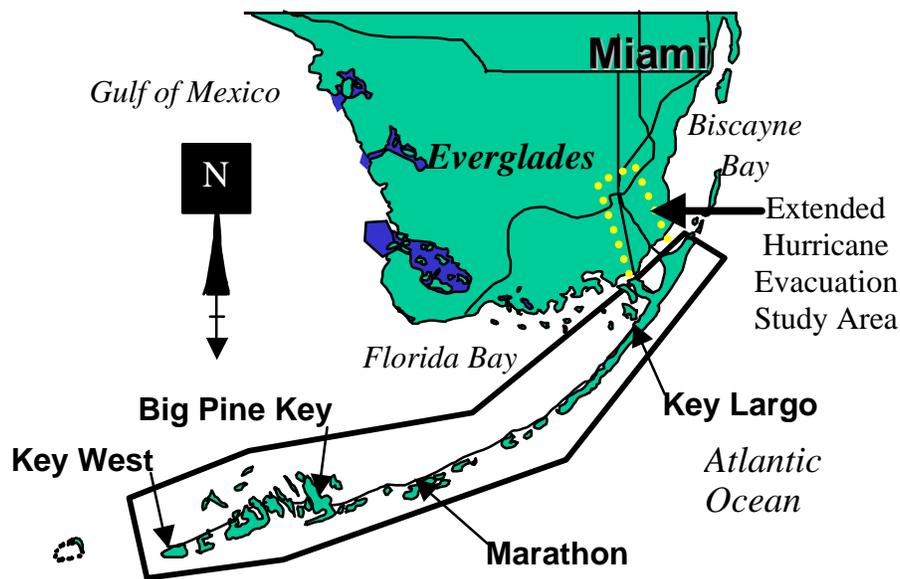


2.0 STUDY METHODS AND PROCESS

2.1 STUDY AREA: THE FLORIDA KEYS CONTEXT

The Florida Keys are a 113-mile long chain of low-elevation islands with a combined area of approximately 100 square miles, and over 200 additional minor islands. The study area encompasses the portion of Monroe County that spans from Key Largo to directly east of the Marquesas, and follows the same boundaries as the Florida Keys National Marine Sanctuary (FKNMS; Figure 2.1). While the mainland portion of Monroe County at the southernmost tip of the Florida peninsula is excluded, the study area considers the hurricane evacuation route to the Florida Turnpike in Miami-Dade County.

FIGURE 2.1
STUDY AREA



The Florida Keys have unique characteristics that affect future planning. First, commercial activities and residential development are largely concentrated along the U.S. Highway 1 (U.S. 1) corridor. U.S. 1 provides not only a structural backbone to the Keys, but it also is its only land-based evacuation route. Second, the economy of the Florida Keys largely relies upon the tourism industry, which creates external demands for land and services. Third, over 60 percent of the land mass is in government ownership, the vast majority of which is set aside for conservation. Conservation lands in the Keys include three state parks and four National Wildlife Refuges, which provide habitat to over 100 protected species of flora and fauna; in addition, the FKNMS includes the marine waters around the Florida Keys. Finally, upland habitats in the Florida Keys, namely hammocks and pinelands, include over 30 endemic species of plants and animals. Hammocks in the Keys harbor several tropical plant species, which reach the northern limit of their distribution in the Florida Keys.

2.2 METHODOLOGICAL APPROACH

The FKCCS largely relied on existing information and focused on two main approaches: the interpretation of existing data and the development of a supplemental analysis tool, the Carrying Capacity/Impact Assessment Model (CCIAM), designed to aid in the evaluation of future development scenarios. While the CCIAM was the focus of most of the stakeholders' scrutiny, the final conclusions of the study draw heavily from insight gained from interpreting data and information outside of the model.

The Technical Contractor searched for and assimilated data throughout the study. All data was evaluated for its suitability for the study and, in particular, for inclusion in the model. The Florida Marine Research Institute (FMRI) acted as the database manager for the study, in charge of data acquisition.

To develop the model, the study team (Technical Contractor and study sponsors) sought data that helped establish predictive relationships between land use and the study categories: natural environment, socioeconomics, and human infrastructure. From the outset, the study team understood that predictive relationships codified in the model had to be scientifically sound and, ideally, based on peer-reviewed scientific literature.

Many residents of the Florida Keys, as well as professionals with extensive experience in the Keys, shared a plethora of anecdotal, observational, circumstantial, and punctual data regarding the terrestrial and marine environments of the Florida Keys. Further, numerous agency reports, non-governmental organizations' documents, and other non-peer-reviewed information provide insight into environmental and socioeconomic issues in the Florida Keys. The study team identified, acquired, and assimilated much of this information into the study.

2.3 DELIVERY ORDERS: THE BUILDING BLOCKS OF THE STUDY

The Technical Contractor, a multidisciplinary team of consultants led by URS Corporation (formerly Dames & Moore), worked under an Indefinite Quantity/Indefinite Delivery Contract with the U.S. Army Corps of Engineers (USACE). Under the master contract, the USACE issued 12 Delivery Orders (DOs) to cover specific aspects of the study. The scope of work for each DO was developed through coordination between the study sponsors, the Technical Contractor and, typically, with input from outside experts. The DOs constitute the building blocks of the study. Final reports produced for all DOs are appended to this report (Appendix A).

2.3.1 Contractor Engagement and Literature Review on Terrestrial and Marine Ecosystems and Species

DO 1 was issued in late 1999, and provided for the Technical Contractor's official engagement in the study. The Technical Contractor attended the last two Technical Workshops: Carrying Capacity Analysis Model Framework (November 1999) and Scenario Development (January 2000).

Under DO 2, the Technical Contractor conducted a comprehensive search to determine the availability of literature, data and databases, mapping, studies and models that were relevant to the study. The initial search was conducted through resources available at the University of Miami, Coral Gables, Florida, as well as Internet resources and coordination with other studies, particularly the Regional Habitat Plan for Big Pine and No Name Keys, Monroe County, Florida. The initial literature search identified a total of 853 references, which were compiled and organized in a ProCite database.

A second effort under DO 2 focused on marine and terrestrial ecosystems and species. The Technical Contractor identified, acquired, and reviewed literature in order to extract documented thresholds, limiting factors, and tolerance limits for terrestrial and marine ecosystems and species. The search also included contacting external technical experts. A total of 10 ecosystems and 24 species or species assemblages were considered. The search yielded over 600 references, which were collected, reviewed, and assimilated.

Very few references provided clear thresholds or clear-cut numerical values for the parameters examined. The literature on terrestrial ecosystems and species, as well as several of the experts contacted, indicated that habitat availability and quality are primary factors in determining the presence of viable populations of plant and animal species in the Florida Keys. The literature documented strict habitat requirements for some of the terrestrial species evaluated. For example:

- Schaus' swallowtail butterfly (*Papilio aristodemus ponceanus*) requires mature hammocks and the presence of sufficient stands of its primary larval host plant, torchwood (*Amyris elemifera*; Emmel 1995a,b).
- Minimum habitat patch size requirements or home ranges have been quantified for a few species such as the Lower Keys marsh rabbit (*Sylvilagus palustris heffnerii*), fledging white-crowned pigeons (*Columba leucocephala*), black-whiskered vireos (*Vireo altiloquus*), and other forest nesting birds (Bancroft et al. 1995, Forsy and Humphrey 1994, 1996).
- Garber's spurge (*Euphorbia garberi*) is restricted to pineland sites that undergo frequent burns (USFWS 1999).

The literature on marine ecosystems and species suggested that water quality, including nutrient concentrations, clarity, and other parameters, is a primary factor influencing the responses of marine ecosystems and species (reviewed in Chiappone and Sullivan 1996, Porter and Porter 2002). Experts in the field discussed the difficulties in establishing absolute thresholds for parameters affecting marine ecosystems and species. Much of this difficulty results from the complex interactions among physical-chemical parameters and their combined, multi-variate effects on ecosystems and species.

2.3.2 Development of a Project Strategy

Under DO 3, the Technical Contractor developed the outline of a strategy to execute the study. The strategy report described and summarized the results of a Technical Contractor/Government Study Team Modeling Workshop for the Florida Keys Carrying Capacity Study (FKCCS), held in Marathon on March 22 and 23, 2000. It outlined the Technical Contractor's strategy to execute the project. The strategy reflected the direction provided by the Government Study Team, the input provided by local government representatives, and the discussions and recommendations made by technical experts in the nine Technical Workshops held in 1999-2000.

The Project Strategy Outline established general assumptions for the study, discussed the conceptual structure of the CCIAM, and set out a sequence of DOs necessary to complete the study. In agreement with the Government Study Team, the Strategy Outline identified the need for a flexible DO, which would provide for project coordination and specific activities that might be required from time to time. The USACE issued DO 4 to meet this need.

2.3.3 The Design of a Conceptual Model

DO 5 provided for three key elements of the study: a Users Needs Assessment (UNA), the development of the conceptual CCIAM, and the preparation of a report entitled, "Preliminary Assessment of Carrying Capacity Concept and Feasibility Report."

The UNA included the following activities:

- Identifying the users of the FKCCS.
- Developing a questionnaire regarding current development dynamics, planning/regulatory activities, planning issues/community concerns, and information technology/Geographic Information Systems (GIS).
- Scheduling and performing interviews with the users.
- Developing a prototype graphic user interface (GUI) for the CCIAM.
- Convening and facilitating a workshop with the users to discuss the findings of the UNA.

The primary users of the study are the Florida Department of Community Affairs (DCA), Monroe County, Village of Islamorada, City of Layton, City of Key Colony Beach, City of Marathon, City of Key West, and the South Florida Regional Planning Council. Other entities may benefit from the study.

While most agencies were interested in the regional answers the model could provide, it was generally recognized that these Keys-wide answers might be of limited use to local planners in their day-to-day work. The concept of providing access to data used and generated in the FKCCS through an Internet application was borne from this realization. This Internet application was named the "Routine Planning Support Tool" (RPST). A by-product of the study,

the RPST will allow users to view GIS data and perform basic GIS functions using a web browser (see Section 3.0).

The Preliminary Assessment of Carrying Capacity Concept and Feasibility Report, issued in October 2000, concluded that it was feasible to develop an adequate and defensible model to support land use policy decisions.

In January 2001, the study team hosted a workshop entitled “Technical Wrap-Up Workshop” in Key Largo to present the Draft CCIAM, developed under DO 5. The Technical Wrap-Up Workshop reconvened the experts who had participated in the Technical Workshop series, as well as the National Research Council (NRC) Review Committee, which had already been engaged to provide an independent technical review of the study. Over 65 experts from around the country gathered to critique the study and model progress to date.

2.3.4 Assessment of Benthic Communities in the Florida Keys

From the outset of the carrying capacity efforts in the mid-1990s, it was obvious that one of the most difficult areas of the study was the marine environment. In particular, understanding the complex interactions between land use and land development with water quality and, ultimately, the health of marine ecosystems and species, had proven elusive. Dr. Jim Fourqurean and Ms. Leanne Miller-Rutten (Florida International University (FIU)) had developed a scope of work to explore spatial and temporal variations within nearshore benthic communities and their associated nutrient regimes and to determine if these variations were associated with land use activity in the Florida Keys. FIU conducted the study under a sub-contract with URS, as part of the FKCCS’ DO 6.

2.3.5 Mapping Historical Habitats in the Florida Keys

DO 7 provided for the development of a historic terrestrial habitat map for the FKCCS area. The purpose of the map was to assess both historic conditions and changes over time. The primary sources of information used to interpret historic vegetation included three aerial photograph series, ranging from 1945 to 1959. The 1945, 1955, and 1959 aerial photographs are the earliest available for the entire study area. Therefore, the resulting map depicted conditions as of 1945.

Comparisons between the 1945 (historic map) and 1991 (Advance Wetland Identification Map, FMRI 1995; see Section 3.0) maps showed an increase of 140 percent in developed areas. This was accompanied by sharp decreases in the area covered by pinelands (-38 percent), hammocks (-35 percent), and saltwater wetlands (-16 percent). Along with the decrease in the size of habitat patches, there was a significant increase in the number of patches for all vegetation types. The total number of patches, as well as that of each vegetation category, roughly doubled throughout the study area (see Section 4.0 for complete discussion).

2.3.6 Study of Water Issues in the Florida Keys

DO 8 entailed a massive effort to identify, acquire, review and assimilate existing data and literature regarding stormwater, wastewater, groundwater, and potable water supply in the Florida Keys.

Much of the effort in this DO focused on establishing parameters and predictive relationships for the Integrated Water Module of the CCIAM. For example, the Technical Contractor gathered rainfall data, event mean concentrations (EMC), and run-off coefficients applicable to the Florida Keys in order to develop the Stormwater Component of the module. DO 8 also included the development of the GIS-based spatial basis for the module. The final report for DO8 established the basis for the Integrated Water Module of the CCIAM.

2.3.7 Socioeconomic Aspects of the Florida Keys

The socioeconomic investigations for the FKCCS, carried out under DO 9, focused on the connection between land use, population, and demands generated on non-residential land uses. In order to establish these relationships, the Technical Contractor used available data to determine current socioeconomic conditions and trends as they relate to land use. DO 9 products included five reports, which documented the research conducted to develop the Socioeconomic Module of the FKCCS.

2.3.8 Evaluating Data Suitability for the FKCCS

One of the most comprehensive efforts in the study was the continuous pursuit of suitable data for the study and model development. The FKCCS relied almost exclusively on existing data, most of which were developed for specific purposes and using standards different from those of the FKCCS. The FMRI provided nearly 2.5 gigabytes of GIS data since October 2000. The Technical Contractor evaluated the suitability of these data for use in the study and the model. The DO 10 report discussed the steps taken to evaluate the suitability and assimilate each dataset acquired for the study.

2.3.9 Development and Refinement of the Test CCIAM

Under DO 11, the Technical Contractor continued to design and develop the CCIAM. Tests of the model were documented in a draft report dated November 2001. The National Research Council (NRC), as well as government agencies and non-governmental organizations, reviewed and critiqued the draft report. The final report for the Test CCIAM benefited from the extensive input those reviewers provided. The model and study were completed under DO 12, the results of which are presented in this FKCCS Final Report.

2.4 PUBLIC INFORMATION AND INVOLVEMENT PROGRAM

A separate contractor (The MarketShare Company) carried out a Public Involvement and Information Program (PIIP) to inform and involve the community in the CCIAM development process (Appendix B). The PIIP sought to develop a productive relationship with stakeholders and create a stakeholders database. The program specifically involved and informed the local

media, created a speakers' bureau, and created a traveling exhibit of educational information about the FKCCS. The PIIP included a media program, public meetings, stakeholder relations, and public information materials. In addition, the PIIP obtained the public input needed to understand and incorporate community character into the FKCCS.

The PIIP Contractor identified previous public opinion surveys taken in the Florida Keys. Environmental topics included natural resources, ecosystems, and species of concern, along with stormwater, wastewater, and water quality issues. Human infrastructure, transportation, and hurricane evacuation topics were also researched. The research yielded 21 previous surveys.

The media program involved developing and maintaining a comprehensive list of print and broadcast media contacts, and coordinating with the press and radio, especially prior to public meetings. In addition, the PIIP Contractor established a clipping service to track applicable and related articles from a variety of Keys' newspapers, newsletters, and special interest group publications including *The Miami Herald*, *The Key West Citizen*, and *The Florida Keys Keynoter*.

Periodically, PIIP Contractor prepared and distributed news releases and public notices. The USACE developed and monitored an FKCCS website to provide information to the public and receive comments. A mailing list of over 6,000 names was developed for disseminating information about the project, as well as a web-based comment tracking system to catalog and cross-reference all comments received via the Internet, mail, workshops, and other media.

Public meetings were held in the Upper, Middle, and Lower Keys in July 2000, March 2001, and April 2002. In addition, community meetings and study team and working group meetings helped furnish information to the public and enhance awareness and understanding of the FKCCS. Other meetings were held with government officials including Monroe County commissioners and municipality representatives.

Public information materials, including three brochures, were prepared at important progress points in the FKCCS development. A speakers' bureau was developed to provide direct communication with organizations throughout the Keys. In addition, a traveling exhibit was designed for public information and outreach. Beginning in November 2000, the exhibit began a schedule of one-week displays at various locations in the Keys. The exhibit provided a thorough description of the many elements of the FKCCS along with describing the goal, objectives, and timing of the work.

2.5 LOCAL PLANNERS WORKING GROUP

From the inception of the study, a Local Planners Working Group (LPWG) was convened to monitor the project progress and, in particular, to assist in ensuring that the study and CCIAM responded to the users needs. The Working Group included the Government Study Team (USACE, DCA), the Technical Contractor (URS Corporation), Monroe County, Village of Islamorada, City of Key Colony Beach, City of Layton, City of Marathon, City of Key West, and

the South Florida Regional Planning Council. The LPWG met roughly every two months through 2000 and most of 2001. All meetings were open to the public.

2.6 STAKEHOLDERS REVIEWS

The FKCCS and CCIAM have been under intense scrutiny from scientists, planners, government agencies, NGOs, and the public. In addition to the input gathered during the three years from the development of the SOW through the Technical Workshops (discussed in Section 1.0), interested parties had an opportunity to comment on the study through technical experts' review of interim FKCCS reports, periodic meetings with local planners, two series of public meetings, over 30 study team presentations to local groups, access to a project website, and a two-day Technical Wrap-Up Workshop which included over 65 experts as well as members of the NRC Review Committee.

Government Study Team members reviewed every FKCCS interim report (included in Appendix A). Most reports were also submitted to external technical experts for review. For example, the research on existing data on terrestrial and marine ecosystems and species was submitted to several experts in order to cover the variety of subjects involved in the research. In every case, reports were revised before being accepted as final.

Some stakeholders' expectations have contrasted with the study methods, progress, and findings. Many of the conflicting expectations are related to the regional scale of the study, the level of detail that has resulted from the required allocation of time and effort to a variety of disciplines (each of which could be the subject of detailed studies), and the almost exclusive use of existing data. Five examples illustrate stakeholder expectations that contrast with the study's framework and intent:

- During the user needs assessment, local planners expressed that the model should allow them to determine the impacts of individual development projects as part of their daily activities. Yet, because of its regional scale, the CCIAM was not intended to assist in individual permitting decisions. Several stakeholders, such as 1,000 Friends of Florida (OTFF) (letter to DCA, dated January 30, 2002), as well as recent newspaper articles (e.g., *The Key West Citizen*, editorial dated March 15, 2002) have expressed similar expectations. A GIS-based Internet application will serve the FKCCS data to the public and local planners. This decision was a direct result of the study team's work in the user needs assessment early on in the project. The prototype Internet application was demonstrated at the January 2001 Technical Wrap-Up Workshop.
- During the technical workshops and in the review of interim FKCCS reports, technical experts expressed expectations or recommended actions for which data do not exist or exceeded the level of effort that could be allocated in this study. For example, water circulation was identified as necessary to evaluate water quality and experts called for the preparation of a hydrodynamic model for the study area. However, the development of such a detailed model is

costly and time consuming; therefore, this recommendation could not be accommodated within the scope of the study. The Florida Bay and Florida Keys Feasibility Study, a component of the Comprehensive Everglades Restoration Plan, is currently addressing the need for a hydrodynamic model for the Florida Bay and Florida Keys. The CCIAM could be updated with this hydrodynamic model, upon completion of its development.

- Technical experts advocated the use of population viability analysis (PVA) techniques to evaluate whether development would jeopardize threatened and endangered species. A thorough literature search as part of DO 2 confirmed that PVAs required detailed population data, which is lacking for virtually every species in the Florida Keys. Two exceptions include the Lower Keys marsh rabbit (*Silvilagus palustris hefneri*) and the Florida Key deer (*Odocoileus virginianus clavium*). A PVA model was developed for the Lower Keys marsh rabbit in the mid-1990s (Forys and Humphrey 1999). For the Key deer, a three-year study recently completed (Lopez 2001) yielded a state-of-the-art PVA model, which is being used to support a Habitat Conservation Plan for Big Pine and No Name Keys sponsored by the Florida Department of Transportation (FDOT), DCA, and Monroe County.
- Recent comments have criticized the inclusion of socioeconomic parameters in the study (Environmental & Land Use Center, Inc. letter to DCA and USACE, dated February 12, 2002). However, the legal mandate for the study, discussed in Section 1.1, required that the study consider socioeconomic issues.
- Several reviewers and stakeholders, including the NRC (NRC 2002) and the FKCC (letter from Curtis Kruer to DCA and the USACE dated March 30, 2002), criticize the omission of local knowledge, anecdotal data, and expert opinion in the technical basis of the model. The Study Team assimilated and recognized the value of local knowledge and expert opinion in the FKCCS. However, in many cases the available information was insufficient or inappropriate to establish predictive relationships between additional land use activities and environmental parameters. Therefore, much available information, while valuable, was not used to build model relationships.
- Similarly, stakeholders pointed out the apparent omission of the effects of tourism in the model. The model incorporates “tourists” as part of the population present in the Keys on any given day (see Section 3.0), and directly measures their impact on water consumption, demand for non-residential land uses, and government expenditures. Data for other tourism-related parameters, such as boating or diving, are insufficient or inappropriate to establish predictive relationships between land use activities and those parameters.

Stakeholders, particularly the general public, expressed additional expectations. These included an evaluation of external issues such as the effect of further development in the tri-county area of southeast Florida, the potential effects of a government change in Cuba, the effects of sea level rise, or the potential effects of Everglades restoration activities. The study addresses issues such

as tourists and potable water, which are generated outside the Florida Keys. The Monroe County Tourist Development Council established the Inter-Governmental Cuba Committee to address issues regarding the opening of Cuba (Inter-Governmental Cuba Committee 2000). The potential effects of the Everglades restoration activities will be addressed in the Florida Bay/Florida Keys Feasibility Study. In adherence to its mandate, the FKCCS focused on the effects of land development activities in the Florida Keys.

The following sections summarize comments and recommendations made by stakeholders on the draft Test CCIAM report, issued in November 2001. It also provides a brief description of how the Technical Contractor addressed the comments.

A common theme was evident in comments by different stakeholders: almost unanimously, reviewers addressed the November 2001 Test CCIAM Report as if it were the final report of the study. Therefore, many comments focused on the interpretation of results or the conclusions of the study. The Test CCIAM Report only documented the testing process and the steps and refinements made to finalize the model.

2.6.1 National Academy of Sciences/National Research Council

The National Research Council provided an independent technical review of the draft Test CCIAM Report dated November 2001. Key comments were addressed as follows:

- **Use of 2000 Census data** - The NRC criticized the study for using Census 1990 and pointed out that this created errors throughout the model. Census 2000 data was not available when the November 2001 draft went to press. Census 2000 data has now been input into the model.
- **Use of independent population projections** - Independent population projections, developed by the Florida Bureau of Business Research (BEBR) and Monroe County were used to provide a reference point for other scenarios evaluated in the study. As the NRC recommended, the independent population projections were removed from the model.
- **Use of constant coefficients** - The NRC suggested that users should be able to change model coefficients at will. This recommendation was not accepted, as it would negate the research invested in developing the coefficients and would open the model to speculative analysis. Most coefficients remain constant, as the model is a steady-state model. However, coefficients can be modified as new data becomes available.
- **Socioeconomic indices** - The Test CCIAM included indices that were removed from the model following the NRC's recommendations.
- **Comments on the Fiscal Module** - The NRC criticized the Fiscal Module for not addressing the cost of stormwater and wastewater improvements and land acquisition and conversion. These costs are included in the Fiscal Module.

- **Comments on the Human Infrastructure Module** - Both the Traffic Component and the Hurricane Evacuation Component were modified.
- **Comments on the Integrated Water Module** - The NRC pointed out that the model omitted important water quality considerations such as pathogens, water quality in dead-end canals, and loading from illicit waste dumping from small craft. No reliable data exist to develop predictive relationships regarding land use activities and pathogens or illegal waste dumping from small craft. A modeling effort to assess impacts of land use on water quality in dead-end canals has now been incorporated into the model (see Section 3.0).
- **Marine Module** - The Marine Module was removed from the model.
- **Comments on the Terrestrial Module** - The NRC found that the Terrestrial Module of the Test CCIAM was appropriate and generally well designed. Several recommendations were made to improve the module, all of which were followed.

2.6.2 Government Agencies

U.S. Environmental Protection Agency

The U.S. Environmental Protection Agency (EPA) expressed questions regarding the assumptions and data used for the Integrated Water Module (letter from Beverly Banister to Ann Lazar, dated February 26, 2002, in lit.). In particular, they identified the need to create formal treatment of uncertainties, sensitivities, and probabilistic elements of the decision matrices. EPA states that, for the model to fulfill its potential as a planning tool, there must be some means provided to evaluate the reliability of a CCIAM prediction of a threshold being exceeded.

Specific modifications made to the CCIAM, which address EPA's comments, include the removal of the marine module and the incorporation of a canal module.

Florida Department of Environmental Protection

The Florida Department of Environmental Protection (FDEP) commented that the study is comprehensive in identifying the various critical socioeconomic and environmental components of the Florida Keys system, and the assumptions are conservative so that the predictions are worst case (electronic mail from Richard Drew and Dick Smith to Ann Lazar, dated March 2002, in lit.). FDEP observes that the Integrated Water Module is a transport model with dilution being the major action.

Regarding the stormwater and rainfall components, DEP observes that rainfall quantities are accurate but estimated pollutant concentrations are probably too low because of the extended period between rainfall events in the Keys as opposed to the source data. In addition, FDEP questions inconsistencies in the estimates of stormwater treatment particularly for passive retention facilities that rely on only filtration, and the selection of runoff coefficients based on land use values from other parts of Florida.

DEP considers that the potable water component is one of the most accurate in the model because of reliance on FKAA records and the absence of private wells. FDEP believes the cost for desalination will drop and be competitive with the increasing use of the southern Miami-Dade County wellfield.

The wastewater component overestimates and simplifies the pollutant load discharge to the nearshore environment. (FDEP's concern for a single conduit of discharge from each island to the nearshore area is now irrelevant because the marine module has been eliminated from the CCOAM). FDEP states that pollutant loading from OSTD's and stormwater sources overestimates the treatment efficiencies used from the Monroe County Sanitary Wastewater Master Plan. FDEP also stated a number of specific observations regarding the design and criteria used for the module.

Sensitivity analyses explored the effects of different treatment and pollutant reduction rates, and are discussed in Section 4.0.

Florida Fish and Wildlife Conservation Commission

The Florida Fish and Wildlife Conservation Commission (FWC) commented exclusively on the terrestrial module. Many questions pertained to the analysis design and conclusions drawn or not drawn regarding habitat loss and protected species declines (letter from Randy Kautz to Ann Lazar, dated February 19, 2002, in lit.). Comments also addressed the theory and purported results of the Smart Growth Scenario. Key issues include:

- The module treatment of habitat, protected species, and direct and secondary impacts requires explanation.
- The components and derivation of equations and indices need to be explained and supported for their validity to be judged.
- Individual data from studies of protected species needs to be reviewed for accuracy for inclusion in the CCIAM module, particularly for the Key deer, Lower Keys marsh rabbit, and others.
- The Smart Growth scenario requires additional analysis and explanation for the treatment of protected species and habitat impacts.

The Technical Contractor followed most of the FWC's recommendations.

South Florida Water Management District

The South Florida Water Management District (SFWMD) makes the overall observation that the study report makes a strong case for a Smart Growth scenario of limited growth and extensive implementation of capital programs to reduce pollutant loading from stormwater runoff and wastewater disposal (letter from Rhonda Haag to Ann Lazar, dated March 28, 2002, in lit.). They state that a no-growth scenario might be desirable, and that a primary value of the exercise might be the comprehensive review and assessment of a variety of databases specific to the Keys

and a body of evidence that supports careful management of the rate and types of development. SFWMD observes that some assumptions are questionable.

Under the components of stormwater, groundwater, potable water, and wastewater, SFWMD makes a variety of specific technical comments recommending revision and alternative viewpoints regarding the design and use of the FKCCS model. Key comments include:

- The key to the stormwater element success will be the future implementation of the Best Management Practices (BMPs) from the Stormwater Master Plan.
- The high concentration of groundwater pollutants may overwhelm the assimilative capacity of the nearshore environment; nearshore water quality has been degraded on a micro-scale.
- There are significant concerns for the study-assumed increase in potable water withdrawal from the Florida City wellfield. Alternative diversified sources must be considered to reduce the reliance on the regional system.
- Modification to the study is recommended to include wastewater issues such as the effects on human health and the use of other studies to measure marine health.

The study 1) does not assume an increase in potable water withdrawal, 2) eliminated the marine module, and 3) could not address human health issues due to lack of appropriate data to establish predictive relationships.

2.6.3 Non-Governmental Organizations

1,000 Friends of Florida (OTFF)

The OTFF commented on the Administration Commission's call for the CCIAM to consider threshold values including findings that nearshore water quality and the carrying capacity of the Key deer had been exceeded (letter from Charles Pattison to Mike McDaniel, dated January 30, 2002, in lit.). They question the model's intent to be used as a regional planning support tool for evaluation of possible development alternatives instead of as a daily permitting tool. OTFF states the need to identify levels of concern for several ecological, water quality and development parameters. Other general issues include:

- Infrastructure planning, cost and funding are important considerations associated with population changes. This includes the availability of increased water supply, which is in question based on permitted allocations and availability of the resource.
- The development potential of 12,000 lots is in question because of comprehensive plan policies. These lots have value as potential restoration sites.
- The assumption that the implementation of future stormwater BMPs will perform in the Keys as well as on the mainland is in question.

The study addresses the cost of infrastructure development and other government expenditures, and does not assume an increase in the withdrawal of potable water.

Environmental and Land Use Law Center

The Environmental and Land Use Law Center (ELULC) commented on behalf of the Florida Keys Citizens Coalition, Florida Keys Environmental Fund, Harris Park Neighborhood Association, Key Deer Protection Alliance, and Save Our Keys (letter from Richard Grosso to Mike McDaniel and Deborah Peterson, dated February 12, 2002, in lit.). Many comments addressed the CCIAM purpose and framework, particularly the analysis of scenarios and the ability of the Keys to withstand impacts of additional development. The Smart Growth definition and assumptions were questioned, particularly on the variety of adverse affects on Keys ecosystems and protected species. Specific comments include:

- There is a need for improvements in assumptions, information, analysis and reporting in the CCIAM report.
- The extent of habitat loss, fragmentation, and current conditions are addressed from a development and protected species carrying capacity perspective.
- The analysis seems calculated to determine the results of various levels of population growth and development, but not to determine the ability of ecosystems to accommodate any additional impacts.
- Some of the socioeconomic factors require explanation and the quality of life parameters should be included in the model.

Some of the comments from the ELULC addressed the Test CCIAM report as if it were the final report of the study. Most of their concerns are addressed in this Final Report.

World Wildlife Fund/The Ocean Conservancy

These two organizations were concerned with how the model addresses water quality issues particularly because of wastewater and stormwater treatment inadequacies (letter from Debra Harrison and David White to Mike McDaniel and Deborah Peterson, dated February 20, 2002, in lit.). They state that the test model is flawed with respect to assessing nutrient pollution and water quality of nearshore waters.

Most of their comments are no longer applicable due to the removal of the marine module. Concerns regarding water quality in canals are addressed in the new canal module.

Florida Keys Aqueduct Authority

The FKAA stated primary concerns and offered clarification on the potable water supply (letter from Roger Braun to Ann Lazar, dated February 27, 2002, in lit.).

- Future supply sources other than the wellfield may include the ASR process or the operational reverse osmosis plants.

- The SFWMD-permitted allocation is for an average day withdrawal of 15.83 millions of gallons per day (mgd) and maximum day withdrawal of 19.19 mgd. The FKAA has requested SFWMD to approve a revised permit volume, which would be authorized through 2006.
- Additional required demands would most likely be met by withdrawals from the Floridian Aquifer and reverse osmosis plants.
- The FKAA has taken measures to reduce excessive water use through rule making to adjust the rate structure and by requesting all communities to adopt mandatory water conservation and irrigation ordinances.

These comments were noted, but did not prompt modifications to the model or the study approach.

Florida Keys Citizens Coalition

Mr. Curtis Kruer prepared extensive comments on the FKCCS on behalf of the Florida Keys Citizens Coalition (FKCC) (letter from Curtis Kruer to Mike McDaniel and Deborah Peterson, dated March 30, 2002, in lit.). He addressed the study scope of work, methods, and conclusions. He stated concern for report observations that little useful data is available, and judges that the model is another impact assessment tool. He expressed disagreement with the supposed study conclusion that obvious environmental problems are really not problems. Finally, he observed that the CCIAM is limited in scope and operates at a coarse scale, and regretted the missed opportunity to use expert judgment, local knowledge, and common sense.

Many of the comments refer to the use of non-peer reviewed information in the model. Non-peer reviewed information is extensively used in the study to support results interpretation and study conclusions. However, only verifiable data was used to develop predictive relationships included in the model.