

SECTION 9
ENVIRONMENTAL EFFECTS

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SECTION 9 ENVIRONMENTAL EFFECTS

9.1 SECTION DEFINITION

This section includes a brief summary of the expected beneficial and adverse physical, ecological, and socio-economic effects if the agency's recommended alternative 3D ("with project") were implemented on resources within the Picayune Strand (Southern Golden Gate Estates - SGGE) project area. It does not attempt to provide comprehensive coverage of all effects on all resources. The following assessments are based on a comparison between the recommended alternative and the "without project" (no action) alternative. **An evaluation and comparison of all the alternatives can be found in Section 6 of this report.**

9.2 GENERAL ENVIRONMENTAL EFFECTS

The primary purpose of this project is to restore the ecosystem within the SGGE Project Area and adjacent affected public lands to conditions as close to the pre-drainage condition as possible. This goal would be accomplished by partially reversing the effects of drainage and compartmentalization, where surface water sheet flow has been intercepted by 279 miles of roads and captured in 48 miles of canal. Alternative 3D would build three pump stations, place plugs in a total of 42 miles of the four canals and grade down or remove 227 miles of roads. The resulting flow patterns would be more natural. It is expected that plant communities will show succession to cover patterns more like historic vegetation cover. These restored communities would provide improved habitat for native fish and wildlife. Additionally, removal of roads and permanent residents will decrease the effects of past human disturbance for sensitive species. Present day freshwater surge discharges through the Faka Union Canal system would be replaced by more natural slow shallow sheetflow across a broad front. Drainage toward all of the estuaries south of the project area would follow a pattern resembling historic drainage patterns, rather than occurring, as now, largely as a single heavy discharge into the Faka Union estuary.

The 55,247-acre SGGE Project Area is extremely important regionally. The SGGE lands have been a "hole" in the center of a complex of surrounding state and federal nature preserves and wildlife areas. Completion of the project and management of the lands as a State Forest, as proposed, will turn all of these reserves into a contiguous block of land (Figure 1-1). This area would be large enough to provide viable habitat for wide ranging species such as the endangered Florida panther and the state listed black bear. Completion of the SGGE ecosystem restoration, and proper management of the resulting Picayune

Strand State Forest, is central to the connectivity of these existing preserved areas. Besides providing an extensive cohesive landscape for wildlife, the restoration area would provide an infiltration area to benefit groundwater aquifers. Pine flatwood and hardwood hammock plant communities are fast disappearing from the South Florida landscape. Because the relatively dry upland nature of these communities, they are the first acreages to be developed into subdivisions. As part of alternative 3D, an area in the northwest corner of the project would intentionally be reserved for restoration of these upland communities. Planned hydrologic changes in Alternative 3D would reestablish a more natural ground water table that would assist the Florida Division of Forestry (DOF) to manage this area for high quality upland habitat.

9.2.1 Infrastructure

Alternative 3D would lower to ambient grade and abandon approximately 227 miles of the 279 total miles of roadway in the SGGE Project Area. Of the remaining 52 miles of roads, 41 would remain at existing grade or be lowered to ambient grade and maintained for use during the dry season by Division of Forestry personnel. The remaining 11 miles of road would be elevated for all-season access to the pump stations and access to the private lands residential area in Belle Meade. Three pump stations located on the Merritt (800 cfs), Faka Union (2,630 cfs), and Miller (1,250 cfs) would be constructed to replace the capacity of the plugged SGGE canals draining the private lands in Northern Golden Gate Estates (NGGE). Spreader canals would be constructed for each pump station to facilitate moving the water onto the land to restore a more natural pre-drainage sheet flow. Most of the culverts, bridges, and weirs would be removed or abandoned. Private land in holdings in the adjacent South Belle Meade part of the Picayune Strand State Forest would be protected by five separate levees. A connector culvert under Everglades Boulevard would be constructed to tie together drainage canals along Interstate 75.

The removal of existing and the construction of the new infrastructure for alternative 3D would require an estimated excavation of 4.7 million cubic yards of material, 2.3 million cubic yards of fill, and the clearing of 5,104 acres.

Alternative 3D would not affect state highways. Pump stations have been designed to operate to maintain drainage in NGGE under average conditions and storm events. I-75 is located along the southern edge of NGGE, and thus would also be protected from changes in groundwater and surface water. State Road 29 is located approximately 7 miles east of SGGE, well beyond any hydrology changes resulting from Alternative 3D. Nine additional culverts would be constructed under U.S. 41. These culverts, in combination with existing culverts and bridges, would prevent any hydrological impacts to U.S. 41 that might occur as a result of the project. However, if any potential impacts to

U.S. 41 from the project were discovered during the detailed design phase of this project, the impacts would be mitigated. The Corps and SFWMD will be working closely with the Florida Department of Transportation (FDOT) during detailed design to ensure that the correct profile information on U.S. 41 is used in the design modeling to ensure that public safety is not compromised. Any necessary road improvements caused by lack of maintenance will be segregated from project costs and negotiated separately with FDOT. At this time, our engineering does not indicate any additional impacts to U.S. 41 related to this project.

9.3 PLANT COMMUNITIES

The long-term goal of Alternative 3D is to return the hydrology of the SGGE Project Area downstream of the pumps and spreader canals to a condition comparable to that which existed prior to drainage and development. This alternative would also produce a beneficial ground water effect on the upland plant communities that are upstream of the pumps. The combination of a restored hydrology, a more natural fire regime, and an appropriate exotic vegetation control program can be expected to reestablish the pre-drainage character of SGGE plant communities. This would mean that plant communities that have developed under the existing hydrologic and fire regimes, but were not present prior to drainage, would be greatly reduced or eliminated during the decades following restoration, and would be replaced by communities more similar to those present prior to drainage. In addition, extant plant and animal communities that also existed in SGGE prior to construction of the canal system, but have become established in new areas as a result of drainage, would likely return to their original distribution.

The time frame for restoration of the original communities would vary, but tree-dominated cover types do not change rapidly. The time to full community restoration would depend on the type of community to be reestablished and the degree to which they have been disturbed, particularly by severe fires. Loss of older forest trees would require at least many decades to replace, during which time the sites would be dominated by earlier successional communities, most likely willow in the cypress swamps and a mixture of wax myrtle and herbaceous species in the pine flatwoods. During this successional period it would be important to monitor for and eradicate exotic/invasive plant species while their populations are small. The proposed monitoring plan includes periodic surveys of vegetation, providing an opportunity for adaptive assessment and management actions to control the process.

The significantly reduced duration of flooding in SGGE under the current drainage regime has likely had dramatic impacts on tropical vegetation due to the loss of freeze protection from the moderating influence of standing water

when winter cold fronts pass through the area. Restoring the natural hydrology by implementing Alternative 3D would reestablish conditions where many of these tropical communities could reestablish.

9.4 FIRE

Under Alternative 3D prescribed burns would be less intense due to the restored water table, resulting in lower tree mortality. With purchase of all residential tracts, prescribed burns may be conducted when conditions are ideal over large areas. The seasonal window for performing prescribed burns would be greatly extended. Longer hydroperiods will permit coverage of more area each year. There would be increased opportunity for doing more lightning season burns, which would mimic the historic fire regime. Removal of most roads would reduce human caused wildfires. In addition to blocking sheet flow, roads also act to check the natural spread of low intensity prescribed fire. Road removal would allow a more efficient and beneficial prescribed fire regime. One of the functions of the at grade roads that would be maintained in the project area would be management of prescribed fire.

9.5 FISH AND WILDLIFE RESOURCES

The presence and health of wildlife populations are a function of the habitats available to support them. Given the dramatic changes in road access, hydrology, plant communities, and fire regimes in SGGE over the past thirty years, the current wildlife populations have undoubtedly changed from those present historically. Alternative 3D would enhance fish and wildlife resources by restoring or reestablishing: natural hydroperiods, pre-drainage sheet flow, freshwater flowways to downstream estuaries, native plant distribution and composition, surface aquifer recharge, and the area's natural fire regime. The ecological condition of SGGE affects wildlife in the immediate Project Area as well as significant regional fish and wildlife resources within the region, due to its central position in a complex of nature reserves, forests and parks. Restoring habitat values in the project area is extremely important to ecosystem connectivity (Figure 1-1). These other reserves include the adjacent Florida Panther National Wildlife Refuge, Fakahatchee Strand State Preserve, Collier Seminole State Park, South Belle Meade portion of the Picayune Strand State Forest, and the Ten Thousand Islands Region, including the Ten Thousand Islands National Wildlife Refuge, Rookery Bay National Estuarine Research Reserve, and Everglades National Park.

Implementing alternative 3D would return the landscape to a more natural hydrology, which has obvious implications for wetland dependent wildlife species. Populations of amphibians, otters, wading birds, forage fish and aquatic

invertebrates would likely increase. Although some of these elements, especially wading birds, would only utilize the area during the rainy season, restoring this habitat can be expected to benefit species that have suffered an overall loss of foraging habitat during the recent historic period, such as the endangered wood stork. It would also benefit terrestrial wildlife through the reestablishment of high quality mesic and hydric pine flatwood / hammock habitats that would have most roads removed, limited human access, and management areas for upland species. In the September 2004 Coordination Act Report (CAR) the FWS states “The Service supports Alternative 3D because it would provide greater wetland restoration benefits to the SGGE project site, Faka Union estuary, and adjacent coastal bays, according to hydrologic modeling results provided by the Corps/SFWMD and our evaluations (than other alternatives evaluated). However, this support is qualified and dependent upon the development of future operational plans for the pump stations”.

In the September 22, 2004 Final Coordination Act Report (FCAR) the FWS made the following major recommendations:

1. Conduct baseline, construction, and post-restoration surveys for federally and state listed species including the West Indian manatee and its critical habitat, Florida panther, Florida black bear, wood stork, red-cockaded woodpecker, and state-listed wading birds;

Response: Surveys of state and federally listed species are proposed in the Ecological Monitoring and Adaptive Assessment Plan. The Corps and WMD staffs have been coordinating the plan included in this PIR with Service, State and non-government conservation groups. The monitoring plan is a result of this ongoing collaboration.

2. Conduct construction and post-restoration surveys for fish and wildlife using methodologies established in existing baseline wildlife surveys;

Response: The monitoring plan includes a provision to continue baseline surveys so that change would be detected. Project construction specifications will specify needed surveys and protections to be established to protect fish and wildlife during construction activities.

3. Continue site management activities and develop the Ten-Year Picayune Strand Resource Management Plan consistent with site restoration and management objectives described in the Picayune Strand Restoration Project, Florida Forever Program, Florida Division of Forestry management goals, and the Farm Bill and Interim Management Agreements with the Department of the Interior;

Response: The Ten-Year Picayune Strand Resource Management Plan is under development by the Florida Department of Forestry with cooperation from other agencies. It is central to the success of many project goals related to land use management, but its development is outside the scope of this PIR.

4. Implement the Ecological and Water Quality Monitoring Plan (Plan) (Appendix H of the Project Implementation Report/Environmental Impact Statement), integrating the results of fish and wildlife monitoring with design and operational plans to increase the long-term resource restoration benefits of the project. Modify the Plan to include Inland and Listed Species elements currently under development by the Service, South Florida Water Management District, Florida Division of Forestry, Florida Fish and Wildlife Conservation Commission and the Conservancy of Southwest Florida.

Response: The Ecological Monitoring and Adaptive Assessment Plan has been further developed with input from Service biologists and staff of the agencies cited above. This plan would be refined, if the project is approved, during the Preconstruction Engineering and Design (PED) phase. Please refer to Appendix H of this report.

5. Following multi-agency review and approval, implement a detailed Project Operating Manual that will benefit restoration of freshwater wetlands and downstream estuaries by restoring the quantity, quality and timing of freshwater flows to the natural system, as well as protect and improve freshwater wetlands upstream of the project. In addition to ecosystem benefits, the project's operational rules must ensure that existing levels of flood protection for surrounding developed communities are not reduced;

Response: A draft Operations Manual for alternative 3D is included in Appendix A of this PIR. The final operations plan will continue to be developed, if this project is authorized, during Pre-Construction Design. We expect to continue to include Service staff in coordination and finalization of this plan.

6. Establish new water quality/quantity monitoring sites on the project and on adjacent public lands, such as the Ten Thousand Islands National Wildlife Refuge that would likely be affected by the project;

Response: A Water Quality Monitoring Plan for the project is included in Appendix H of this PIR. Establishment of additional monitoring stations (not included in the Monitoring Plan) is not within the financial scope of the project. Many groundwater monitoring stations and flow transects have already been set up by the SFWMD to obtain baseline data prior to

project construction. The Corps notes that the National Estuarine Research Reserve currently operates several automated water quality data loggers at the mouths of some of the affected estuarine creeks.

7. Monitor conditions in estuarine environments during project operation to validate hydrologic model predictions and provide a basis for improving the performance of the plan within the range of operational flexibility provided by the project design structures;

Response: The Ecological Monitoring and Adaptive Assessment Plan (Appendix H) includes some estuarine monitoring. The intensity of monitoring in terrestrial vs estuarine habitats is roughly proportional to the ecosystem benefits expected to be derived in each area as a result of the project.

8. Ensure that existing baseline water quality data continue to be collected by government and local entities, such as Collier County, U.S. Geological Survey, Florida Department of Environmental Protection, the South Florida Water Management District and the Southwest Florida Water Quality Consortium;

Response: A Water Quality Monitoring Plan is included in this report. The intent of CERP projects is not to substitute for or subsidize ongoing monitoring programs of other agencies. These programs are expected to continue under their existing funding sources.

9. Develop an estuarine mixing model for the downstream estuaries of Faka Union, Fakahatchee, Pumpkin, and Blackwater Bays.

Response: The intent is to include evaluation tools for the post-restoration conditions in the Ecological Monitoring and Adaptive Assessment Plan subject to available funding. Developing an estuarine mixing model is however beyond the scope of this project. Modeling tidal hydrodynamics in this extensive region might be an objective for the more comprehensive Southwest Florida Feasibility Study, but the Corps notes that detailed bathymetry of the region would be required in order for such a model to be developed. Data do not exist at present to calibrate an estuarine mixing model for the region.

10. Draft an Exotic/Invasive Species Management Plan for the project and implement measures to control exotic plants during project construction and operation phases throughout the project area.

Response: The Florida Division of Forestry has stated that it will include measures for invasive and exotic plant control in the Ten-Year Picayune

Strand Resource Management Plan. Corps construction specifications will contain exotic plant control language for the contractors, such as washing construction vehicles prior to entering/leaving the work site. The project O&M plan will contain exotic species control within the footprint of construction activities during the second and fourth year after construction. However, the plan recommended in Alt 3D does not include a major budget item for overall exotic invasive plant control. The Corps and SFWMD acknowledge that invasive exotics are a problem throughout the south Florida ecosystem. Other CERP programs are dedicated to address the invasive exotics problem directly through research in new control agents and techniques.

11. Identify and reach consensus on issues related to design storm calculations by development of a “white paper” by an interagency team;

Response: The Corps and SFWMD are not proposing such a study, which is outside the scope of this project. The Corps follows Engineer Regulations that determine how the level of protection is defined; and SFWMD and ACE engineers are in agreement regarding the design storm calculations.

12. Develop a specific Comprehensive Everglades Restoration Plan Guidance Memorandum on Flood Damage Assessment Procedures.

Response: The CERP Design Coordination Team (DCT) may consider this recommendation, but it is outside the scope of this project. Note that the Corps already has Engineer Regulations that direct that flood damage be assessed in certain ways. These regulations are promulgated at a national level. Likewise, the State of Florida has statutory regulations that address reductions in level of service for flood protection on new projects.

13. Evaluate hydrologic information for the thirteen-year period of record simulated by the model to provide a full analysis of the project effects on the natural system. Develop assessment performance measures for dry season conditions, flood control and water supply.

Response: Dry and wet season Hydrologic performance measures were included in Section 6.7.2. The engineering Operations Manual is based on maintaining existing drainage conditions for NGGE. Water supply is covered under Project Assurances located in Section 12 of this PIR.

14. Remediate any contaminated portions of the project impact area where wildlife could be adversely affected by high levels of selenium, chlordane, and dieldrin as a result of project operation.

Response: SFWMD is working with the US Fish and Wildlife Service to decide on the most cost effective and preferred options for cleanup of site contaminants. Note that the local sponsor is aware of its responsibility to remediate HTRW problems prior to conveying the lands to the Federal Government. SFWMD has made significant progress in selecting remediation methods in consultation with other State agencies and FWS. The Federal Government will not accept lands for the project until they are certified free of contamination. This is a general procedure applied to all Federal construction projects, and is not unique to CERP.

15. Modify detailed project design to reduce engineered structures such as pumps and berms to allow for more passive water management in the project area; and

Response: A number of alternatives with a more passive design were evaluated during development of the recommended plan. To date these designs did not allow rehydration of lands south of I-75 while maintaining "level of service for flood control" in NGGE. Construction designs that allow for a more passive management of the flows to the natural system may be re-evaluated, if the project is approved, during the Preconstruction Engineering and Design phase (PED) when additional data are available.

16. Ensure that all recreation proposals by the site manager, Florida Division of forestry, are consistent with the restoration objectives of this project which are primarily to restore natural resources to their natural condition and to prioritize protection of fish and wildlife resources, listed species and downstream estuaries. All activities proposed by the Florida Division of Forestry must be reviewed and approved by the Department of the Interior consistent with Farm Bill 3 and Interim Protocol Agreements, National Environmental Policy Act, Endangered Species Act, and various other State and Federal regulations.

Response: The Corps and WMD intend to continue in close collaboration with FWS and other Federal agencies to assure that the management plan is developed to foster the purposes and objectives of the proposed Federal project. We note that it is DOI responsibility to assure consistency with the Farm Bill.

Interagency coordination among biologist and hydrologist staff of FWS, Corps and SFWMD staffers has continued. Project staff met with FWS staff at the FWS South Florida Ecosystem Office on August 5 and 11, 2004 to discuss, respectively, fish and wildlife and habitat issues, and hydrologic modeling issues. PIR team members of USACE and SFWMD repeated their commitment to continue working in close coordination with resource agencies to develop the best possible management and monitoring plans for this project, within the scope of the budget.

It is expected that, if the project is approved, better data to support endangered species information and monitoring will be available after the required surveys are completed in the PED phase.

9.6 THREATENED AND ENDANGERED SPECIES

An October 27, 1999 FWS Planning Aid Letter (PAL) for the SGGE project was received by the Corps. It outlined fish and wildlife concerns including federally listed threatened and endangered (T&E) species that are known to or may occur in the vicinity of or may be affected by the SGGE project. These species are the threatened eastern indigo snake (*Drymarchon corais couperi*), endangered wood stork (*Mycteria Americana*), endangered red-cockaded woodpecker (*Picoides borealis*), endangered Florida panther [*Felis* (=Puma) *concolor coryi*], endangered snail kite, (*Rostrhamus sociabilis plumbeus*), endangered American crocodile (*Crocodylus acutus*), and endangered West Indian manatee (*Trichechus manatus*) (U. S. FWS 1999). In a PAL dated January 17, 2003, FWS reaffirmed this list of species and added the threatened bald eagle (*Haliaeetus leucocephalus*). In a second PAL dated August 11, 2003. The February 2004 draft Coordination Act Report (dCAR) also reaffirmed the above list of T & E species. On May 1, 2003 the smalltooth sawfish (*Pristis pectinata*) was added under this section heading when the National Marine Fisheries Service (NMFS) listed it as an endangered species.

In southwest Florida all of the above threatened and endangered species are vulnerable to the same significant threats to their survival. They require relatively large home ranges. Residential and commercial construction, agriculture, and timbering expansion have caused wide spread habitat loss, degradation, and fragmentation. Extensive tracts of wild land are the most important refuge for large numbers of these species. SGGE is located in Collier County, which has one of the fastest growing human populations in the United States. SGGE is also bordered on three sides by large expanses of federal and state owned public lands dedicated to the preservation of natural ecosystems (Figure 1-1). The restoration of SGGE is the key to providing the connectivity of the extensive home ranges needed by these and many other species. Additional information about the effects of the recommended alternative on these species can be found in the FWS Coordination Report located in Appendix D.

In response to the October 27, 1999 PAL the Corps submitted to FWS a draft Biological Assessment (BA) of federally listed T&E species that may be affected by the SGGE project. The determinations in this BA, which can be found on the SGGE WEB site, were not responded to by FWS due to a Corps and SFWMD decision to develop new alternatives. As a member of the PDT the FWS has actively assisted the Corps in development of alternatives and the selection of the recommended alternative. This extensive informal consultation process is

intended to minimize the adverse effects of the project on federally listed species and maximize positive effects. In the FCAR The FWS stated that it believed that further coordination and baseline studies must be committed to by the action agencies before the ongoing informal consultation can be concluded. In accordance with Corps planning regulations, an updated Biological Assessment was coordinated with the Service on October 20, 2004 (it is included in Appendix D of this PIR). This BA coordinated “no effects” determinations for Everglades snail kite and American crocodile critical habitat. It concluded “may affect, unlikely to adversely affect” regarding the red-cockaded woodpecker, the bald eagle, the Everglade snail kite, the eastern indigo snake, and West Indian manatee habitat. It concluded that there is still insufficient information to determine effects on the West Indian manatee, wood stork or Florida panther. The Service indicated concurrence with the BA on October 20, 2004. Coordination will continue on the 3 species listed above during the detailed design and engineering phase of the project, if it is approved. In any case no construction of recommended alternative 3D will take place prior to full concurrence of FWS. It is the intention of the USACE to comply fully with requirements of the ESA.

The following is a discussion of individual listed species known to occur in the region.

9.6.1 American Crocodile

The crocodile is an estuarine species; its largest population occurs in extreme southeast Florida, in the “Model lands” and south Everglades panhandle, extending to north Key Largo. A few observations of crocodiles have been made in the Ten Thousand Islands Region, and it is thought that under favorable estuarine conditions the American Crocodile may be expanding its range into the southwest Florida coast. The hydrologic restoration of SGGE would restore freshwater flows to offsite creeks and inland marshes downstream of the project. Discharges now reaching mostly the Faka Union Canal system would be distributed across a broad front of intertidal crocodile habitat in other parts of estuaries and bays within the Ten Thousand Islands Region. Among other beneficial effects, the increased freshwater in these estuaries should stimulate more prolific mangrove growth and litter production. The Corps of Engineers believes that the recommended plan would have a favorable influence on American crocodile habitat.

9.6.2 Bald Eagle

Eagle distribution is influenced by the availability of suitable nest and perch sites near large, open water bodies, typically with high amounts of water-to-land

edge. While the edge habitat already exists, suitable perch trees may be restricting current eagle habitat use. Restoration of the project lands, along with stimulation of growth of cypress and pine flatwoods communities, should improve perch and nest habitat by stimulating tree growth. This is a long-term effect that may take 20 years or more to occur. One of the current factors limiting full development of mesic and wet pine flatwoods communities has been the frequency of hot fires that shoot to the crowns of trees, killing them. Additionally, improvement of the overall productivity of the estuaries, expected as a consequence of the re-distribution of water, is expected to result in an increase of prey species. There are records of eagle nests during recent years in lands adjacent to the project. Surveys for nests will occur during P.E.D. and prior to construction in all areas, and appropriate eagle protection measures will be incorporated, as customary, in project specifications.

The reestablishment of long hydroperiod wetlands dominated by tall trees, the removal of roads, and the restricted human presence would provide the eagle with suitable nest sites near the estuaries and bays of the Ten Thousand Islands Region. The restoration of wetlands within the SGGE Project Area would make available some foraging areas for the eagle.

9.6.3 Eastern Indigo Snake

The Project Area is a critically important segment in the consolidation of a landscape that would connect surrounding public lands into a large block of relatively wild habitat for the snake. The removal of hundreds of miles of road, and a restricted human presence would produce a more natural landscape. It is expected that recommended alternative 3D would increase the indigo snake's ability to feed, breed, and shelter, as a result of hydrological restoration of both wetlands and uplands on the Project Area site. To restore indigo habitat, it is important to be able to predict, design, and construct a project that will restore habitats as close as possible to natural conditions. Eastern indigo snakes could be encountered during construction; therefore implementation of the standard construction practices to avoid adverse effect on the species would be included in the construction specifications for this plan.

9.6.4 Florida Panther

The recommended plan is expected to benefit populations of Florida panther that utilize habitats in the region. Figures 9 and 10 in the FCAR (Appendix D) show the project area in context of the surrounding region. Panthers habitually are found in the SGGE area and surrounding protected lands. Each dot on the map indicates a position (a "hit") of an animal bearing a telemetry collar. These maps clearly show the importance of the area as panther habitat; but they show that

adjacent, less disturbed areas such as Fakahatchee Strand State Preserve are even better habitat. Road removal, land purchase, and administration as part of a State Forest all are actions that should increase the panther habitat value of the land. Although panthers generally den in uplands, they utilize marsh and swamp habitat extensively, especially seasonally wet-and-dry wetlands like pine flatwoods and short-hydroperiod marshes. In order to appreciate project benefits to the panther, consider that under the no-action plan (“future without project”) about 40 percent of SGGE lands were expected to be developed as residential tracts. Under existing conditions, there are hundreds of miles of roads, accessible to high-clearance vehicles and ORV’s, throughout the project area. Under the 40 percent development scenario it would be expected that many of the existing roads would be paved and widened, traveled by ordinary passenger cars at high speed, and daily traffic would be substantial. Conversion of the project area to a managed State forest, rehydration of project wetlands, restoration of more natural plant cover, and removal of most human disturbance over such a large area will undoubtedly favor the panther’s ability to feed, breed, and shelter. Restoration will also improve habitat conditions for the panthers’ prey base, and a more restricted human presence would produce a large block of moderately wild habitat for the panther. A major feature of the suggested restoration plan is the removal of the majority of the 279-mile road grid. This is important to the panther because it would reduce vehicle-related mortality, decrease human disturbance to panthers and panther prey, reduce exotic plant invasion that tends to be more severe near disturbed roadsides, and result in thousands of acres of restored habitat. The SGGE Project Area is a critically important segment in the consolidation of a natural landscape that would connect surrounding public lands (Figure 1-1) into a region of sufficient size to assist in the recovery of the panther.

9.6.5 Red-Cockaded Woodpecker

The recommended plan, with its incomplete hydrologic restoration of SGGE in the project’s northwest corner would retain some upland habitat (pine flatwoods) for terrestrial wildlife such as red-cockaded woodpeckers (RCW). RCW groups utilize mature pine flatwood communities and nest in older pines. The SGGE Project Area is not currently documented as RCW habitat although active clusters are located within the adjacent South Belle Meade portion of Picayune Strand State Forest and in Big Cypress Preserve approximately 37 miles east of the site. Habitat evaluations predicted by the MIKE SHE hydrological model indicate that a significant acreage of flatwoods will be replaced by cypress and other wetland communities as a result of the restoration. However these flatwoods that the model shows as being lost are low quality artifacts of overdrainage that still have remnant populations of wetland plant communities interspersed or dominated by invasive or exotic plant species. The effect of alternative 3D is to improve the quality of the remaining pine flatwoods and

potentially restore a forest that can support additional RCW clusters. It is also the intent of the restoration to protect existing or reestablish lost pine strands that under natural condition were located on slightly elevated ridges that ran parallel to the southwesterly wetland flow patterns on the site. The geographic location of flatwoods communities on the post-restoration site will also be important in enhancing regional RCW populations. Forest restoration would contribute to adjacent public lands management of this endangered species, and possibly contribute to regional recovery of the RCW population in southwest Florida by providing a forested “bridge” of habitat for the woodpeckers to disperse over a wider landscape.

9.6.6 Estuarine Fishes and Sea Turtles

The hydrologic restoration of SGGE under alternative 3D would redistribute freshwater flows from the Faka Union Canal system to other parts of Study Area estuaries and bays within the Ten Thousand Islands Region. Reestablishing a more natural hydrology would restore the slow year-round influx of fresh water needed to maintain the salinity in the natural range that is optimal for estuarine organisms. The only truly estuarine endangered species found in the region is the smalltooth sawfish, recently listed. Improvements in estuarine salinity gradients will in turn benefit (stimulate) estuarine secondary productivity, which will benefit the sawfish by favoring development of forage fish and invertebrate communities. No effects are expected on marine turtles, which are not normally present in the inner estuaries. The Faka Union Canal weir #1 that is just north of US Highway 41 will remain in place as a barrier to salt water intrusion. It will act as a barrier to any upstream movement of these species thus protecting them during construction. Implementation of the recommended plan should have a favorable impact on estuarine habitats used by these T&E fishes and turtles.

9.6.7 Everglades Snail Kite

The hydrologic restoration of SGGE is not expected to greatly benefit the snail kite, a bird of open marshes that depends on sight-feeding to locate its favored food source, the apple snail. There is virtually no apple snail habitat in the project area under current conditions. Under the “no-action” scenario, increased and intensified residential development would reduce snail and snail kite habitat even further. The proposed project would restore primary and secondary wetland habitats for the snail kite. Offsite creeks and inland marshes located downstream from the project that may be used by the snail kite might benefit from the reestablishment of a slow continuous release of freshwater. The habitats used by the Everglade snail kite would not be adversely affected and might be positively influenced by implementation of the recommended plan.

9.6.8 West Indian Manatee

The most important habitat utilized by the local sub-population of manatees is the area downstream of the Faka Union canal weir. USGS biologists have been monitoring this sub-population, and report that large numbers of manatees aggregate in the Port of the Islands marina basin in winter. These animals have been observed swimming upstream to the weir to drink fresh surface water. During the rest of the time, in cold weather they aggregate on the bottom in the deepest parts of the (dredged) marina basin. The recommended project will not affect this basin, and is not expected to adversely affect manatee aggregation in winter, but it will affect flows over the weir.

Manatee mortality related to cold-stress has been observed in this location. This tidal boat basin shows a typical saline stratification during calm dry weather, with denser (warmer) salt water covering the basin deep spots, while less dense freshwater forms the surface layers. The animals evidently rest in the warmer bottom waters, rising to the surface to breathe or drink. During warmer months, manatees visit the marina, but venture to the outer Ten Thousand Islands area to feed on marine vegetation.

Clusters of mortality at the site are associated with cold fronts, with air temperature dropping below 20° C. The hypothesis is that the animals utilize the (relatively) warm bottom water to avoid hypothermia, remaining in the marina rather than going to deeper ocean waters because they need to drink fresh water. The weir appears to be a constant source of freshwater overflow in the dry season under existing conditions. Some weather events linked to cold front passage may play a role in manatee mortality, inducing turnover or mixing of the deep water.

It is unknown what role the dynamics of freshwater inflow at the weir play in the balance of marina water temperature or basin stratification. It is known that conditions during the coldest, driest winter months are most critical. Therefore, the project-monitoring plan includes monitoring flows at the weir and providing support to monitor this manatee sub-population to attempt to determine project effects and avoid adverse effects. The project will be managed to assure that a minimum influx of freshwater remains available at the FU-1 weir to satisfy this sub-population's freshwater needs during the winter dry season. It is the intention of the USACE and SFWMD to cooperate with FWS and USGS manatee researchers and manage flows at the weir interactively (probably by installation of a well-supplied alternate fresh water source) to assure that lack of freshwater does not add to natural cold stress.

The recommended plan is projected to substantially reduce the average freshwater November-May dry season flows from the Faka Union Canal system into Faka Union Bay. Under this alternative the reduction of canal system flows

would restore watershed connections to the adjacent estuaries in bays to the west and to a lesser degree the Fakahatchee Bay estuaries to the east (Figure 3-2). Restoration of the watershed may contribute to additional manatee use of these natural freshwater sources as opposed to the existing freshwater point source discharges from the canal system into Faka Union Bay. This redistribution of flow to more natural discharge points is likely to influence manatee use of the Faka Union Canal and therefore their distribution throughout the region. USGS biologists hypothesize that during cold periods (water temperature $< 20^{\circ}\text{C}$), manatees will continue to aggregate in the Port of the Islands Marina basin south of the SGGE project, in part because of thermal buffering provided by the deeper (saline) bottom water. During warmer periods (water temperature $>20^{\circ}\text{C}$), manatees will tend to disperse from the canal, particularly if adjacent rivers are receiving greater freshwater input than the canal and are closer to feeding areas.

Because use of the Faka Union Canal brings manatees into close proximity with boats, it is possible that boat-related deaths and injuries in this region will be reduced if manatees become less reliant on the canal as their major source of fresh water. A change in manatee use of Faka Union Canal during periods of cold stress could also change exposure to boat traffic.

The impacts of the SGGE project on the extensive seagrass beds located in the outer edges of this estuarine system cannot be quantified due to lack of models for tidal circulation, but the project's influence is likely limited to the inner estuaries. However, in Faka Union Bay, directly downstream of Faka Union canal, studies indicate that algae dominate during winter (dry season) months, and seagrasses increase during the summer (wet season) months (USFWS 2002). Dramatic seasonal increases in seagrasses occur in Fakahatchee Bay west of the project, where inflows into the estuary follow a more natural hydrologic regime (Carter *et al.* 1973). Restoration of more natural flows to the estuary is expected to improve marine resources, including seagrass distribution and abundance.

As part of their research contribution to the CERP, the U.S. Geological Survey initiated a study on the impacts of hydrological restoration on manatees in the Ten Thousand Islands region in June 2000. The major objectives of the study are to determine distribution, movements, and habitat use of manatees associated with coastal waters and rivers, and to develop a population-level model to predict manatee response to changes in hydrology achieved by the SGGE project as well as the overall CERP. These data provide the basis for the first detailed analysis of manatee use patterns in the Ten Thousand Islands/Everglades National Park area.

9.6.9 Wood Stork

Alternative 3D would restore extensive primary and secondary wetland habitats for wood storks. These wetlands would provide expanded foraging opportunities for wood stork colonies located 23km away at the Corkscrew Sanctuary. Wetlands within 30 km of rookery sites have been described as core forage areas for wood storks; however, they may forage as far as 75 km from rookery sites. The preservation and restoration of hydrology and connectivity of wetlands on an ecosystem scale is essential to the survival and reproduction of wood storks in South Florida. The hydrologic restoration of SGGE would establish a contiguous block of protected wetlands near this sanctuary.

Tentatively recommended alternative 3D would reestablish critical natural hydroperiods in post-restoration wetlands. The more natural sheetflow would support surface water connections between wetlands to allow forage fish dispersal, establish dry-season or drought-resistant refugia, increase the extent and quality of wetlands; decrease competition between forage fish species; reduce predation on forage fish species, and reduce unwanted exotic fish species that compete with forage fish. Under this alternative the plugging and filling of canals would eliminate year round habitat for predatory species of native and exotic fish. Predatory fish prey upon smaller fish species that provide an important forage base for wood storks. Wet season rainfall could result in access for predatory fish to isolated wetlands and increased predation of small fishes on the site, reducing the small fish forage base for wading birds and wood storks.

Water management and operation plans for alternative 3D infrastructure are critical in determining the effects of the project on wood storks. During wet years, water management practices could prevent the formulation of shallow pools that concentrate wood stork forage fishes. During dry years, water management practices could overdrain the freshwater sloughs and reduce wetland productivity of forage fishes for wood storks. Variable water management practices could increase or decrease frequencies of wood stork nest failure in area rookeries. A water control plan that considers wood stork habitat will be completed during the DDR phase of this project.

9.6.10 Endangered Plants

Tentatively recommended alternative 3D might decrease native tropical plant species mortality and tissue damage experienced during brief freeze periods. Hydrologic restoration of the project area will raise groundwater levels and allow surface water to remain in many wetlands well into the coldest part of winter. As water freezes it gives off heat that in combination with restored plant canopies would create localized microclimates where these plants could survive. Under this alternative federally listed orchids, which can be found in the

adjacent Fakahatchee Strand State Preserve, would someday have a chance to reestablish in SGGE.

9.6.11 Essential Fish Habitat

The Magnuson–Stevens Fishery Conservation and Management Act is intended to protect essential habitat for economically important species of marine fish. The species and habitats requiring evaluation are determined by regional Fisheries Councils; in the case of this project the Gulf Fisheries Council determined species and habitats of importance. The law requires coordination with the National Marine Fisheries Service (NMFS) anytime a federal project may adversely impact Essential Fish Habitat (EFH). The intent of the Southern Golden Gate Estates project is to restore to the extent possible the pre-development overland hydrology that feeds fresh water into the Ten Thousand Islands Region. This alternative would reduce point-source fresh water surges into Faka-Union Bay and restore more natural pre-development flows to Palm Bay, Black Water Bay, Buttonwood Bay, Pumpkin Bay, and Fakahatchee Bay, thereby vastly improving the extent and health of essential fish habitat predicted for the "without project" condition. The NMFS web site lists the Ten Thousand Islands Region as Essential Fish Habitat for adult and juvenile for brown shrimp (*Penaeus aztecus*), gray snapper (*Lutjanus griseus*), gulf stone crab (*Menippe adina*), pink shrimp (*Penaeus duorarum*), red drum (*Sciaenops ocellatus*), Spanish mackerel (*Scomberomorus maculatus*), spiny lobster (*Panulirus argus*), stone crab (*Menippe mercenaria*), and white shrimp (*Penaeus setiferus*).

All the construction features of the alternative 3D are well upstream of any juvenile or adult habitat for the listed species. Standard best management practices to reduce erosion and downstream turbidity will be included in the construction specifications. Construction should have no impact on EFH in the receiving bays. It is therefore the conclusion of the Corps of Engineers that restoring a more natural hydrology to the Study Area will have a positive affect on Essential Fish Habitat in the Ten Thousand Islands Region. David Dale of NMFS was contacted by email in August 2001 and agreed with the Corps evaluation that implementation of alternative 3D would have only beneficial effects on EFH and did not require formal consultation with NMFS.

9.7 GEOLOGY AND SOILS

The geology within SGGE would not be expected to be significantly altered within the 50-year life of the project except in the case of an unpredictable cataclysmic event

Tentatively recommended alternative 3D would reestablish a more natural hydrology over the SGGE landscape. The restoration of water depth and duration and reestablishment of a higher ground water table would help arrest the destruction of organic soils by oxidation and fire. Organic matter will start to deposit in areas with the proper parent material, living organisms, climate, and topography; however the rate of organic soil formation over time is not clear.

9.8 AIR QUALITY

Tentatively recommended alternative 3D would not adversely affect air quality within the project area. Some temporary increase in air pollution within the project vicinity can be expected from equipment used during construction. The elimination of most project roads would benefit air quality by reducing dust and emissions from vehicular traffic. SGGE is considered by the Environmental Protection Agency (EPA) to be an air quality attainment area. Project construction would not affect that status.

9.9 CLIMATE

A draft CERP Guidance Memorandum (17 October 2003) titled “*Sea Level Rise Considerations for Design of CERP Projects*” states that the Project Delivery Team (PDT) should consider sea level rise as a future condition. This guidance was not available during the building of the MIKESHE model used to evaluate the SGGE tentatively recommended alternative hence the model does not contain a sea level rise component. Tables in the above memo were used to calculate a 50% probability of an 8” rise in sea level for the Naples area in 2050. Elevations in the study area vary between sea level and 28 feet so it is probable that an 8” rise may have some effects. The PDT has decided to address effects of sea level rise on tentatively recommended alternative 3D during the Detailed Design Report (DDR) phase of this project.

9.10 HYDROLOGY

For information identifying the appropriate quantity, timing and distribution of water to be dedicated and managed for the natural system, the amount to be reserved by the state, and the water available for other uses see Section 12 Project Assurances.

9.10.1 Increases in Water Supply

Discussion of the effects of the preferred alternative on water supply is found in Section 12, "Project Assurances". In essence, the requirements of the Water Resources Development Act of 2000 is that each CERP project must identify the amount of water reserved for environmental restoration and that reserved for other purposes.

The water made available for the natural system that is necessary for the protection of fish and wildlife will be incorporated into a water reservations rule and protected under State law prior to execution of the PCA. Since this PIR is a design document that will be followed by a detailed design phase, construction, and final operating manuals, it is possible that the actual performance of the recommended plan may change. This change may affect the amount of water initially identified to be reserved by rule for the natural system. Therefore, the reservation rule has been conditioned to reflect that all of the reserved water may not be delivered to the natural system until the facility is constructed, operated, tested, and a final operating manual is approved. Hydrologic monitoring is included in the operations plan to verify the quantities of water delivered to the natural system and made available for other uses. A detailed description of the monitoring plan is included in the Appendix H Ecological and Water Quality Monitoring Plan. This adaptive assessment and management process provides an opportunity to revise the amount of water reserved for the natural system as appropriate and provides flexibility to account for changes in implementation strategies during the life of the project.

9.10.2 Water Quality

The implementation of Alternative 3D would improve the water quality of coastal estuaries by increasing freshwater distribution to estuaries east and west of Faka-Union Bay and reducing very large wet season discharges into Faka-Union bay. Additionally, sheet flow of water originating upstream of the project will improve the quality of this water as it passes through restored wetlands communities. The diversity and productivity of estuarine plants and benthic communities (mangroves, seagrass beds, macroalgal beds and oyster reefs) should improve.

As documented in Sections 3.10 Water Quality and 3.14 HTRW under the existing conditions of this report, there are within the project area soils contaminated with organochlorines, polycyclic aromatic hydrocarbons and/or other toxins. SFWMD is actively developing and implementing remediation for these substances in cooperation with DEP and FWS, and lands will be fully remediated when transferred to the Federal Government for implementation, if the project is authorized.

Considering the rapidly urbanizing NGGE area, the water quality from the NGGE canals would continue to worsen particularly in terms of nutrients (total phosphorous and total nitrogen) and coliform bacteria due to the expected increase of septic tanks in the area. Increased nutrient concentrations coupled with storm water point source inputs could potentially lead to the formation of enriched gradients within the study area and encourage the growth of nuisance plant species, e.g. cattails and primrose willow. If phosphorus levels become sufficiently high as NGGE develops, it may become necessary to implement storm water treatment management of canal inflows to protect the character of SGGE native communities. USGS and FDEP have performed, and continue to conduct, significant groundwater and water quality studies within the SGGE project boundaries and downstream estuaries. A water quality-monitoring plan has been developed as part of this project and is included in Appendix H.

9.10.3 Water Management

Several versions of the operating manual will be prepared prior to project completion. In the Pre-construction and Detailed Design phase, the draft operating manual developed for the PIR may be modified, as necessary, for operations during construction. A draft-operating manual for the operational testing and monitoring phase will then be prepared. Experience gained from the operational testing and monitoring phase will be incorporated into the final operating manual, which will be coordinated with SFWMD and the South Atlantic Division (SAD), and will supercede all other iterations of the operating manual. At this point, the SFWMD, as the local non-Federal sponsor, will accept ownership and responsibility for long-term operations of the project. The versions of the operating manual would include the operating criteria and additional provisions that may be required to collect, analyze, and disseminate basic data. Detailed operating instructions to ensure project safety, and operation of the project to assure restoration is achieved would also be included in the versions of the operating manual. The Corps and the SFWMD would jointly develop the operating manuals and ensure that the objectives of the restoration project are met using operational criteria and rules. The Draft Operating Manual will be consistent with the reservation or allocation of water described in the PIR and the PCA.

9.11 ESTUARINE RESOURCES

The benefits of alternative 3D transcend the freshwater wetland boundaries of the Project Area. Estuarine resources in the Ten Thousand Islands Region would be positively affected by the hydrologic restoration. The sheetflow disrupted by the existing SGGE canal system has altered salinities within much

of the 83 square mile area that makes up the Ten Thousand Islands Region (Figure 3-2). Adding the rehydrated marine area to the upland acreage restored within the SGGE Study Area increases total project benefits.

The severely altered freshwater input to three major estuarine systems (from west to east: Blackwater River, Pumpkin Bay, and Faka-Union Bay), and the smaller intervening estuaries, would be restored by the recommended plan. Plugging of the project canal system would reverse the freshwater inundation experienced by Faka-Union Bay during the rainy season. This inundation significantly reduces salinity along with other co-varying physical quality parameters. Sheetflow to the estuaries west of Faka-Union has been substantially reduced and this has artificially increased salinity during the rainy season. The impacts to water quality in Fakahatchee, the estuary east of Faka-Union, are not as clear because this system has not been monitored as extensively. It is suspected however, that this system has also experienced freshwater flow reduction to a lesser extent. Alternative 3D would restore the pre-alteration seasonal timing and discharge of sheet flow to the central Ten Thousand Islands Region, and would eliminate the point-source discharge of freshwater from SGGE into Faka Union Bay.

Although estuarine ecosystems are designed to withstand seasonal variation in salinity, the pulsing or inundation by freshwater or, alternatively, the elimination of variability because of the reduction of freshwater input, is harmful to the health of the system. All estuarine habitats, including sub-aquatic vegetation beds, oyster reefs, soft-bottom embayments, sand or mud shoals, fringing mangrove forests, and the open water nekton, all depend upon fresh- and marine water mixing. Brackish water conditions provide nutrient and dissolved oxygen enrichment, which promotes productivity. These conditions also provide a refuge from predation and an ideal setting for reproduction and juvenile growth and development. Ultimately, the health of the entire estuarine system is predicted to improve. However since a hydrologic restoration project of this magnitude has not been previously attempted in South Florida, the ecologic response of the estuarine aquatic system is unclear. Therefore the estuarine experts on the SGGE Project Delivery Team recommend monitoring efforts to establish pre-project baselines and post-restoration effectiveness on such parameters as salinity response, oyster health and reef distribution, the effects upon state and federally listed marine species, changes in salt marsh plant diversity and fishes, and the potential for sea grass development. Specific recommendations can be found in the Ecological Monitoring and Adaptive Management Plan found in Appendix H of this report.

9.12 SOCIO-ECONOMICS

9.12.1 Land Use/Population

Lands acquired with state and Federal dollars for the purpose of this restoration project would undergo extensive ecological and hydrological restoration. The land in the SGGE study area would not be used for development purposes with the SGGE recommended plan implementation, and would provide environmental benefits and much more closely resemble predevelopment condition. The surrounding residential areas will experience a large population increase, therefore an increase in infrastructure.

As part of project implementation, a monitoring plan would be conducted to assist in verifying desired benefits were achieved and help lay the groundwork for future operational plans in the area.

9.12.2 Population

The recommended plan will to some degree limit the growth potential of Collier County. Lands otherwise expected to grow in proportion to the rest of the County in the project area will not be available for growth. Lands in NGGE are expected to gradually convert from the present mix of residential/commercial/vacant to fully developed.

Development of adjacent lands will increase demands on regional water supply, recreational use of State and Federally owned lands, and increase pressure on native wildlife and their habitats. The complex of Federal and State Forests, refuges and preserves will play an ever increasing and critical role in the survival of native vegetation types and native species, as undeveloped but unprotected habitats disappear under golf courses, residential tracts and commercial-industrial sites.

In comparison to the "future without project" scenario, which contemplated 40 percent development in the project lands, about 23,000 fewer acres will be available to support development in Collier County through 2060.

Current statistics demonstrate that Collier County, including the study area of SGGE, is characterized by a much greater population growth rate than the rest of the State and the Nation as a whole. Collier County had a 2000 census population of 251,377 persons. The population of this county had an enormous increase of 65.3 percent from 1990 to 2000, and the estimate percentage change between 2000 and 2001 was 5.7 percent. The population of Florida and the United States increased 23.5 percent and 13.1 percent respectively during the

same period. The state of Florida added over three million persons from 1990 to 2000, ranking third in the nation in numerical change.

Population in Collier County is expected to more than triple from 2000 to 2060. Due to this anticipated population growth, the county is expected to have one of the largest populations in the Lower West Coast. The dense urban area of southwestern Florida has contributed to development pressure and population increases in Collier County.

Table 9-1 summarizes existing and projected population in the study area. The 2000 figures are from the U.S. Census. The future estimates are based on Collier County's April 1, 2001 publication of population projection to the year 2030. BEBR medium estimates (there are also "high" and "low" estimates) growth trends evident between 2020-2030 were utilized to extend Collier County's population projection out to 2050. Build out is expected to occur in the county prior to 2050, therefore projections between 2050-2060 are nominal. These population projections were calculated for the South West Florida Feasibility Study. Table 9-2 displays the population rates of growth for each decade from 2000 to 2050. Table 9-3 indicates the population growth rate of the study area is expected to exceed that of the State from 2000-2050.

TABLE 9 - 1 STUDY AREA POPULATION ESTIMATES, 2000-2050

Population (1,000's)							
	Year						
	2000	2010	2020	2030	2040	2050	2060
Collier	251.3	383.7	529	689.3	740.9	792.6	800
Share of Florida Total	1.60%	2.00%	2.20%	2.40%	2.60%	2.90%	N/A
Florida Total	15,982.40	18,866.70	21,792.60	24,528.60	27,118.70	29,714.50	N/A

TABLE 9 - 2 STUDY AREA POPULATION RATES OF GROWTH 2000-2050

Average (% Per year) Population Growth						
	2000-2010	2010-2020	2020-2030	2030-2040	2040-2050	2050-2060
Collier	5.3%	3.8%	3.0%	>1%	>1%	>1%
Florida Total	1.8%	1.55%	1.26%	1.06%	0.96%	N/A

TABLE 9 - 3 STUDY AREA POPULATION GROWTH

	% Change 2000-2060
Collier	215%
Florida	85.9%

9.12.3 Water Demand

Under all alternatives the water demands will increase due to an increase in population. Water demand calculations are being conducted for 2000-2050 by Gulf Engineers in conjunction with the Southwest Florida Feasibility Study. The results of these projections are in draft form, but the final figures are not expected to significantly change. Preliminary water demand projections estimate Collier County's most likely population scenario, conservation-adjusted water use in 2050 at 295.3 MGD. Due to the exceptionally small rate of growth projected between 2050 and 2060, it not expected that 2060's water demands will be any higher than in 2050, after taking into account conservation measures. Collier County is expected to be using 60 percent of the total water demanded in the Lower West Coast.

With the implementation of the recommend plan, the groundwater levels will increase leading to increased supplies of water and decreased salinity levels in private wells in the NGGE. With more persons drawing water and less water available, the increased level of groundwater may provide incidental water supply benefits. The amount of additional water supplied is unknown, so an attempt to quantify the NED benefits has not been conducted.

The SFWMD requires the development of water conservation plans as a prerequisite for water utilities to obtain a water use permit. With the implementation of conservation plans, water demand should change. Most conservation plans incorporate passive water conservation measures that include increasing block rate structures, the required use of ultra-low flow water fixtures on new or renovated construction, restrictions on lawn watering, requiring rain sensors on automatic sprinkler systems, a leak detection program, and public education concerning water conservation measures.

9.13 AESTHETIC RESOURCES

Under Alternative 3D, 100 percent of the SGGE landscape would be in public ownership and managed as a natural area. The existing infrastructure of roads and canals would be mostly eliminated. Limited motor vehicle access would reduce illegal dumping, poaching, and the irresponsible use of firearms.

9.14 HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE

The SFWMD contracted with URS Corporation for Hazardous, Toxic, and Radioactive Waste (HTRW) Phase I, II, & III assessments on the SGGE project site and immediate surrounding area. The contract was completed on September 30, 2003 by delivery of the report entitled *Phase I/II Environmental Site & Ecological Risk Assessment*. Additionally the District contracted with Environmental Consulting & Technology, Inc (ECT), to delineate impacts in a portion of the SGGE project and prepare a supplemental assessment a report entitled *Additional Scope Sampling Program*. Executive summaries for the URS and ECT reports, including instructions for accessing an electronic copy of each document, can be found in Appendix D. The URS report delineates the project area into 4 zones. The following is a brief overview of the potential HTRW remediation solutions within each zone. Each of these specific zones can be located on Figure 3-3. High levels of selenium, chlordane and dieldrin were found on several locations in the project area, which could pose a risk to small mammals, birds, and invertebrates.

(1) Interior Area

The URS report identified no significant HTRW impacts that would inhibit the proposed restoration activities within this zone. It recommended that the homesteads in the Interior Area be surveyed for potential asbestos containing materials, the potable wells abandoned, and the septic systems decommissioned.

(2) Former Agricultural Area – Southeast (FASE)

Soil sampling in this zone identified selenium above the USFWS interim guideline concentration. The results of the URS ERA indicate that levels of selenium in soils found within these two areas may pose a minimal risk potential for small ground foraging mammals however it is unlikely that the contamination will affect any ESA trustee species. Based on the results of the selenium desorption tests, the statistical review, and groundwater analytical results, it was recommended in the Phase III ERA that no additional assessments or corrective activities be conducted in the FASE. This zone within SGGE should be acceptable for the District's proposed future use of the property. It is important to note that the USFWS has not completed their review of this section of the property. At sites where selenium has been found in high concentrations in the FASE (Grids 25 and 29), it was tentatively recommend that remediation or capping actions be conducted.

(3) Former Agricultural Area Northeast (FANE)

Composite soil sampling within the FANE identified areas of organochlorine pesticides above the Sediment Quality Assessment Guideline (SQAG). Follow-up testing indicated that these residual pesticides were not consistently applied across the FANE, and are limited to localized areas at low concentrations. Two of the 24 composite soil samples contained selenium at levels above USFWS

guidelines. Based on the results of the ERA, soils impacted with selenium in the FANE may pose a minimal risk potential for certain small ground foraging mammals, however; it is unlikely that these selenium concentrations will affect the USFWS trustee species. According to the URS Phase III report the FANE is acceptable for the District proposed future use pending FWS final review and concurrence.

(4) Former Agricultural Area – West (FAW)

Soil sampling within the FAW indicated that organochlorine pesticides chlordane and dieldrin were detected above the SQAG and selenium above the USFWS interim guideline concentration. Therefore the URS report recommends that the District Project manager and project design team (PDT) consider implementing a final design to minimize the ecological risk associated with inundating the contaminated areas. Design modifications consistent with minimizing this ecological risk may include shifting the southwestern project boundary to exclude the impacted area, site grading, and changing the depth/time interval of flooding by manipulating pump operations. In the event that these design modifications are not reasonable alternatives, corrective action may be required.

ECT conducted a supplementary assessment to confirm the extent of impacted soil that will require corrective action. Since no selenium was detected above the 1.0 mg/kg USFWS guidance concentration, ECT proposed no further action with respect to selenium impacts. Nevertheless, as discussed with the USFWS, ECT will re-sample grids 29 and 30 (25 acres each) with the USFWS to confirm results in these two grids. It is anticipated that the selenium re-sampling will return results less than the guidance concentration. In the event the guidance concentration is exceeded, corrective action may be required.

Based on the results of the supplementary assessment, 36 acres of chlordane impacted soil will require additional assessment or corrective actions. A remedial approach was developed that could effectively balance the reduction of risk to an acceptable level and reasonable restoration costs. The remediation strategy is predicated on USFWS' conceptual agreement that (1) "hotspots" identified in a 2000 FDEP report (and included in ECT's estimation of area of impacts) will be delineated and (2) three remediation approaches will be applied, based on the severity of chlordane impacts. The three remediation approaches are:

- Soil inversion by plowing of 8 acres (low-level chlordane impacts, e.g., between 100 ug/kg and 200 ug/kg);
- Soil inversion by burial and capping of 21 acres (by trackhoe/pan scraper) with native, subsurface soils (medium level impacts, e.g., between 200 ug/kg and 1,000 ug/kg); and
- Excavation and disposal of 7 acres for high impacts (e.g., greater than 1,000 ug/kg).

Corrective action costs were estimated based on assumptions of areal extent of impacts, unit costs from the 2004 Means Construction Cost Estimating manual, and unit costs obtained from contractors. The estimated corrective action cost for the 36 acres in FAW is \$1,690,000.

Under Alternative 3D the asphalt from the 60 miles of paved road within SGGE would be removed and disposed of consistent with DEP and EPA guidance.

9.15 CULTURAL RESOURCES

Coordination with the State Historic Preservation Officer (SHPO) of the recommended alternative 3D is complete. The Army Corps of Engineers (Corps) has concluded that Phase I and Phase II cultural resources surveys are necessary to determine the potential impacts of alternative 3D on historic resources.

These surveys are being coordinated with the SHPO and the Advisory Council on Historical Places (ACHP), in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended through 2000 (PL-89-665) and the Archaeological and Historic Preservation Act of 1974, as amend (PL 93-291). Site file reviews, consultation with the SHPO, other concerned parties, surveys, and determinations of significance will continue until the Section 106 process is completed. If research identifies additional historic properties that are determined to be eligible or potentially eligible for the National Register of Historic Places, further measures will be taken to avoid, minimize or mitigate adverse impacts to such sites. Required Cultural Resource Management (CRM) Surveys will be conducted during the DDR phase of this project.

Coordination with SHPO on that portion of alternative 3D known as the Prairie Canal “Early Start” project construction is complete. A Phase I Survey of the Prairie Canal area was conducted as part of the “Early Start Prairie Canal Project”. The survey area was a 60-meter band on each side of Prairie Canal, from the north terminus to the south bend, an estimated 7 miles. The Phase I survey did not locate any previously unrecorded archaeological or historical sites in the project area; therefore, the refilling of Prairie Canal will have no impact on any known archaeological or historical sites that are eligible, or potential eligible, to the National Register.

A second portion of the survey, a Phase II Survey of areas considered to be high probability, located between 88th Ave. SE & 92nd Ave SE and 104th & 106th Ave St., were not surveyed due to inclement weather. These high probability areas will be investigated in future.

9.16 RECREATION RESOURCES

The SGGE ecosystems can support a significant amount of outdoor recreation in the Lower West Coast of Florida. A significant portion of the expenditures comes from tourists. It is not possible at this time to anticipate precisely how expenditures and consumer surplus associated with SGGE-related recreation would change with the recommended plan. However, based on the recent adverse effects related to environmental damaging of the ecosystem, it can be concluded that improving the environmental quality of the SGGE ecosystem, there will be substantially increased recreation-based businesses. Future recreational activities will be environmentally friendly activities and not contribute to future detriment of the ecosystem. Given the potential levels of expenditures and consumer surplus in the future, a small percentage increase in the quantity or quality of SGGE-related recreation could represent an increase in recreation value.

The State of Florida has planned recreation activities to be implemented with or without the SGGE project implementation. The uses presently considered compatible with resource protection and passive recreation include: horseback riding, hiking, camping, fishing, off road bicycling, hang gliding, some types of hunting, wildlife viewing and nature study. All the uses are consistent with the five-year management plan and use best management practices (BMPs) to protect the natural resources.

Benefits that could arise from recreation include the following:

- Properties that are adjacent to recreation areas often increase in value.
- Can provide stimulus for growth in the immediate area.
- Create a demand for jobs, sales, and service to tourists.

9.17 NOISE

The elimination of 227 miles of road under alternative 3D would have a beneficial effect on noise pollution. Reducing easy access by motor vehicle should decrease noise from the incidences of reckless firearm use. The restriction on use of ORV would also lower noise levels.

9.18 ENVIRONMENTAL EFFECTS ON ADJACENT LANDS

Within the SGGE Study Area (Figure 1-4) the following administrative units will be affected by Alternative 3D: Fakahatchee Strand State Preserve (FSSP), Panther National Wildlife Refuge (FPNWR), South Belle Meade (SBM), Collier

Seminole State Park (CSSP), and the estuaries and bays of the Ten Thousand Islands Region. Ecosystem restoration in SGGE would restore the connectivity (Figure 1-1) between all of these units. Other benefits to CSSP and FPNWR from 3D would be primarily hydrologic with the consequent improvement in the health of their native plant communities.

Under alternative 3D, the 42 miles of the canal system in SGGE would be removed. The hydrology would be restored to near pre-drainage conditions. Plugging and filling of the Faka Union Canal system would restore sheet flow across the landscape, reestablish the natural flowways, and bring back ground water levels to near pre-drainage conditions on much of the surrounding public lands. Plugging the Prairie Canal would improve ground water levels within the affected portion of Fakahatchee Strand State Preserve. Filling the Merritt Canal would mitigate overdrainage problems in the FL Panther National Wildlife Refuge. Flowways in South Belle Meade and Collier Seminole State Park would be reestablished by plugging the Miller and Faka Union Canals. Damaging freshwater surges from the Faka Union Canal system into Faka Union Bay would be eliminated. The other bays within the Ten Thousand Islands Region would benefit from a return of the slow discharge of fresh water flows from creeks and springs that are needed for healthy estuarine ecosystems.

9.18.1 Cumulative Effects

A cumulative impact, according to the Council on Environmental Quality's National Environmental Policy Act-implementing guidelines, is "the impact on the environment that results from the incremental impact of the action when added to other past, present, and 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 time (40 CFR 1508.7)." Individually, the alternative 3D would benefit estuarine resources, wildlife, water quality, water supply, and other ecosystem values in the SGGE Study Area. Together with other similar ecosystem restoration activities (which are existing or being considered in the area) even greater benefit could be expected. The Southwest Florida Feasibility Study (SWFFS) is an ongoing inquiry that may be able to enhance the ecosystem benefits that the SGGE restoration project would produce.

The Tamiami Trail Critical Project involves road resurfacing and the construction of new culverts under U.S. Highway 41 to facilitate the more natural redirected flows from the SGGE hydrologic restoration. Although this project has overall beneficial effects, it may potentially increase overall vehicle use, which, in turn, may pose long-term consequences to endangered Florida panthers in the form of increased automobile-animal interactions.

Fish and wildlife as well as T&E species are vulnerable throughout the SGGE Planning Area. Urbanization, rural subdivision, timbering, agriculture, and other land-clearing activities continue to destroy, degrade, and fragment their habitat. Lack of fire or infrequent fire that maintains habitat quality, invasion by exotic vegetation, and short-circuiting of the natural hydrology would persist as problems for all plant and animal species.

Eutrophication of water bodies and wetlands occurs in SW Florida through inappropriate disposal of domestic sewage and runoff of nutrient-laden water from urban and agricultural lands. The build out of Northern Golden Gate Estates and other acreage in the Planning Area may cause longterm degradation of water quality entering the SGGE Project Area.

While hydrologic conditions most favorable to one species may not be most favorable for another, all animals have evolved to survive the hydrologic variability characteristic of the natural system. The reduced heterogeneity and extent of the present SGGE habitat make certain species more vulnerable to natural and man-caused threats. Management actions may be required on a temporary basis to protect a particular species from a high risk of extinction, but long-term management goals should not be driven by protection of a single species, but rather geared toward the sustainability of the entire ecosystem.

9.19 ENVIRONMENTAL COMMITMENTS

The Corps and its sponsor the SFWMD agree to follow-up on and maintain the commitments in the Ecological and Water Quality Monitoring Plan located in Appendix H. The U.S. Army Corps of Engineers and contractors commit to avoiding, minimizing, or mitigating for adverse effects by taking the following actions:

1. Employ best management practices with regard to erosion and turbidity control. Prior to construction, the construction team should examine all areas of proposed erosion/turbidity control in the field, and make adjustments to the plan specified in the plan control device as warranted by actual field conditions at the time of construction.
2. Construction at each location should be timed to avoid relevant nesting and/or breeding seasons for animals, which may be impacted by the project. Each location should be surveyed prior to construction to determine if any protected species are using the area.
3. The contract specifications will prohibit the contractor from dumping oil, fuel, or hazardous wastes in the work area and will require that the contractor adopt safe and sanitary measures for the disposal of solid wastes. Contract

specifications will also include protective measures for listed species as appropriate, in coordination with FWC and FWS. A spill prevention plan will be prepared.

4. Demolition debris would be transported to a landfill or otherwise disposed of in accordance with Federal, State, and local requirements. Concrete or paving materials would be disposed of in accordance with Federal, State, and local requirements.

5. The Corps and the SFWMD agree to maintain an open and cooperative informal consultation process with the FWS throughout the design, construction, and operation of this restoration project.

9.20 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Alternative 3D would require commitment of a combination of local, state, and federal funding, labor project materials, and energy to build, operate and maintain this ecosystem restoration project. The estimated cost of this alternative is \$349,422,000. Four canals would be permanently plugged, 227 miles of roads would be removed, 19,992 parcels would be purchased from private landowners, and 55,247 acres would be restored to a more natural pre-drainage condition.

9.21 RELATIONSHIP BETWEEN SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

The overall long-term goal of this restoration project is to create a healthy, sustainable ecosystem on the SGGE landscape and to restore more natural freshwater flows to the bays and estuaries of the Ten Thousand Islands Region. Alternative 3D will reduce the negative environmental impacts relative to the infrastructure of the SGGE subdivision including loss of wetland habitat, contaminants into the groundwater, freshwater surge discharges, wildlife disturbance due to human activities, and irreversible conversion of wetlands into residences. With implementation, approximately 55,247 acres of natural areas will come into public ownership. Over the long-term, these areas will form a more natural mosaic of habitats, decrease runoff, increase water quality, and provide habitat for numerous species of plants and animals.

9.22 UNAVOIDABLE ADVERSE ENVIRONMENTAL EFFECTS

Alternative 3D would result in net benefits to the SGGE watershed and the bays and estuaries in the Ten Thousand Islands Region. Direct impacts to the fish and wildlife habitat would be small and offset by the environmental benefits of this project. Construction would require filling or plugging of the canals, which would displace fauna currently living in them. The Corps is conducting Section 7 consultation with the USFWS and National Marine Fisheries Service and both agencies have concluded that this alternative would have overall benefits to the ecosystem required by the threatened and endangered species existing in the Study Area. For more information see the USFWS FCAR in Appendix D.

Construction activities proposed under the preferred alternative that may result in the removal of native vegetation, include: the removal and grading of selected roads, ditches, and berms; and the construction of canal plugs, spreader channels, pump stations, and earthen levees around private property.

Exotic plant species such as Melaleuca, cogon grass, and especially Brazilian pepper are common in the Study Area. Soil disturbance associated with construction activities creates the potential for introduction and propagation of exotic and nuisance plant species. This propagation has already been observed in the Prairie Canal backfill project (Duever, pers. comm. Jan. 28, 2004). Invasion of restored areas by exotic plants would limit restoration benefits by more than 2,735 acres (approximate footprint of disturbance associated with canal and road removal). Introduction of exotics, or creation of conditions that favor exotic establishment, will be addressed in contract specifications for future work, if the project is approved.

Noise, fumes, and human presence associated with mobilization of equipment and temporary construction activities may disturb roosting or foraging wading and water birds as well as breeding birds. Construction activities will result in the loss of some native fishes, particularly sunfish and tarpon. Amphibians and reptiles may experience temporary increases in mortality associated with construction access on roadways during the wet season or the onset of dredge and fill activities after the wet season

Canals function as fire breaks which would be partially eliminated by canal backfill activities.