

Regulations and Policies—The NPS Management Policies (NPS, 2006b) state:

"The National Park Service will provide visitor and administrative facilities that are necessary, appropriate, and consistent with the conservation of park resources and values. Facilities will be harmonious with park resources, compatible with natural processes, aesthetically pleasing, functional, energy- and water-efficient, cost-effective, universally designed, and as welcoming as possible to all segments of the population. NPS facilities and operations will demonstrate environmental leadership by incorporating sustainable practices to the maximum extent practicable in planning, design, siting, construction, and maintenance.

The Park will conduct a program to:

- provide a safe, sanitary, environmentally protective, and esthetically pleasing environment for park visitors and employees;
- protect the physical integrity of facilities; and
- preserve or maintain facilities in their optimum sustainable condition to the greatest extent possible."

Approach and Assumptions—Evaluation of impacts to Park operations was based on a qualitative assessment of how a programmatic approach to restoration actions would impact the operating divisions that administer programs at BISC. Effects on Park operations associated with coral reef restoration actions are primarily related to divisional personnel and budgetary resources, restoration planning requirements, and uncertainty related to the unpredictable and infrequent nature of groundings that injure coral resources.

Impact Threshold Definitions—Impacts to Park operations were evaluated using the following threshold definitions:

Negligible: No discernable effect to Park operations.

Minor: Park operations would be affected, and the effect would be discernable, but current levels of funding and staff would be adequate and other Park operations would not be reduced.

Moderate: Park operations would be affected in a readily apparent manner. Increased staff and funding would be needed or other Park operations would need to be reduced.

Major: Substantial, highly noticeable influence on Park operations. Increased staff and funding would be needed or other Park programs would have to be eliminated.

4.13.1 Alternative 1—No Action

This section evaluates the effects on Park operations associated with the planning required to prepare individual environmental review and NEPA documentation for each vessel-grounding event. Under Alternative 1, restoration methods would be evaluated in each individual NEPA document and are therefore not considered under Alternative 1 in this RP/PEIS.

Direct Effects

Minor, periodic, short-term to long-term, adverse direct effects on Park operations are anticipated under the No Action alternative. Those effects are related to diversion of limited personnel and budgetary resources to manage and conduct restoration planning and environmental compliance to restore grounding-related coral reef injuries because Alternative 1 would require those activities for every grounding incident before restoration could commence. The effects of Alternative 1 have high uncertainty because incidents are unpredictable in terms of frequency, location, and timing. The duration of this effect could be short-term (12 months or less) or long-term (greater than 12 months) depending upon the duration of the NEPA planning process. Periods of time where Damage Recovery Program (DRP) personnel and budgetary resources are temporarily committed to restoration planning and environmental compliance for an injury site would be longer and more frequent under Alternative 1 than under a programmatic approach. Furthermore, the length of time to complete restoration planning and environmental compliance at an individual injury site would take longer before restoration was completed.

Indirect Effects

The No Action alternative could cause minor short-term adverse indirect effects to other resource management programs that are also the responsibility of DRP and other Resource Management staff. Those effects would be felt when there is a temporary diversion of personnel and budgetary resources to manage coral reef restoration planning and environmental reviews. The indirect effects of Alternative 1 have high uncertainty because incidents have unpredictable frequencies, locations, degree of injury, and timing. Periods of time where DRP personnel and budgetary resources redirect their attention to perform or manage restoration planning and environmental compliance for an injury site would be longer under Alternative 1 than under a programmatic approach.

Cumulative Effects

There are numerous past, present, and future planning and management activities that compete with restoration planning and environmental compliance for BISC personnel and budgetary resources. The unpredictable nature of groundings contributes to uncertainty in overall management of resources and program planning. Alternative 1 would maintain the current practice of planning on a case-by-case basis to address restoration of grounding injuries. Cumulative impacts would be adverse, long-term, and minor.

Conclusion

Any potential adverse impacts (direct, indirect, and cumulative) identified under this alternative would be minor and short-term to long-term. Uncertainty related to temporary diversions of personnel and budgetary resources would continue because temporary commitments of resources to address restoration planning and environmental review would remain when addressing incidents individually.

4.13.2 Alternative 2—Restoration Using a Programmatic Approach

This section evaluates the effects on Park operations that would result from the reduced planning and environmental review associated with implementation of a programmatic approach to coral reef restoration, rather than undertaking individual environmental review and NEPA documentation for each vessel-grounding event. Environmental review after adoption of a programmatic approach would allow for tiering to address NEPA analysis and compliance requirements.

Direct Effects

Beneficial effects on Park operations are anticipated by using a programmatic approach, which would allow the NPS to implement more cost-effective planning practices to coral reef restoration and to tier future NEPA analyses from this comprehensive environmental review done in advance. Those effects are related to reducing the periodic, unplanned diversion of personnel and budgetary resources to manage restoration planning and conduct environmental compliance to address individual groundings. Alternative 2 would reduce the time-lag for commencing restoration after grounding incidents and introduce a greater degree of certainty regarding personnel workloads and budgetary commitments. Those periods of time where DRP personnel and budgetary resources are temporarily committed to plan and manage environmental reviews necessary to restore an injury site would be shorter under a programmatic approach than under Alternative 1. Furthermore, the cost to complete restoration planning and environmental compliance at an individual injury site would be reduced.

Indirect Effects

Using a programmatic approach to restoration planning would reduce minor diversions of resources from other resource management programs that are also the responsibility of DRP and other Resource Management personnel (a beneficial effect). Alternative 2 would provide greater certainty in allocating personnel and budgetary resources among Park staff divisions, thereby allowing the NPS to implement more efficient solutions to resource management challenges.

Cumulative Effects

There are numerous past, present, and future planning and management activities that compete for BISC personnel and budgetary resources to address restoration planning and environmental compliance. The unpredictable nature of groundings contributes to uncertainty in overall management of resources and program planning. Implementing Alternative 2 would help to alleviate some aspects of the uncertainty.

Conclusion

Potential impacts (direct, indirect, and cumulative) to Park operations identified under this alternative for implementing a programmatic approach are anticipated to have beneficial effects. Uncertainty related to temporary diversions of personnel and budgetary resources would be reduced because temporary commitments of resources to address restoration planning and environmental review would be fewer, less frequent, and of shorter duration than by responding on an individual basis. Overall, Park operations within BISC would be improved by taking this action.

4.13.3 Alternative 2—Restoration Actions

This section evaluates the effects on Park operations from actions, methods, and techniques that would be included in the "restoration toolbox" under Alternative 2. The impacts on Park operations from the proposed restoration actions are described together in the following sections.

Direct Effects

The restoration actions would have negligible or no discernable direct effects on Park operations. Current NPS personnel have the capability to implement or manage the implementation of any of the restoration actions proposed in the toolbox. No additional resources would be anticipated.

Indirect Effects

The indirect effects of the restoration actions on Park operations are difficult to ascertain so any impacts would be considered negligible.

Cumulative Effects

There are numerous past, present, and future planning and management activities that compete for BISC personnel and budgetary resources to address restoration planning and environmental compliance. The unpredictable nature of groundings contributes to uncertainty in overall management of resources and program planning. Under Alternative 2, contributions or restoration actions to cumulative effects to Park operations of any and/or all of the restoration actions would not be discernable.

Conclusion

Negligible adverse impacts are anticipated upon Park operations from the implementation of any of the restoration activities proposed in the toolbox.

4.14 Relationship between Local Short-term Uses of the Environment and the Maintenance and Enhancement of Long-term Productivity

Coral reefs and associated reef resources that have been impacted from a vessel grounding could affect the short-term use and long-term productivity of the affected area depending on the extent of the injuries and restoration that is needed. The impacted sites would be expected to be closed for public use for an undetermined amount of time under the No Action alternative, until the NEPA planning process was completed. These areas would be expected to recover faster and more productively if restoration was conducted in a timely manner under Alternative 2. Biological and physical resource impacts would be addressed more rapidly under Alternative 2, thereby enhancing conditions for long-term productivity.

Recreational usage of areas that may contain NRHP-eligible or listed cultural resources may be temporarily made inaccessible to the public during periods following injury events and up to completed implementation of remedies. Protection of cultural resources that may be present in the areas of intrusive injury will benefit in the long-term by diligent compliance with the NPS evaluation process that address both NHPA Section 106 and NPS Cultural Resource Management Guideline No. 28 (NPS, 1997).

4.15 Irreversible or Irretrievable Commitments of Resources

Irreversible and irretrievable commitment of resources pertains to the resources that cannot be reversed or that would not be reversed in a foreseeable amount of time under the Action Alternative or an irretrievable commitment of resource so that a resource that is lost for a period of time or as long as the action exists.

Under Alternative 2, restoration activities would not be expected to damage or reverse the resources at the damaged or adjacent site. Conducting restoration in a timely manner would be expected to preserve or foster the recovery and functionality of corals or coral resources that have been injured. In addition, physical resources such as geology and water quality would be expected to improve due to timely efforts to restore the site to its original state. Where efforts to restore an injured site may cause further damage, appropriate mitigation would be used.

During restoration efforts disturbance of the site may cause decreased productivity of corals, ichthyofauna, and T&E species, and short-term water quality fluctuations (e.g., turbidity). However, these disturbances would not cause an irretrievable commitment of the resources. Under Alternative 2, resources in the affected area would be expected to improve more quickly and productively than under Alternative 1.

Following NPS Guidance for cultural resources management and the NPS process for compliance with NHPA Section 106 should prevent irreversible actions that would cause adverse impacts to cultural resources that are listed in or are eligible to the NRHP. The BISC Archeologist/Cultural Resources Manager’s input to NPS selections of remedial alternatives will assure that non-renewable resources such as cultural resources are appropriately addressed during coral reef restoration.

4.16 Unavoidable Adverse Impacts

Biological and Physical Resources

Localized disturbances are expected during restoration activities under Alternatives 1 and 2. However, under Alternative 2 injured resources could be restored in a timelier manner then under Alternative 1. Restoration efforts to restore injured resources and habitat to its natural state expeditiously would be expected to increase productivity of corals, invertebrates, ichthyofauna, and other species that inhabit or utilize the area. Under Alternative 1, restoration efforts would be delayed, beyond emergency triage, potentially causing further degradation to the site and productivity of the resources. There are no adverse effects expected under Alterative 2.

Threatened and Endangered Species

Restoration activities are not anticipated to adversely affect threatened and endangered species. Motile threatened and endangered species may leave the work area (temporary displacement) during restoration efforts under both alternatives, but this would not be expected to pose adverse impacts. In the event that work must occur near or around elkhorn, staghorn, and pillar corals, extreme care will be taken to ensure damage to these resources does not occur during restoration activities.

Cultural Resources

In situations where adverse impacts to cultural resources cannot be avoided, the BISC Archeologist/Cultural Resources Manager will oversee development of a MOA that will outline steps to appropriately modify the intensity of impact thresholds that may result from a variety of proposed remedial activities.

Recreation and Visitor Experience

Recreation such as diving, snorkeling, fishing, and boating would be affected during restoration activities. However, under Alternative 2, restoration activities would be conducted closer to when the vessel grounding occurs, opening access to visitor use sooner. Any adverse impacts would be short-term under this alternative.

Aesthetic Resources

Under Alternative 2, the visual landscape would be restored to its natural state in a timely manner. During restoration activities and while injured resourced recover, aesthetics may be impacted. However, this is expected to be short-term and no long-term adverse effects are expected.

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5. CONSULTATION AND COORDINATION

Under NEPA, federal agencies are required to consider all environmental impacts associated with the proposed action and evaluate all reasonable alternatives. NEPA also stipulates that agencies cooperate with other federal agencies, and involve state and local governments and interested stakeholders in the decision-making process. All persons and organizations that may be affected by the proposed action as part of this RP/PEIS are urged to participate in the NEPA process.

5.1 History of Public Involvement

5.1.1 The Scoping Process

The NPS divides the scoping process into two parts: internal scoping and external or public scoping. Internal scoping involved discussions among NPS personnel regarding the purpose of and need for management actions, issues, management alternatives, mitigation measures, the analysis boundary, appropriate level of documentation, available references and guidance, and other related topics.

Public scoping is the early involvement of the interested and affected public in the environmental analysis process. The public scoping process helps ensure that people have an opportunity to comment and contribute early in the decision-making process. For this planning document and assessment, project information was distributed to individuals, agencies, and organizations early in the scoping process, and people were given opportunities to express concerns or views and to identify important issues or other alternatives.

Taken together, internal and public scoping are essential elements of the NEPA planning process. The following sections describe the various ways scoping was conducted for this impact statement.

5.1.2 Internal Scoping

The NPS IDT conducted internal scoping in a workshop format on October 26 and 27, 2004, at BISC Headquarters. The scoping was conducted systematically to identify purpose and need for coral restoration actions to address grounding-related injuries, establish objectives and goals for restoration, determine the types of geological and biological injuries to the BISC coral reef tracts that are caused by groundings for which restoration methods would be evaluated, inventory an initial array of possible restoration techniques and methods for consideration, identify key environmental issues and analysis topics, and set screening and evaluation criteria against which method effectiveness would be judged and impacts would be analyzed.

5.1.3 Public Scoping

The public was provided several opportunities to comment on the development of this RP/PEIS. The NOI to prepare this RP/PEIS was published in the *Federal Register* on February 17, 2006. The public was encouraged to comment on any issues associated with the proposed action within 60 days of publication of the NOI by U.S. mail or the internet by posting comments on the Planning, Environment and Public Comment (PEPC) website (http://parkplanning.nps.gov). No public comments were received in response to the NOI.

Informal public scoping for the Coral Reef PR/PEIS was also conducted during public meetings held for the Allie B and Igloo Moon RP/EAs in 2006 in Homestead, Florida. The NPS gave verbal notice to individuals at that public meeting that the NPS was planning to prepare the Coral Reef RP/PEIS. The public feedback at the meeting related to this announcement was positive.

5.2 Agency and Tribal Consultation and Coordination

5.2.1 National Oceanic and Atmospheric Administration, Florida Department of Environmental Protection

On October 1–2, 2003, a Coral Reef and Seagrass Restoration Workshop was held at BISC in Homestead, Florida. The 2-day workshop was sponsored by NPS and NOAA and held to discuss coral reef and seagrass restoration. At the workshop, restoration managers discussed common goals, issues, and techniques including coral reef restoration methods. The workshop included scientists and managers from federal and state agencies with jurisdiction over submerged marine resources in south Florida, the Florida Keys, and the Caribbean. Thirty-six participants attended the workshop representing NPS, NOAA, and FDEP. The organizations represented included NOAA FKNMS, Center for Coastal Fisheries and Habitat Protection, Damage Assessment Center, Restoration Center, and Sanctuary Program, and FDEP Lower Keys Sanctuary Program, Upper Keys Sanctuary Program, and Florida Park Service.

5.2.2 U.S. Fish and Wildlife Service and NOAA Fisheries

Section 7 of the ESA, Interagency Cooperation, is the process used to ensure that the actions taken by federal agencies do not jeopardize the existence of any listed species. This process is intended to involve the identification and resolution of species conflicts in the early stages of project planning. To ensure compliance with ESA, the NPS initiated consultation with the USFWS and NOAA Fisheries in letters sent on March 19, 2009 (included in Appendix E). The NPS will coordinate with NOAA Fisheries and USFWS regarding federally listed species that occur within BISC and that may be affected by the proposed actions of this PEIS. All communication between agencies will occur through written letters and other NPS-established channels of communication.

5.2.3 Florida State and Tribal Historic Preservation Officers

In letters sent on March 19, 2009, the NPS initiated Section 106 consultation with the Florida SHPO. The NPS also offered government-to-government consultations to the THPOs for the Seminole Tribe of Florida, the Seminole Nation of Oklahoma, and the Miccosukee Tribe of Indians of Florida. These and other relevant consultation letters are included as Appendix E of this RP/PEIS. The NPS will continue to consult with the Florida SHPO, THPOs, interested parties, and the ACHP, if appropriate, as part of its ongoing compliance with Section 106 of the NHPA. NPS will undertake consultation through its established communication channels and practices. Copies of all NEPA documents and studies performed specifically in compliance with Section 106 will be provided to SHPO, THPOs, and interested parties for review and comment.

5.2.4 Other Agency and Tribal Coordination

In addition, letters were mailed to several agencies and tribes in March 2009 (included in Appendix E). The NPS received two comments in response to these letters, one from the FDEP, Florida State Clearinghouse, and one from the Mikasuki tribe. Lauren P. Milligan of the Florida State Clearinghouse submitted a comment requesting that the NPS coordinate with the FDEP, Coral Reef

Conservation Program. Fred Dehas indicated that the Mikasuki tribe had no scoping comments related to the RP/PEIS. No other comments were received from agencies or tribes involved in scoping.

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5.4 List of Recipients

Congressional Delegates

Honorable George LeMieux
Honorable Bill Nelson
Honorable Ileana Ros-Lehtinen

Federal Agencies

Advisory Council on Historic Preservation
National Marine Fisheries Service
U.S. Environmental Protection Agency

U.S. Fish and Wildlife Service
U.S. Department of the Interior

Tribal Governments

Miccosukee Tribe of Indians of Florida
Seminole Tribe of Florida
Seminole Nation of Oklahoma

State Agencies

Florida Department of Environmental Protection
Florida Division of Historical Resources

Public Libraries

Legislative Library, Tallahassee, FL
Miami-Dade Library, Homestead Branch, Homestead, FL
Miami-Dade Library, South Dade Regional Branch, Miami, FL
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Appendix A
Site-Specific Restoration Plans

Site-Specific Restoration Plans

Site-specific restoration plans (RPs) should direct restoration actions implemented at Biscayne National Park (BISC) coral reef restoration sites. An outline that may be used to develop a site-specific RP is included below.

The preparation of a RP is required under Director's Order #14 (DO-14) and ensures National Environmental Policy Act (NEPA) compliance under both Director's Order #12 (DO-12) and DO-14. A typical RP addressing site-specific coral reef injury at BISC would state that the environmental impacts of the proposed restoration action have already been analyzed in a previous NEPA analysis (i.e., this RP/Programmatic Environmental Impact Statement [PEIS]). However, if coral reef restoration technologies have changed and the site conditions are not addressed in this RP/PEIS, then further NEPA analysis may be required. If restoration technologies have not changed and conditions at the site to be restored are addressed in this RP/PEIS, a Memo to File may be prepared. That memo should be approved by the BISC Superintendent in consultation with the Regional Environmental Coordinator (Reference: DO-12, Sec.2.6.C.).

Site-Specific Restoration Plan Outline

A suggested outline for a site-specific coral reef RP at BISC is shown below.

- I. Introduction
  - a. Description of the Incident
  - b. Summary of Settlement
  - c. Purpose and Need (includes Objectives and/or Goal Statements)
  - d. Environmental Compliance Discussion
- II. Affected Environment Discussion (the environment which will be affected by implementing the alternative(s))
- III. Restoration Alternative(s) [Note: it is possible to have only one alternative]
  - a. Describe Alternative(s)
  - b. Restoration Objective (how the alternative(s) make the injured resource whole)
  - c. Toolbox, if appropriate (when a previous RP and NEPA Analysis have resulted in a "toolbox" of restoration alternatives)
- IV. Success Criteria and Monitoring Plan (includes measurement parameters and standards, frequency, length of monitoring period, and the frequency of Monitoring Reports)
- V. Field Implementation Plan
  - a. Onsite National Park Service (NPS) Requirements
  - b. Current Site Conditions (including type of and extent of resource injuries)
  - c. Restoration Description (description of the chosen alternative)
  - d. Restoration Approach (include how to implement the restoration alternative(s) in detail, including tools and supplies required, various specifications, etc.)

e. Restoration Implementation Schedule/Timeline

f. Permits

Appendices, including laboratory analysis results, permits, any NEPA documents, and other applicable materials.

Each site-specific RP should include the following:

- Description of size and nature of the injury and how it occurred
- Current site conditions
- Characteristics of the injury site
- Presence of threatened and endangered (T&E) species
- Presence of cultural resources
- Selected site-specific RP actions compared with consent decree/settlement document requirements
- Health and safety of workers implementing the restoration action

Each RP should include a site-specific field implementation plan that describes the equipment, materials, personnel, staging, and the timeline for restoration activities. The implementation plan should also include onsite NPS/BISC restoration implementation requirements (see Section 1.5), descriptions of the restoration actions/methods, an implementation schedule, a monitoring plan, and a list of applicable permits. A site visit should be conducted before preparation of the field implementation plan to establish work zones and confirm the suitability of the selected restoration alternatives.

Restoration Implementation Requirements

All activities during restoration efforts, whether performed in-house or by a qualified contractor with NPS oversight, will meet the following BISC and NPS requirements, many of which are established to mitigate implementation impacts:

- Restoration operations within BISC will not proceed without the presence of a representative from the Park Resources Management Division unless prior approval from the Park has been obtained.
- The Park's Resources Management Division must be notified and grant approval for any and all changes from the site-specific RP.
- Park Resources Management Division personnel will approve the size and number of vessels to be used before restoration work proceeds as documented in the site-specific RP.
- All vessels involved in restoration activities must maintain, at a minimum, a draft clearance of 0.5 meter (m) (18 inches) while working within BISC. The 0.5-m (18-inch) clearance

would be measured from the lowest part of the vessel to the bay/sea floor. Any variances to this measurement will be identified in the site-specific RP.

- Fracture filling, rubble relocation and removal, and fill placement will be controlled and turbidity monitored at all times during restoration activities.
- All restoration work will be performed during suitable tides unless prior approval from the Park's Resources Management Division has been obtained.
- Anchoring may be allowed, but the Park's Resources Management Division must approve the anchoring method documented in the site-specific RP before work commences. Vessels would be anchored outside the injury area with minimal anchor points. Anchor placement and security would be monitored to reduce possible resource damage.
- Compliance with all federal, state, and county regulations and permits is required.
- All restoration sites will be marked with buoys during restoration activities, and notification and/or bulletins will be given to the United States Coast Guard to issue to local mariners when restoration work is in progress. The Park's Resources Management Division must be alerted when the United States Coast Guard is notified.
- Before transplantation of biotal material from previously displaced material, a suitable donor site, or a nursery, within the Park, approval by the Chief of Resources Management Division for BISC is required.
- Characterization of site conditions should occur prior to any field implementation activities unless prior approval is granted by the Park's Resources Management Division.
- If during restoration activities, any T&E species were to be observed within 91.4 m (100 yards) of the activities, all appropriate precautions would be implemented to ensure its protection. These precautions would include shutting down the operation of all moving equipment within 15.2 m (50 feet [ft]) of the animal. Activities would not resume until the animal has departed the project area of its own volition.
- Observation of manatees and smalltooth sawfish during in-water work will be conducted as required by U.S. Fish and Wildlife Service and National Oceanic and Atmospheric Administration (Appendices C and D).
- Any sediment placement operations in shallow areas will only be conducted on nearly calm days (seas less than 2 ft and winds less than 5 miles per hour) using skilled vessel operators, marker buoys, and personnel inspection unless specialized mitigation procedures are planned for, approved by the Park's Resources Management Division, and implemented.
- Donor material will be collected in a manner to ensure that the donor locales are not degraded, including, but not limited to, the removal of previously displaced biota.
- If transplantation is required, only species native to BISC may be utilized.

Project Completion Report

After implementation of coral reef restoration at a site, including monitoring and achievement of success criteria, a Project Completion Report should be written to document pertinent restoration activities, key project milestones, and success in achieving restoration goals.

Appendix B
Cumulative Actions Considered

Affected Resource: <u>Physical Environment</u>

Temporal Boundary: establishment of BISC Nat'l. Monument to the lifespan of the new General Management Plan
Spatial Boundary: park boundary

Past Actions	Present Actions	Future Actions
▪ Existing General Management Plan ▪ Hurricanes ▪ Vessel groundings ▪ Channel maintenance ▪ Scientific research and monitoring ▪ Snorkeling and diving ▪ Commercial fishing ▪ Recreational fishing	▪ Existing General Management Plan ▪ Hurricanes ▪ Vessel groundings ▪ Channel maintenance ▪ Scientific research and monitoring ▪ Snorkeling and diving ▪ Commercial fishing ▪ Recreational fishing	▪ New General Management Plan (in process) ▪ Hurricanes ▪ Vessel groundings ▪ Channel maintenance ▪ Scientific research and monitoring ▪ Snorkeling and diving ▪ Commercial fishing ▪ Recreational fishing

Affected Resource: Biological and Natural Resources

Temporal Boundary: establishment of BISC Nat'l. Monument to the lifespan of the new General Management Plan
Spatial Boundary: BISC area watershed & boundary, FL reef tract and extent of East FL seagrass community

Past Actions	Present Actions	Future Actions
▪ Existing General Management Plan ▪ Fire Management Plan ▪ Exotic Plant Management projects ▪ Coral Reef Initiatives (Fed & State) ▪ Hurricanes ▪ Vessel groundings ▪ Columbus Day Weekend Regatta ▪ Channel maintenance ▪ Scientific research and monitoring ▪ Recreational boating ▪ Snorkeling and diving ▪ Lobster sport season ▪ Recreational fishing ▪ Commercial fishing	▪ Existing General Management Plan ▪ Fire Management Plan ▪ Exotic Plant Management projects ▪ Biscayne Bay Partnership Initiative ▪ Coral Reef Initiatives (Fed & State) ▪ Hurricanes ▪ Vessel groundings ▪ Columbus Day Weekend Regatta ▪ Channel maintenance ▪ Scientific research and monitoring ▪ Recreational boating ▪ Snorkeling and diving ▪ Lobster sport season ▪ Recreational fishing ▪ Commercial fishing	▪ New General Management Plan (in process) ▪ Fishery Management Plan (in process) ▪ Fire Management Plan ▪ Exotic Plant Management Plan (in process) ▪ Homestead Buffer ▪ Florida Keys Nat'l. Marine Sanctuary-Fisheries Management Plan ▪ Biscayne Bay Partnership Initiative ▪ Manatee Plan ▪ Coral Reef Initiatives (Fed & State) ▪ Biscayne Bay Coastal Wetlands ▪ Homestead Comprehensive Plan ▪ Miami Urban Development ▪ 2 new FPL nuclear plants ▪ Wastewater reuse for coastal wetland rehydration ▪ Hurricanes ▪ Vessel groundings ▪ Columbus Day Weekend Regatta ▪ Channel maintenance ▪ Scientific research and monitoring ▪ Recreational boating ▪ Snorkeling and diving ▪ Lobster sport season ▪ Recreational fishing ▪ Commercial fishing

Affected Resource: Threatened and Endangered Species

Temporal Boundary: establishment of BISC Nat'l. Monument to the lifespan of the new General Management Plan
Spatial Boundary: migratory range of various Threatened and Endangered species that live within the park

Past Actions	Present Actions	Future Actions
▪ Existing General Management Plan ▪ Fire mgmt. plan ▪ Exotic Plant Mgmt. ▪ Coral Reef Initiatives (Fed & State) ▪ Hurricanes ▪ Habitat fragmentation due to development, agricultural use, etc. ▪ Fisheries Management Plan ▪ Columbus Day Weekend Regatta ▪ Scientific research and monitoring ▪ Recreational boating ▪ Snorkeling and diving ▪ Lobster sport season ▪ Recreational fishing ▪ Commercial fishing	▪ Existing General Management Plan ▪ Fire mgmt. plan ▪ Exotic Plant Mgmt. projects ▪ Coral Reef Initiatives (Fed & State) ▪ Lionfish Management Plan ▪ Hurricanes ▪ Fisheries Management Plan ▪ Columbus Day Weekend Regatta ▪ Scientific research and monitoring ▪ Recreational boating ▪ Snorkeling and diving ▪ Lobster sport season ▪ Recreational fishing ▪ Commercial fishing	▪ New General Management Plan (in process) ▪ Fishery Management Plan (in process) ▪ Fire mgmt. plan ▪ Exotic Plant Mgmt. Plan ▪ Florida Keys Nat'l. Marine Sanctuary-Fisheries Management Plan ▪ Manatee Protection Plan ▪ Coral Reef Initiatives (Fed & State) ▪ 2 new FPL nuclear plants ▪ Wastewater reuse for coastal wetland rehydration ▪ Hurricanes ▪ Columbus Day Weekend Regatta ▪ Scientific research and monitoring ▪ Recreational boating ▪ Snorkeling and diving ▪ Lobster sport season ▪ Recreational fishing ▪ Commercial fishing

Affected Resource: <u>Historic and Cultural Resources</u>

Temporal Boundary: establishment of BISC Nat'l. Monument to the lifespan of the new General Management Plan
Spatial Boundary: Park Boundary

Past Actions	Present Actions	Future Actions
▪ Existing General Management Plan ▪ Exotic Plant Mgmt. ▪ Stiltsville Plan ▪ Mooring Buoy Plan ▪ BISC Access Plan ▪ Historically black beach at the site of Homestead Bayfront Park ▪ Hurricanes ▪ Vessel groundings ▪ Scientific research and monitoring ▪ Snorkeling and diving ▪ Lobster sport season ▪ Recreational fishing ▪ Commercial fishing	▪ Existing General Management Plan ▪ Exotic Plant Mgmt. ▪ Stiltsville Plan ▪ Mooring Buoy Plan ▪ BISC Access Plan ▪ Maritime Heritage Trail ▪ Hurricanes ▪ Vessel groundings ▪ Scientific research and monitoring ▪ Snorkeling and diving ▪ Lobster sport season ▪ Recreational fishing ▪ Commercial fishing	▪ New General Management Plan (in process) ▪ Virginia Key Resource Study ▪ Miami Circle Resource Study ▪ Exotic Plant Mgmt. Plan ▪ Stiltsville Plan ▪ Mooring Buoy Plan ▪ BISC Access Plan ▪ Hurricanes ▪ Vessel groundings ▪ Scientific research and monitoring ▪ Snorkeling and diving ▪ Lobster sport season ▪ Recreational fishing ▪ Commercial fishing

Affected Resource: Water Quality

Temporal Boundary: establishment of BISC Nat'l. Monument to the lifespan of the new General Management Plan
Spatial Boundary: BISC watershed and influential current ranges

Past Actions	Present Actions	Future Actions
▪ Existing General Management Plan ▪ Canals ▪ Central and South Florida Project ▪ Hurricanes ▪ Columbus Day Weekend Regatta ▪ Channel maintenance ▪ Scientific research and monitoring ▪ Recreational boating ▪ Commercial fishing	▪ Existing General Management Plan ▪ Miami-Dade watershed study ▪ Comprehensive Everglades Restoration Project ▪ Biscayne Bay surface water management ▪ Lower East Coast Regional Water Supply Plan ▪ Hurricanes ▪ Columbus Day Weekend Regatta ▪ Channel maintenance ▪ Scientific research and monitoring ▪ Recreational boating ▪ Commercial fishing	▪ New General Management Plan (in process) ▪ Miami-Dade watershed study ▪ Comprehensive Everglades Restoration Project ▪ Biscayne Bay surface water management ▪ Lower East Coast Regional Water Supply Plan ▪ Airbase Cleanup ▪ Wetlands Plan ▪ 2 new FPL nuclear plants ▪ Wastewater reuse for coastal wetland rehydration ▪ Homestead Buffer ▪ Biscayne Bay Coastal Wetlands ▪ Hurricanes ▪ Columbus Day Weekend Regatta ▪ Channel maintenance ▪ Scientific research and monitoring ▪ Recreational boating ▪ Commercial fishing

Affected Resource: <u>Human Health and Safety</u>

Temporal Boundary: Present day to the lifetime of the new General Management Plan
Spatial Boundary: Park boundary & proposed Greenway extent

Past Actions	Present Actions	Future Actions
▪ Existing General Management Plan ▪ BISC access plan ▪ Mowry Canal Gate ▪ Hurricanes ▪ Columbus Day Weekend Regatta ▪ Channel maintenance ▪ Recreational boating ▪ Snorkeling and diving ▪ Lobster sport season ▪ Recreational fishing ▪ Commercial fishing	▪ Existing General Management Plan ▪ Fire mgmt. plan ▪ BISC access plan ▪ Hurricanes ▪ Columbus Day Weekend Regatta ▪ Channel maintenance ▪ Recreational boating ▪ Snorkeling and diving ▪ Lobster sport season ▪ Recreational fishing ▪ Commercial fishing	▪ New General Management Plan (in process) ▪ Fire mgmt. plan ▪ BISC access plan ▪ Biscayne trail ▪ Greenway ▪ 2 new FPL nuclear plants ▪ Wastewater reuse for coastal wetland rehydration ▪ Hurricanes ▪ Columbus Day Weekend Regatta ▪ Channel maintenance ▪ Recreational boating ▪ Snorkeling and diving ▪ Lobster sport season ▪ Recreational fishing ▪ Commercial fishing

Affected Resource: Recreation and Visitor Experience

Temporal Boundary: establishment of BISC Nat'l. Monument to the lifespan of the new General Management Plan
Spatial Boundary: within view or earshot of the park boundary

Past Actions	Present Actions	Future Actions
▪ Existing General Management Plan ▪ Exotic plant mgmt. ▪ Stiltsville Plan ▪ Mooring Buoy Plan ▪ South Dade Landfill ▪ Florida Power and Light ▪ Coral Reef Initiatives (Fed. & State) ▪ Integrated Pest Management ▪ Hurricanes ▪ Fisheries Management Plan ▪ Vessel groundings ▪ Columbus Day Weekend Regatta ▪ Recreational boating ▪ Snorkeling and diving ▪ Lobster sport season ▪ Recreational fishing ▪ Commercial fishing	▪ Existing General Management Plan ▪ Fire mgmt. plan ▪ Exotic plant mgmt. ▪ Stiltsville Plan ▪ Mooring Buoy Plan ▪ Biscayne Bay surface water mgmt. ▪ Coral Reef Initiatives (Fed. & State) ▪ Integrated Pest Management ▪ Turkey Point Expansion ▪ Hurricanes ▪ Fisheries Management Plan ▪ Vessel groundings ▪ Columbus Day Weekend Regatta ▪ Recreational boating ▪ Snorkeling and diving ▪ Lobster sport season ▪ Recreational fishing ▪ Commercial fishing	▪ New General Management Plan (in process) ▪ Fire mgmt. plan ▪ Exotic plant mgmt. ▪ Stiltsville Plan ▪ Mooring Buoy Plan ▪ Mowry Canal Gate ▪ DeLamour encroachment ▪ Biscayne Bay surface water mgmt. ▪ Coral Reef Initiatives (Fed. & State) ▪ Integrated Pest Management ▪ Homestead Comprehensive Plan ▪ Biscayne trail ▪ Miami urban development (including Burger King Property) ▪ 2 new FPL nuclear plants ▪ Hurricanes ▪ Fishery Management Plan ▪ Vessel groundings ▪ Columbus Day Weekend Regatta ▪ Recreational boating ▪ Snorkeling and diving ▪ Lobster sport season ▪ Recreational fishing ▪ Commercial fishing

Affected Resource: Park Management and Operations

Temporal Boundary: establishment of BISC Nat'l. Monument to the lifespan of the new General Management Plan
Spatial Boundary: park boundary

Past Actions	Present Actions	Future Actions
▪ Existing General Management Plan ▪ Fisheries Management Plan ▪ Stiltsville plan ▪ BISC access plan ▪ Integrated Pest Management and Exotic Plant Management ▪ Addition of 70 acres from Florida Power and Light ▪ Hurricanes ▪ Vessel groundings ▪ Columbus Day Weekend Regatta ▪ Scientific research and monitoring ▪ Recreational boating ▪ Snorkeling and diving ▪ Lobster sport season ▪ Recreational fishing ▪ Commercial fishing	▪ Existing General Management Plan ▪ Fisheries Management Plan ▪ Fire mgmt. plan ▪ Stiltsville plan ▪ Biscayne Bay Partnership Initiative ▪ Manatee protection plan ▪ BISC access plan ▪ Integrated Pest Management and Exotic Plant Management ▪ Hurricanes ▪ Vessel groundings ▪ Columbus Day Weekend Regatta ▪ Scientific research and monitoring ▪ Recreational boating ▪ Snorkeling and diving ▪ Lobster sport season ▪ Recreational fishing ▪ Commercial fishing	▪ New General Management Plan (in process) ▪ Miami Circle resource plan ▪ VA Key resource plan ▪ Fishery Management Plan ▪ Fire mgmt. plan ▪ Stiltsville plan ▪ Biscayne Bay Partnership Initiative ▪ Manatee protection plan ▪ Homestead Airbase disposal ▪ BISC access plan ▪ Integrated Pest Management and Exotic Plant Management ▪ Turkey Point expansion ▪ Greenway ▪ Hurricanes ▪ Vessel groundings ▪ Columbus Day Weekend Regatta ▪ Scientific research and monitoring ▪ Recreational boating ▪ Snorkeling and diving ▪ Lobster sport season ▪ Recreational fishing ▪ Commercial fishing

Appendix C
Standard Manatee Conditions for In-Water Work

Standard Manatee Conditions for In-Water Work 2005

The permittee shall comply with the following conditions intended to protect manatees from direct project effects:

a. All personnel associated with the project shall be instructed about the presence of manatees and manatee speed zones, and the need to avoid collisions with and injury to manatees. The permittee shall advise all construction personnel that there are civil and criminal penalties for harming, harassing, or killing manatees which are protected under the Marine Mammal Protection Act, the Endangered Species Act, and the Florida Manatee Sanctuary Act.

b. All vessels associated with the construction project shall operate at "Idle Speed/No Wake" at all times while in the immediate area and while in water where the draft of the vessel provides less than a 4-foot clearance from the bottom. All vessels will follow routes of deep water whenever possible.

c. Siltation or turbidity barriers shall be made of material in which manatees cannot become entangled, shall be properly secured, and shall be regularly monitored to avoid manatee entanglement or entrapment. Barriers must not impede manatee movement.

d. All on-site project personnel are responsible for observing water-related activities for the presence of manatee(s). All in-water operations, including vessels, must be shutdown if a manatee(s) comes within 50 feet of the operation. Activities will not resume until the manatee(s) has moved beyond the 50-foot radius of the project operation, or until 30 minutes elapses if the manatee(s) has not reappeared within 50 feet of the operation. Animals must not be herded away or harassed into leaving.

e. Any collision with or injury to a manatee shall be reported immediately to the Florida Fish and Wildlife Conservation Commission (FWC) Hotline at 1-888-404-FWCC. Collision and/or injury should also be reported to the U.S. Fish and Wildlife Service in Jacksonville (1-904-232-2580) for north Florida or Vero Beach (1-561-562-3909) for south Florida.

f. Temporary signs concerning manatees shall be posted prior to and during all in-water project activities. All signs are to be removed by the permittee upon completion of the project. Awareness signs that have already been approved for this use by the FWC must be used. One sign measuring at least 3 feet by 4 feet that reads *Caution: Manatee Area* must be posted. A second sign measuring at least 8 1/2 inches by 11 inches explaining the requirements for “Idle Speed/No Wake” and the shut down of in-water operations must be posted in a location prominently visible to all personnel engaged in water-related activities.

FWC Approved Manatee Educational Sign Suppliers

ASAP Signs & Designs
624-B Pinellas Street
Clearwater, FL 33756
Phone: (727) 443-4878
Fax: (727) 442-7573

Wilderness Graphics, Inc.
P. O. Box 1635
Tallahassee, FL 32302
Phone: (850) 224-6414
Fax: (850) 561-3943
www.wildernessgraphics.com

Cape Coral Signs & Designs
1311 Del Prado Boulevard
Cape Coral, FL 33990
Phone: (239) 772-9992
Fax: (239) 772-3848

Municipal Supply & Sign Co.
1095 Fifth Avenue, North
P. O. Box 1765
Naples, FL 33939-1765
Phone: (800) 329-5366 or
(239) 262-4639
Fax: (239) 262-4645
www.municipalsigns.com

Vital Signs
104615 Overseas Highway
Key Largo, FL 33037
Phone: (305) 451-5133
Fax: (305) 451-5163

Universal Signs & Accessories
2912 Orange Avenue
Ft. Pierce, FL 34947
Phone: (800) 432-0331 or
(772) 461-0665
Fax: (772) 461-0669

New City Signs
1739 28th Street N.
St. Petersburg, FL 33713
Phone: (727) 323-7897
Fax: (727) 323-1897
www.NewCitySigns.com

United Rentals Highway Technologies
309 Angle Road
Ft. Pierce, FL 34947
Phone: (772) 489-8772
or (800) 489-8758 (FL only)
Fax: (772) 489-8757

CAUTION: MANATEE HABITAT

All project vessels

IDLE SPEED / NO WAKE

When a manatee is within 50 feet of work all in-water activities must

SHUT DOWN

Report any collision or injury to:

1-888-404-FWCC (1-888-404-3922)

Florida Fish and Wildlife Conservation Commission

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Appendix D
Sea Turtle and Smalltooth Sawfish Construction Conditions

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
263 13th Avenue South
St. Petersburg, FL 33701

SEA TURTLE AND SMALLTOOTH SAWFISH CONSTRUCTION CONDITIONS

The permittee shall comply with the following protected species construction conditions:

a. The permittee shall instruct all personnel associated with the project of the potential presence of these species and the need to avoid collisions with sea turtles and smalltooth sawfish. All construction personnel are responsible for observing water-related activities for the presence of these species.

b. The permittee shall advise all construction personnel that there are civil and criminal penalties for harming, harassing, or killing sea turtles or smalltooth sawfish, which are protected under the Endangered Species Act of 1973.

c. Siltation barriers shall be made of material in which a sea turtle or smalltooth sawfish cannot become entangled, be properly secured, and be regularly monitored to avoid protected species entrapment. Barriers may not block sea turtle or smalltooth sawfish entry to or exit from designated critical habitat without prior agreement from the National Marine Fisheries Service's Protected Resources Division, St. Petersburg, Florida.

d. All vessels associated with the construction project shall operate at "no wake/idle" speeds at all times while in the construction area and while in water depths where the draft of the vessel provides less than a four-foot clearance from the bottom. All vessels will preferentially follow deep-water routes (e.g., marked channels) whenever possible.

e. If a sea turtle or smalltooth sawfish is seen within 100 yards of the active daily construction/dredging operation or vessel movement, all appropriate precautions shall be implemented to ensure its protection. These precautions shall include cessation of operation of any moving equipment closer than 50 feet of a sea turtle or smalltooth sawfish. Operation of any mechanical construction equipment shall cease immediately if a sea turtle or smalltooth sawfish is seen within a 50-ft radius of the equipment. Activities may not resume until the protected species has departed the project area of its own volition.

f. Any collision with and/or injury to a sea turtle or smalltooth sawfish shall be reported immediately to the National Marine Fisheries Service's Protected Resources Division (727-824-5312) and the local authorized sea turtle stranding/rescue organization.

g. Any special construction conditions, required of your specific project, outside these general conditions, if applicable, will be addressed in the primary consultation.

Revised: March 23, 2006
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Appendix E
Consultation Letters

United States Department of the Interior

IN REPLY REFER TO:

National Park Service
Biscayne National Park
9700 S. W. 328th Street
Homestead, Florida 33033-5634

L7615

March 19, 2009

Mr. Frederick Gaske
State Historic Preservation Officer and Division Director
Division of Historical Resources, Department of State
500 S. Bronough Street, Room 305
Tallahassee, FL 32399-0250

Subject: Section 106 Consultation, Restoration Plan/Programmatic Environmental Impact Statement for Coral Reef Restoration in Biscayne National Park

Dear Mr. Gaske:

In accordance with the National Environmental Policy Act (NEPA), the National Park Service (NPS) has started preparing a Restoration Plan/Programmatic Environmental Impact Statement (RP/PEIS) for Coral Reef Restoration at Biscayne National Park. This plan will be used to restore coral reefs following injuries caused by vessels or vessel operations.

The goal of coral reef restoration actions is to create a stable, self-sustaining reef environment of similar topography and surface complexity to that which existed prior to injury, such that natural recovery processes, enhanced through mitigation, if needed, will lead to a fully functioning coral reef community with near natural complexity, structure, and make-up of organisms.

The purpose of this RP/PEIS is to assist NPS during the planning of future coral reef restoration projects at Biscayne National Park by guiding the selection of preferred restoration actions. The RP/PEIS will enable NPS to more rapidly determine the type of actions needed after an injury, thereby assisting in timely implementation of necessary restoration, preventing injuries from expanding in size or increasing in severity, and expediting recovery to pre-incident conditions.

The RP/PEIS will analyze a range of methods for restoration of coral reefs injured by vessel groundings within Biscayne National Park. The final RP/PEIS will provide Biscayne National Park staff with a systematic approach to addressing coral reef injuries in the park.

We believe that the use of this RP/PEIS may have the potential to affect properties that may be eligible for inclusion in the National Register of Historic Places. We want to ensure that this plan provides appropriate protection for cultural resources which could be affected. Therefore, we are initiating consultation with your office in accordance with 36 CFR 800.

This letter also is to notify your office that we plan to use the environmental impact statement process to accomplish compliance for both Section 106, in accordance with the National Historic Preservation Act, as amended, and the National Environmental Policy Act (as described in 36 CFR 800.8 (a-c)), and to analyze potential effects from proposed implementation of this plan.

Please note at this stage in the process we are currently soliciting input from government agencies only. A 60-day public comment period on the draft RP/PEIS is now scheduled for summer 2009. During that period, non-governmental stakeholders, interested parties, and the general public, as well as government agencies will be invited to submit comments in writing and during public meetings. A Notice of Intent to prepare this RP/PEIS was published in the Federal Register on February 17, 2006 (Vol. 71, No. 33).

As soon as the draft RP/PEIS is available, we will send it to you for your review, comment, and concurrence that the Section 106 process has been completed. Additional supporting data, including results of archeological inventories and National Register nomination forms, as appropriate, will be included with the PEIS transmittal to your office.

We look forward to your participation on this project. We believe that it will result in better planning for cultural resources management and will help ensure that cultural resources are adequately considered during the preparation of the RP/PEIS.

If you have any questions or want additional information, please contact Amada Bourque, Biologist, Biscayne National Park, 9700 SW 328th Street, Homestead, FL 33033; 786-335-3626, amanda_bourque@nps.gov.

Sincerely,

Myrna J. Palfrey

for Mark Lewis
Superintendent

IN REPLY REFER TO:

United States Department of the Interior

National Park Service
Biscayne National Park
9700 S. W. 328th Street
Homestead, Florida 33033-5634

L7615

March 19, 2009

Mr. Willard S. Steele, THPO
Seminole Tribe of Florida
Ah-Tah-Thi-Tiki Museum
HC-61, Box 21-A
Clewiston, Florida 33440

Dear Mr. Steele:

The National Park Service (NPS) is now preparing a Restoration Plan/Programmatic Environmental Impact Statement (RP/PEIS) for Coral Reef Restoration at Biscayne National Park in accordance with the National Environmental Policy Act (NEPA). The purpose of this project is to facilitate restoration of coral reefs following injuries caused by vessels or vessel operations. More detail on this project is included in the Agency Scoping Notice enclosed.

NPS has recently sent a letter to Mr. Mitchell Cypress, President Seminole Tribe of Florida, inquiring about government-to-government consultation concerning this RP/PEIS.

The purpose of this correspondence is to provide some background information about this project and forward a courtesy copy of my letter to Mr. Cypress for your records. In sending these documents, we intend no deviation from government-to-government protocol, but provide them as potentially useful information for your office.

Sincerely,

Myrna D. Palfrey

for: Mark Lewis
Superintendent

Enclosures:
Agency Scoping Notice
Letter to Tribal Leader

TAKE PRIDE IN AMERICA

United States Department of the Interior

National Park Service
Biscayne National Park
9700 S. W. 328th Street
Homestead, Florida 33033-5634

IN REPLY REFER TO:

L7615

March 19, 2009

Mr. Mitchell Cypress, President
Seminole Tribe of Florida
6300 Stirling Road
Hollywood, FL 33024

Dear Mr. Cypress:

This letter is to inquire whether your tribe desires to undertake government-to-government consultation in conjunction with a Restoration Plan/Programmatic Environmental Impact Statement (RP/PEIS) for Coral Reef Restoration in Biscayne National Park

This RP/PEIS is now being prepared by the National Park Service (NPS) in accordance with the National Environmental Policy Act (NEPA). The purpose of this project is to facilitate restoration of coral reefs following injuries caused by vessels or vessel operations. More detail on this project is included in the Agency Scoping Notice enclosed.

In addition to government-to-government consultation, the Seminole Tribe of Florida is invited to participate during a 60-day public comment period now scheduled for summer 2009. During that period, non-governmental stakeholders, interested parties, and the general public, as well as tribes and government agencies will be invited to submit comments in writing and during public meetings. A Notice of Intent to prepare this RP/PEIS was published in the Federal Register on February 17, 2006 (Vol. 71, No. 33).

Please contact me at your earliest convenience if you wish to undertake government-to-government consultation concerning the RP/PEIS for Coral Reef Restoration in Biscayne National Park. Even if you do not wish to engage in formal consultation, I would welcome any thoughts and recommendations you might have about this project.

Thank you for your time and interest in this important project.

Sincerely,

Myrna J. Palfrey

for Mark Lewis, Superintendent

Enclosure

TAKE PRIDE IN AMERICA

United States Department of the Interior

National Park Service
Biscayne National Park
9700 S. W. 328th Street
Homestead, Florida 33033-5634

IN REPLY REFER TO:

L7615

March 19, 2009

Mr. Enoch Kelly Haney, Principal Chief
Seminole Nation of Oklahoma
P.O. Box 1498
Wewoka, Oklahoma 74884

Dear Mr. Haney:

This letter is to inquire whether your tribe desires to undertake government-to-government consultation in conjunction with a Restoration Plan/Programmatic Environmental Impact Statement (RP/PEIS) for Coral Reef Restoration in Biscayne National Park

This RP/PEIS is now being prepared by the National Park Service (NPS) in accordance with the National Environmental Policy Act (NEPA). The purpose of this project is to facilitate restoration of coral reefs following injuries caused by vessels or vessel operations. More detail on this project is included in the enclosed Agency Scoping Notice.

In addition to government-to-government consultation, the Seminole Nation of Oklahoma is invited to participate during a 60-day public comment period now scheduled for summer 2009. During that period, non-governmental stakeholders, interested parties, and the general public, as well as tribes and government agencies will be invited to submit comments in writing and during public meetings. A Notice of Intent to prepare this RP/PEIS was published in the Federal Register on February 17, 2006 (Vol. 71, No. 33).

Please contact me at your earliest convenience if you wish to undertake government-to-government consultation concerning the RP/PEIS for Coral Reef Restoration in Biscayne National Park. Even if you do not wish to engage in formal consultation, I would welcome any thoughts and recommendations you might have about this project.

Thank you for your time and interest in this important project.

Sincerely,

Myrna J. Palfrey

for: Mark Lewis, Superintendent

Enclosure

TAKE PRIDE IN AMERICA

United States Department of the Interior

National Park Service
Biscayne National Park
9700 S. W. 328th Street
Homestead, Florida 33033-5634

IN REPLY REFER TO:

L7615

March 19, 2009

Mr. Steve Terry, NAGPRA and Section 106 Representative
Miccosukee Tribe of Indians of Florida
Tamiami Station
P.O. Box 440021
Miami, FL 33144

Dear Mr. Terry:

The National Park Service (NPS) is now preparing a Restoration Plan/Programmatic Environmental Impact Statement (RP/PEIS) for Coral Reef Restoration at Biscayne National Park in accordance with the National Environmental Policy Act (NEPA). The purpose of this project is to facilitate restoration of coral reefs following injuries caused by vessels or vessel operations. More detail on this project is included in the Agency Scoping Notice enclosed.

NPS has recently sent a letter to Mr. Billy Cypress, Chairman Miccosukee Tribe of Indians of Florida, inquiring about government-to-government consultation concerning this RP/PEIS.

The purpose of this correspondence is to provide some background information about this project and forward a courtesy copy of my letter to Mr. Cypress for your records. In sending these documents, we intend no deviation from government-to-government protocol, but provide them as potentially useful information for your office.

Sincerely,

Myra J. Palfrey

for: Mark Lewis
Superintendent

Enclosures:
Agency Scoping Notice
Letter to Tribal Leader

TAKE PRIDE IN AMERICA

IN REPLY REFER TO:

United States Department of the Interior

National Park Service
Biscayne National Park
9700 S. W. 328th Street
Homestead, Florida 33033-5634

L7615

March 19, 2009

Mr. Fred Dayhoff, NAGPRA and Section 106 Representative
Miccosukee Tribe of Indians of Florida
HC61 S.R. 68
Ochopee, FL 34141

Dear Mr. Dayoff:

The National Park Service (NPS) is now preparing a Restoration Plan/Programmatic Environmental Impact Statement (RP/PEIS) for Coral Reef Restoration at Biscayne National Park in accordance with the National Environmental Policy Act (NEPA). The purpose of this project is to facilitate restoration of coral reefs following injuries caused by vessels or vessel operations. More detail on this project is included in the Agency Scoping Notice enclosed.

NPS has recently sent a letter to Mr. Billy Cypress, Chairman Miccosukee Tribe of Indians of Florida, inquiring about government-to-government consultation concerning this RP/PEIS.

The purpose of this correspondence is to provide some background information about this project and forward a courtesy copy of my letter to Mr. Cypress for your records. In sending these documents, we intend no deviation from government-to-government protocol, but provide them as potentially useful information for your office.

Sincerely,

Myrna D. Palfrey

for: Mark Lewis
Superintendent

Enclosures:
Agency Scoping Notice
Letter to Tribal Leader

TAKE PRIDE IN AMERICA

United States Department of the Interior

National Park Service
Biscayne National Park
9700 S. W. 328th Street
Homestead, Florida 33033-5634

IN REPLY REFER TO:

L7615

March 19, 2009

Chairman Billy Cypress
Miccosukee Tribe of Indians of Florida
P.O. Box 440021 Tamiami Station
Miami, FL 33144

Dear Mr. Cypress:

This letter is to inquire whether your tribe desires to undertake government-to-government consultation in conjunction with a Restoration Plan/Programmatic Environmental Impact Statement (RP/PEIS) for Coral Reef Restoration in Biscayne National Park

This RP/PEIS is now being prepared by the National Park Service (NPS) in accordance with the National Environmental Policy Act (NEPA). The purpose of this project is to facilitate restoration of coral reefs following injuries caused by vessels or vessel operations. More detail on this project is included in the Agency Scoping Statement enclosed.

In addition to government-to-government consultation, the Miccosukee Tribe of Indians of Florida is invited to participate during a 60-day public comment period now scheduled for summer 2009. During that period, non-governmental stakeholders, interested parties, and the general public, as well as tribes and government agencies will be invited to submit comments in writing and during public meetings. A Notice of Intent to prepare this RP/PEIS was published in the Federal Register on February 17, 2006 (Vol. 71, No. 33).

Please contact me at your earliest convenience if you wish to undertake government-to-government consultation concerning the RP/PEIS for Coral Reef Restoration in Biscayne National Park. Even if you do not wish to engage in formal consultation, I would welcome any thoughts and recommendations you might have about this project.

Thank you for your time and interest in this important project.

Sincerely,

Myrna D. Palfrey

for: Mark Lewis
Superintendent

Enclosure

TAKE PRIDE IN AMERICA

United States Department of the Interior

National Park Service
Biscayne National Park
9700 S. W. 328th Street
Homestead, Florida 33033-5634

IN REPLY REFER TO:

L7615

March 19, 2009

Ms. Natalie Deere
Historic Preservation Officer
Seminole Nation of Oklahoma
P.O. Box 1498
Wewoka, Oklahoma 74884

Dear Ms. Deere:

The National Park Service (NPS) is now preparing a Restoration Plan/Programmatic Environmental Impact Statement (RP/PEIS) for Coral Reef Restoration at Biscayne National Park in accordance with the National Environmental Policy Act (NEPA). The purpose of this project is to facilitate restoration of coral reefs following injuries caused by vessels or vessel operations. More detail on this project is included in the enclosed Agency Scoping Notice.

NPS has recently sent a letter to Mr. Enoch Kelly Haney, Principal Chief Seminole Nation of Oklahoma, inquiring about government-to-government consultation concerning this RP/PEIS.

The purpose of this correspondence is to provide some background information about this project and forward a courtesy copy of my letter to Mr. Haney for your records. In sending these documents, we intend no deviation from government-to-government protocol, but provide them as potentially useful information for your office.

Sincerely,

Myrna D. Palfrey

Mark Lewis
Superintendent

Enclosures:
Agency Scoping Notice
Letter to Tribal Leader

TAKE PRIDE IN AMERICA

United States Department of the Interior

National Park Service
Biscayne National Park
9700 S. W. 328th Street
Homestead, Florida 33033-5634

IN REPLY REFER TO:

L7615

March 19, 2009

Ms. Lauren Milligan
Florida State Clearinghouse Coordinator
Florida Department of Environmental Protection
3900 Commonwealth Blvd., Mail Station 47
Tallahassee, FL 32399-3300

Subject: Advance Notification, Restoration Plan/Programmatic Environmental Impact Statement for Coral Reef Restoration in Biscayne National Park

Dear Ms. Milligan:

In accordance with the National Environmental Policy Act (NEPA), the National Park Service (NPS) has started preparing a Restoration Plan/Programmatic Environmental Impact Statement (RP/PEIS) for Coral Reef Restoration at Biscayne National Park. This plan will be used to restore coral reefs following injuries caused by vessels or vessel operations.

The enclosed Scoping Notice is forwarded to your office for processing through appropriate State agencies. Although more specific comments on the RP/PEIS will be solicited during the 60-day public comment period now scheduled for summer 2009, we request that permitting and permit reviewing agencies review the attached information and furnish us with whatever general comments they consider pertinent at this time.

We are looking forward to receiving your comments on this project, which should be addressed to Amada Bourque, Biologist, Biscayne National Park, 9700 SW 328th Street, Homestead, FL 33033; 786-335-3626, amanda_bourque@nps.gov.

Your expeditious handling of this notice will be appreciated. To help facilitate review of this project, distribution of this notice is also being made directly to the State Historic Preservation Officer and Division Director (Mr. Frederick Gaske) and appropriate officials of the Miccosukee and Seminole tribes.

Sincerely,
Myxra D. Palfrey
Mark Lewis
Superintendent

Enclosure

TAKE PRIDE IN AMERICA

IN REPLY REFER TO:

United States Department of the Interior

National Park Service
Biscayne National Park
9700 S. W. 328th Street
Homestead, Florida 33033-5634

L7615

March 19, 2009

Mr. Miles Croom
Assistant Regional Administrator
National Marine Fisheries Service
Habitat Conservation Division
263-13th Avenue South
St. Petersburg, FL 33701

Subject: Consultation, Restoration Plan/Programmatic Environmental Impact Statement for Coral Reef Restoration in Biscayne National Park

Dear Mr. Croom:

In accordance with the National Environmental Policy Act (NEPA), the National Park Service (NPS) has started preparing a Restoration Plan/Programmatic Environmental Impact Statement (RP/PEIS) for Coral Reef Restoration at Biscayne National Park. This plan will be used to restore coral reefs following injuries caused by vessels or vessel operations.

The goal of coral reef restoration actions is to create a stable, self-sustaining reef environment of similar topography and surface complexity to that which existed prior to injury, such that natural recovery processes, enhanced through mitigation, if needed, will lead to a fully functioning coral reef community with near natural complexity, structure, and make-up of organisms.

The goal of this RP/PEIS is to assist NPS during the planning of future coral reef restoration projects at Biscayne National Park by guiding the selection of preferred restoration actions. The RP/PEIS will enable NPS to more rapidly determine the type of actions needed after an injury, thereby assisting in timely implementation of necessary restoration, preventing injuries from expanding in size or increasing in severity, and expediting recovery to pre-incident conditions.

The RP/PEIS will analyze a range of methods for restoration of coral reefs injured by vessel groundings within Biscayne National Park. The final RP/PEIS will provide Biscayne National Park staff with a systematic approach to addressing coral reef injuries in the park.

We believe that the use of this RP/PEIS may have the potential to affect essential fish habitats. Therefore, in keeping with the requirements of the Magnuson-Stevens Act and NPS policy, we invite your input and participation in the planning process. Additionally, we will send you a copy of the draft RP/PEIS for your review and comment as soon it is available.

Please note at this stage in the process we are currently soliciting input from government agencies only. A 60-day public comment period is now scheduled for summer 2009. During that period, non-governmental stakeholders, interested parties, and the general public, as well as government agencies

will be invited to submit comments in writing and during public meetings. A Notice of Intent to prepare this RP/PEIS was published in the Federal Register on February 17, 2006 (Vol. 71, No. 33).

We look forward to your participation in this project. If you have any questions or desire additional information, please contact Amada Bourque, Biologist, Biscayne National Park, 9700 SW 328th Street, Homestead, FL 33033; 786-335-3626, amanda_bourque@nps.gov.

Sincerely,

Myra D. Palfrey

for Mark Lewis
Superintendent

IN REPLY REFER TO:

United States Department of the Interior

National Park Service
Biscayne National Park
9700 S. W. 328th Street
Homestead, Florida 33033-5634

L7615

March 19, 2009

Mr. David Bernhart
Assistant Regional Administrator
National Marine Fisheries Service
Protected Resources Division
263-13th Avenue South
St. Petersburg, FL 33701

Subject: Section 7 Consultation, Restoration Plan/Programmatic Environmental Impact Statement for Coral Reef Restoration in Biscayne National Park

Dear Mr. Bernhart:

In accordance with the National Environmental Policy Act (NEPA), the National Park Service (NPS) has started preparing a Restoration Plan/Programmatic Environmental Impact Statement (RP/PEIS) for Coral Reef Restoration in Biscayne National Park. This plan will be used to restore coral reefs following injuries caused by vessels or vessel operations.

The goal of coral reef restoration actions is to create a stable, self-sustaining reef environment of similar topography and surface complexity to that which existed prior to injury, such that natural recovery processes, enhanced through mitigation, if needed, will lead to a fully functioning coral reef community with near natural complexity, structure, and make-up of organisms.

The goal of this RP/PEIS is to assist NPS during the planning of future coral reef restoration projects in Biscayne National Park by guiding the selection of preferred restoration actions. The RP/PEIS will enable NPS to more rapidly determine the type of actions needed after an injury, thereby assisting in timely implementation of necessary restoration, preventing injuries from expanding in size or increasing in severity, and expediting recovery to pre-incident conditions.

The RP/PEIS will analyze a range of methods for restoration of coral reefs injured by vessel groundings within Biscayne National Park. The final RP/PEIS will provide Biscayne National Park staff with a systematic approach to addressing coral reef injuries in the park.

In accordance with Section 7 of the Endangered Species Act, we wish to begin informal consultation with your agency so that we may fully evaluate the potential effects of coral reef restoration on federally listed species. We welcome your input on any aspect of the project. However, we are specifically requesting information about the presence of listed threatened and endangered species in the vicinity of Biscayne National Park, along with any pertinent critical habitat designations.

Please note at this stage in the process we are currently soliciting input from government agencies only. A 60-day public comment period on the draft RP/PEIS is now scheduled for summer 2009.

During that period, non-governmental stakeholders, interested parties, and the general public, as well as government agencies will be invited to submit comments in writing and during public meetings. A Notice of Intent to prepare this RP/PEIS was published in the Federal Register on February 17, 2006 (Vol. 71, No. 33).

We look forward to your participation in this project. If you have any questions or desire additional information, please contact Amada Bourque, Biologist, Biscayne National Park, 9700 SW 328th Street, Homestead, FL 33033; 786-335-3626, amanda_bourque@nps.gov.

Sincerely,

Myrna D. Palfrey

for: Mark Lewis
Superintendent

United States Department of the Interior

National Park Service
Biscayne National Park
9700 S. W. 328th Street
Homestead, Florida 33033-5634

IN REPLY REFER TO:

L7615

March 19, 2009

Mr. Paul Souza
Field Supervisor, South Florida Field Office
U.S. Fish and Wildlife Service
1339-20th Street
Vero Beach, FL 32960

Subject: Section 7 Consultation, Restoration Plan/Programmatic Environmental Impact Statement for Coral Reef Restoration in Biscayne National Park

Dear Mr. Souza:

In accordance with the National Environmental Policy Act (NEPA), the National Park Service (NPS) has started preparing a Restoration Plan/Programmatic Environmental Impact Statement (RP/PEIS) for Coral Reef Restoration in Biscayne National Park. This plan will be used to restore coral reefs following injuries caused by vessels or vessel operations.

The goal of coral reef restoration actions is to create a stable, self-sustaining reef environment of similar topography and surface complexity to that which existed prior to injury, such that natural recovery processes, enhanced through mitigation, if needed, will lead to a fully functioning coral reef community with near natural complexity, structure, and make-up of organisms.

The goal of this RP/PEIS is to assist NPS during the planning of future coral reef restoration projects at Biscayne National Park by guiding the selection of preferred restoration actions. The RP/PEIS will enable NPS to more rapidly determine the type of actions needed after an injury, thereby assisting in timely implementation of necessary restoration, preventing injuries from expanding in size or increasing in severity, and expediting recovery to pre-incident conditions.

The RP/PEIS will analyze a range of methods for restoration of coral reefs injured by vessel groundings within Biscayne National Park. The final RP/PEIS will provide Biscayne National Park staff with a systematic approach to addressing coral reef injuries in the park.

In accordance with Section 7 of the Endangered Species Act, we wish to begin informal consultation with your agency so that we may fully evaluate the potential effects of coral reef restoration on federally listed species. We welcome your input on any aspect of the project. However, we are specifically requesting information about the presence of listed threatened and endangered species in the vicinity of Biscayne National Park, along with any pertinent critical habitat designations.

TAKE PRIDE IN AMERICA

Please note at this stage in the process we are currently soliciting input from government agencies only. A 60-day public comment period on the draft RP/PEIS is now scheduled for summer 2009. During that period, non-governmental stakeholders, interested parties, and the general public, as well as government agencies will be invited to submit comments in writing and during public meetings. A

Notice of Intent to prepare this RP/PEIS was published in the Federal Register on February 17, 2006 (Vol. 71, No. 33).

We look forward to your participation in this project. If you have any questions or desire additional information, please contact Amada Bourque, Biologist, Biscayne National Park, 9700 SW 328th Street, Homestead, FL 33033; 786-335-3626, amanda_bourque@nps.gov.

Sincerely,

Myra J. Palfrey

for: Mark Lewis
Superintendent

IN REPLY REFER TO:

United States Department of the Interior

National Park Service
Biscayne National Park
9700 S. W. 328th Street
Homestead, Florida 33033-5634

L7615

March 19, 2009

Ms. Kelly Yasaitis Fannizo
Advisory Council on Historic Preservation
Old Post Office Building
1100 Pennsylvania Avenue, NW, Suite 809
Washington, DC 20004

Subject: Section 106 Consultation, Restoration Plan/Programmatic Environmental Impact Statement for Coral Reef Restoration in Biscayne National Park

Dear Ms. Fannizo:

In accordance with the National Environmental Policy Act (NEPA), the National Park Service (NPS) has started preparing a Restoration Plan/Programmatic Environmental Impact Statement (RP/PEIS) for Coral Reef Restoration in Biscayne National Park. This plan will be used to restore coral reefs following injuries caused by vessels or vessel operations.

The goal of coral reef restoration actions is to create a stable, self-sustaining reef environment of similar topography and surface complexity to that which existed prior to injury, such that natural recovery processes, enhanced through mitigation, if needed, will lead to a fully functioning coral reef community with near natural complexity, structure, and make-up of organisms.

The purpose of this RP/PEIS is to assist NPS during the planning of future coral reef restoration projects at Biscayne National Park by guiding the selection of preferred restoration actions. The RP/PEIS will enable NPS to more rapidly determine the type of actions needed after an injury, thereby assisting in timely implementation of necessary restoration, preventing injuries from expanding in size or increasing in severity, and expediting recovery to pre-incident conditions.

The RP/PEIS will analyze a range of methods for restoration of coral reefs injured by vessel groundings within Biscayne National Park. The final RP/PEIS will provide Biscayne National Park staff with a systematic approach to addressing coral reef injuries in the park.

We believe that the use of this RP/PEIS may have the potential to affect properties that may be eligible for inclusion in the National Register of Historic Places. We want to ensure that this plan provides appropriate protection for cultural resources which could be affected. Therefore, we are initiating consultation with your office in accordance with 36 CFR 800.

TAKE PRIDE IN AMERICA

This letter also is to notify your office that we plan to use the environmental impact statement process to accomplish compliance for both Section 106, in accordance with the National Historic Preservation Act, as amended, and the National Environmental Policy Act (as described in 36 CFR 800.8 (a-c)), and to analyze potential effects from proposed implementation of this plan.

Please note at this stage in the process we are currently soliciting input from government agencies only. A 60-day public comment period on the draft RP/PEIS is now scheduled for summer 2009. During that period, non-governmental stakeholders, interested parties, and the general public, as well as government agencies will be invited to submit comments in writing and during public meetings. A Notice of Intent to prepare this RP/PEIS was published in the Federal Register on February 17, 2006 (Vol. 71, No. 33).

As soon as the draft RP/PEIS is completed, we will send it to you for your review, comment, and concurrence that the Section 106 process has been completed. Additional supporting data, including results of archeological inventories and National Register nomination forms, as appropriate, will be included with the PEIS transmittal to your office.

We look forward to your participation in the planning process. We believe that it will result in better planning for cultural resources management and will help ensure that cultural resources are adequately considered during the preparation of the RP/PEIS.

If you have any questions or desire additional information, please contact Amada Bourque, Biologist, Biscayne National Park, 9700 SW 328th Street, Homestead, FL 33033; 786-335-3626, amanda_bourque@nps.gov. As required by 36 CFR 800, the State Historic Preservation Office has been notified regarding inclusion of Section 106 compliance within the RP/PEIS.

Sincerely,

Myrna D. Palfrey

for: Mark Lewis
Superintendent

Appendix F
Glossary

Glossary

Blowhole: Formed from the concentrated force of propeller wash, either from the grounded vessel attempting to power off the reef or the propeller wash of the salvage vessel pulling the grounded vessel off the reef.

Coral Reef: A calcareous mass formed by the deposition of coral skeletons over a long period of time and are the most biologically diverse ecosystems in the world.

Donor Sites: Surrounding areas with similar site characteristics (e.g., physical and chemical attributes) to those at the transplant site. Donor sites are pre-determined, established areas identified by BISC Resource Managers.

Endangered Species Act: Enacted in 1973, this Act directs federal and state agencies to protect and conserve listed endangered and threatened animals and plants. The habitat of endangered and threatened species takes on special importance because of these laws, and conservation of these species requires careful management.

Epibenthic Biota: Sessile plants and animals living on the surface of the ocean bottom.

Grounding: The result of a vessel coming into contact with the bottom of the bay. During grounding events, corals can be damaged by the force of the vessel engines and other damage may occur.

Hard-bottom: Low-relief, solid carbonate rock that supports flora and fauna such as soft corals, sponges, and numerous other invertebrates.

Injury Assessment: An assessment that documents injured resources, quantifies the areal extent and degree of injury and describes the adjacent unaffected reference areas. It is used to develop a claim settlement report and costs of agency response, prescribed restoration (primary and compensatory), primary and compensatory monitoring, and administrative/legal costs.

Restoration Plan/Programmatic Environmental Impact Statement: A document that describes the methods and restoration techniques BISC has assembled to determine and compensate for natural resource injuries to coral reef resources caused by vessel groundings within BISC. It provides a set of potential actions available to BISC to restore injured coral reef resources, evaluates the environmental impacts of the alternatives, including the "toolbox" of restoration actions most compatible with the Park's mission of preserving and protecting coral reef ecosystems.

Prop Wash: Occurs when the concentrated force of the wash from a vessel's propeller, either from the grounded vessel attempting to power off the reef or the from the salvage vessel pulling the grounded vessel free. This leaves blowholes.

Responsible Party: An entity (persons, corporation, etc.,) that caused injury to Park resources.

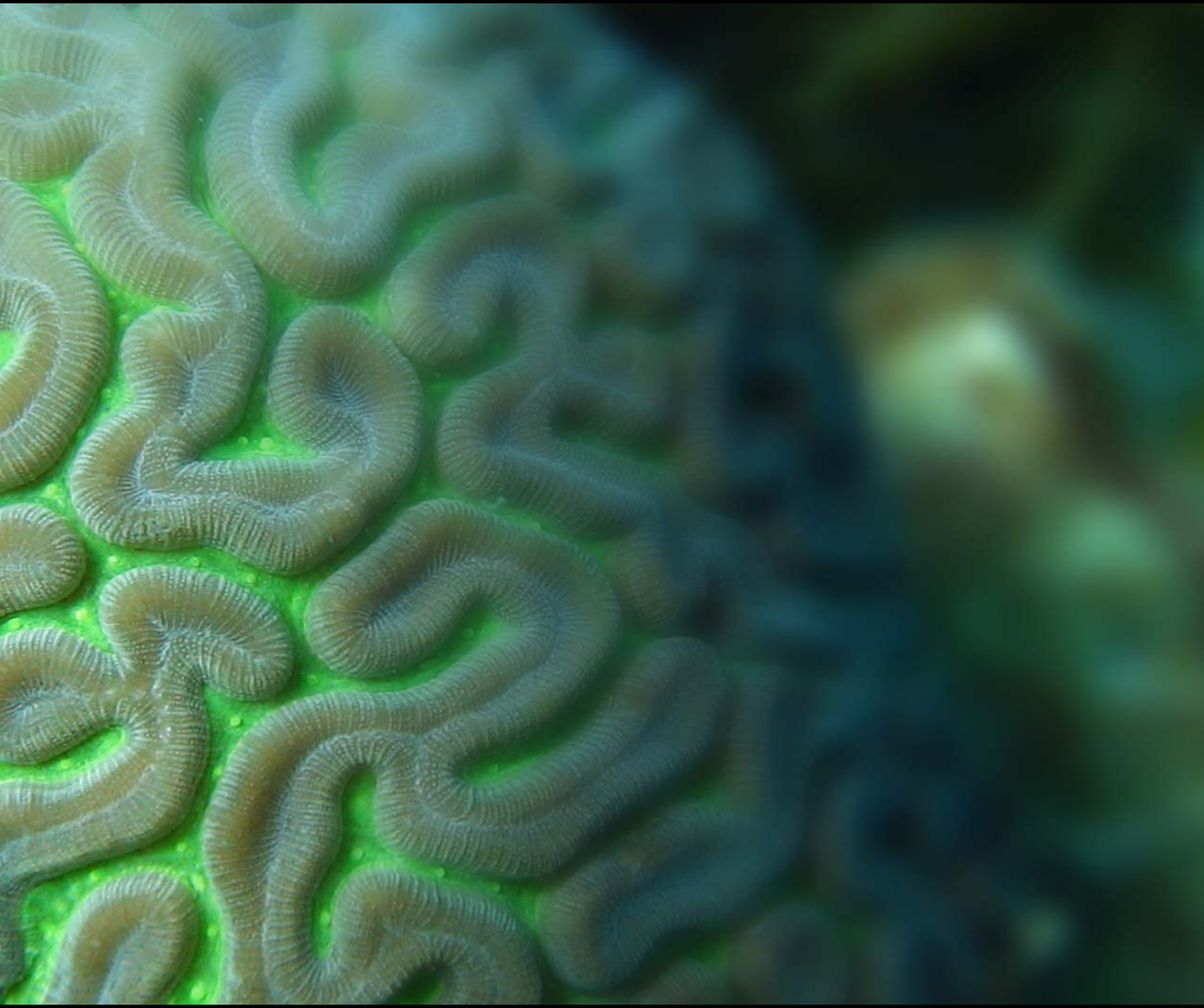
Restoration Actions: Methods or measures conducted to create a stable, self-sustaining environment of similar topography and reef sediment composition to that which existed prior to injury, such that natural recovery processes, enhanced through mitigation if needed, will lead to a fully functioning coral reef community with near natural complexity, structure and makeup of organisms.

Site-specific Restoration Plan: A document that evaluates alternatives and methods presented in the Programmatic RP for each particular injury site and outlines an appropriate course of restoration action(s).

Tool-box: A list of methods provided in the Programmatic Restoration Plan that are evaluated and selected for an injury to a particular site when developing a Site-specific Restoration Plan.

As the nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering wise use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historic places, and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people. The department also promotes the goals of the Take Pride in America campaign by encouraging stewardship and citizen responsibility for the public lands and promoting citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

United States Department of the Interior • National Park Service



Biscayne National Park
Coral Reef Restoration Plan

Draft Programmatic Environmental Impact Statement