THE NATIONAL ACADEMIES
Advisers to the Nation on Science, Engineering, and Medicine
National Academy of Sciences
National Academy of Engineering
Institute of Medicine
National Research Council

Stephen D. Parker, Director
Water Science and Technology Board
Commission on Geosciences, Environment, and Resources
sdparker@nas.edu

January 5, 2000

Col. Terrence "Rock" Salt, Executive Director
South Florida Ecosystem Restoration Task Force
c/o Florida International University
OE Building, Room 148
Miami, Florida 33199

Dear Col. Salt:

I am pleased to submit the first "Quarterly Interim Progress Report" describing the activities and plans of the National Research Council's (NRC) new Committee on Restoration of the Greater Everglades Ecosystem (CROGEE). This report is one of the required deliverables described in Cooperative Agreement 5280-9-9029, executed August 31, 1999, between the National Academy of Sciences and the U.S. Department of the Interior supporting the work of the CROGEE.

Committee Appointment. As you know, within days after execution of the cooperative agreement, the CROGEE members were appointed with the approval of the NRC chair, Dr. Bruce Alberts. The selection resulted from a rigorous analysis of the various disciplinary needs and a broad solicitation of nominees for the committee. Approximately 200 qualified candidates were considered for membership, of whom 16 were invited to be members and of whom 15 accepted appointment. A geographer/environmental planner was invited to join the committee, but declined. The committee realizes the importance of land-use change on the greater Everglades ecosystem and therefore we plan to recommend the appointment of an expert in this field in the near future. The current committee membership roster and biographical sketches are attached (Attachments A and B).

Preparations for Committee Analysis and Staffing. In October and November 1999, a concentrated effort was made to compile background material on the Everglades history and the Restudy plan, to establish working relationships with the various parties engaged in the greater Everglades restoration effort, and to prepare for the first meeting of the committee, held on December 2-4, 1999, at the Anne Kolb Nature Center in Hollywood, Florida. The following NRC staff members have been assigned to the project (all part-time on this project): Patricia Jones, Staff Associate; William Logan, Staff Officer; Stephen Parker, WSTB Director who will serve as responsible staff officer; and David Policansky, Associate Director of the Board on Environmental Studies and Toxicology. As you know, on September 29-30, Dr. Policansky and I participated in a meeting of the South Florida Ecosystem Restoration Task Force (SFERTF) in

Ft. Lauderdale to further our education on issues, establish contacts, discuss plans for the committee, and generally answer questions about relevant NRC policies. This proved to be most helpful and informative. On December 2-4, all four staff members participated in the inaugural meeting of the CROGEE.

First Meeting of the Committee on Restoration of the Greater Everglades Ecosystem. The CROGEE held its first meeting on December 2-4, 1999, at the Anne Kolb Nature Center in Hollywood, Florida. As shown on the attached agenda (Attachment C), this meeting emphasized orientation and planning. Numerous presentations on the history and current science issues in the Everglades were provided on December 2-3, and on December 4 the CROGEE toured the northern Everglades and Everglades Agricultural Area via airboats and helicopter. A special stop was made at the Everglades Nutrient Removal site where short briefings were given by South Florida Water Management District (SFWMD) scientists. Minutes of the first meeting of the CROGEE are attached (Attachment D).

Future Plans for CROGEE. During the first meeting, the committee heard from scientists from many of the agencies and organizations involved in various Everglades restoration activities. Based on the presentations and discussions that took place at that meeting, the committee members formed some preliminary plans for the near future. This diverse committee has members from many parts of the United States, and some had only limited familiarity with the hydrological, ecological, social, and political framework that surrounds the Everglades system. They all gained an appreciation for the centuries-long history of human activity in the system, the multiplicity of current and proposed operational and construction features, the diversity of opinions concerning restoration goals, objectives and strategies, and the wealth of relevant published materials from the U.S. Army Corps of Engineers, SFERTF, SFWMD, Governor's Commission for a Sustainable South Florida, the Miccosukee and Seminole Indian Tribes, and other governmental and non-governmental organizations. However, even the members of the CROGEE most familiar with Everglades issues believe that further briefings in specific areas must be obtained before the committee will be in a position to address some of the very complex issues in an informed way. It did not, therefore, seem appropriate at this first meeting to establish a detailed and fixed plan of action. The committee did come to some consensus on the following issues.

Spatial, temporal, and social context.

The Cooperative Agreement between the NAS and the DOI states that the committee was established to provide scientific advice to the SFERTF and its multiple agencies charged with preservation and restoration of the Greater Everglades ecosystem. This guidance is to be in the areas of "restoration theory and conceptual ecosystem models, performance measures, and success indicators", "predictive hydrological and ecological models", "long term ecological trends in southern Florida", and "by mutual consent…particular topics of concern." The spatial and temporal dimensions of the greater Everglades ecosystem are interpreted fairly broadly for the purpose of providing this guidance. Most members agreed that the appropriate temporal context varies from the scale of decades for many of the processes to centuries or more for others

(such as response to sea-level rise). The degradation of the Everglades has taken place over many decades, and restoration is likely to require a similar time frame or longer. The spatial dimension would include not only the "wet" part of the system, but the populated centers including the urban and agricultural areas.

In the next half-century, as in the previous half-century, significant changes are likely in the major physical, biological, and socioeconomic drivers affecting the dynamic behavior of the Everglades. Indicative examples of social drivers include expected growth and settlement patterns of the South Florida population, a high degree of uncertainty in global and regional agriculture, dynamic and nonlinear land-use values across broad spatial scales, and severely restricted development options in a system that is already extremely stressed. Physical and biological examples include climatic change, sea-level rise, and the increased introduction of exotic species.

The future of the Everglades is highly dependent on these drivers. It is important that the broadest possible set of plausible future conditions be taken into account in the hydrological and ecological modeling. A priority for the committee, therefore, is to better understand the assumptions about development and other factors that impact the hydrology which serves as a key basis for Restudy implementation. This consideration is undertaken with an eye toward providing guidance for a flexible, robust, and scientifically grounded restoration effort.

This review would examine the interdependence among the land uses, hydrology, and ecology, and how they are being modeled (mathematically, conceptually, or otherwise) and used to predict the impacts of urban growth, climatic, and land and water management scenarios. Many of these goals are reflected in the Working Group's suggested topic #7 – Linking land-use planning to conservation planning (Document attached for reference—Attachment E).

Review of the scientific underpinning of the Conceptual Ecosystem Model report.

The committee, in concurrence with the Working Group (its suggested topic #1), agrees that a review of the scientific basis for the conceptual ecological models of the major physiographic features in South Florida should be of high priority. These models purport to link stressors of the ecosystem with a set of measurable attributes that can and will be used to characterize the ecological performance of the system. Inaccurate linkages may lead to inappropriate monitoring and assessment. While a well-designed adaptive assessment program should eventually uncover these problems, they may still be costly with respect to both time and money.

Therefore, selected components of this review might include:

- Review of the scientific underpinnings of the conceptual ecosystem models,
- Review of the assumed linkages between the conceptual ecosystem models and the hydrological models, and

- Review of the hydrological and ecological restoration targets, and consideration of the need for alternative restoration targets, including targets related to water quality.

Aquifer storage and recovery (ASR) (Working Group topic #3).

The importance of ASR to the overall success of the restoration plan, the unprecedented scale of the project, and the fact that three of the six proposed pilot projects involve ASR, all argue for expeditious review of this topic. The committee is eager to learn more about plans for ASR pilot projects, read available reviews on this topic, and to have some special attention given to this aspect in briefings provided at its second meeting. The committee is especially interested in how the design of the pilot projects will maximize learning and reduce uncertainty.

A review of the regional assessment of invasive exotic plants (Working Group topic #4).

One of the primary assumptions of the Restudy has been that "getting the water right" is the most important factor leading to ecologic restoration. One phenomenon that has complicated restoration efforts has been the introduction of alien species—both plant and animal—to the Everglades. A review of the nearly completed assessment of this threat by the Working Group would be an appropriate activity for this committee.

A review of the hydrological models with respect to the following topics:

- Sensitivity analysis of the hydrological models with respect to topographic gradients, vegetative flow resistance, and velocity measurements.
- Analysis of the size and location of water storage components proposed in the Restudy, particularly surface water storage, with the goal of seeking opportunities to reduce the reliance on more costly ASR or wastewater reuse components.
- The use of hydrological models and other supporting analyses to set depth and flow performance targets within the remnant Everglades.

In summary, consistent with the Cooperative Agreement, the committee proposes to evaluate implementation of the Restudy through two different kinds of review activities along parallel tracks. The first track consists of studies of general issues related to the robustness and flexibility of the overall plan, considering possible changes in the human, biological, and climatic drivers over and beyond the course of the restoration efforts. The second track would include more focused studies of various aspects of the plan. Progress reports such as this will maintain a current record of committee plans as they evolve.

Next Meeting. The second meeting of the CROGEE is tentatively scheduled to take place on February 28-March 1 in South Florida. One of the major goals of the meeting will be for the committee to learn more about the topics listed above. Additionally, in the weeks since the first meeting a number of other issues have been raised by committee members that we want to bring to your attention. These are listed on an attached document titled Information Needs

(Attachment F). The topics noted vary in scope from focused (e.g., Does a good review of research and data associated with STAs exist?) to broad (e.g., What assumptions and independent variables were used in the development and operation of the Natural System Model?). Obviously it will not be possible to address all of these issues—in addition to the topics already mentioned—in a two-day session. We look forward to discussing with you the best ways to begin providing some background information on these topics to the committee.

The next quarterly report, which will describe committee activities during January through March 2000 will be submitted in approximately mid-April. As we continue our information gathering and planning, we will keep you abreast of our day to day progress and information needs. We believe we are off to a great start and we appreciate your continued support. Please feel free to contact us should you have questions or comments about this progress report or any other matter.

Sincerely,

Stephen D. Parker

Attachments

Attachment A

COMMITTEE ON RESTORATION OF THE GREATER EVERGLADES ECOSYSTEM "CROGEE"

Water Science and Technology Board (WSTB) (lead)
Board on Environmental Studies and Toxicology (BEST)
2101 Constitution Avenue, N.W., HA 466
Washington, D.C. 20418

Phone: 202-334-3422
Fax: 202-334-1961
www.national-academies.org/wstb
www.national-academies.org/cls/best

James M. Davidson, Chair
University of Florida, Gainesville (Ret.)
(agronomy/hydrology)

Scott W. Nixon,
Vice Chair
University of Rhode Island, Narragansett
(marine ecology)

Jean M. Bahr
University of Wisconsin, Madison
(hydrogeochemistry)

Linda K. Blum
University of Virginia, Charlottesville
(ecology)

Patrick L. Brezonik
University of Minnesota, St. Paul
(environmental engineering)

Frank W. Davis
University of California, Santa Barbara
(biogeography/ conservation planning)

Wayne C. Huber
Oregon State University, Corvallis
(hydrologic engineering)

Stephen R. Humphrey
University of Florida, Gainesville
(wildlife science)

Daniel P. Loucks
Cornell University
Ithaca, New York
(environmental systems engineering)

Gordon H. Orians
University of Washington, Seattle (Ret.)
(wildlife science)

Kenneth W. Potter
University of Wisconsin, Madison
(hydrology/water resources)

Larry Robinson
Florida Agricultural and Mechanical University, Tallahassee
(environmental chemistry)

Steven E. Sanderson
Emory University
Atlanta, Georgia
(environmental policy)

Rebecca R. Sharitz
Savannah River Ecology Laboratory
Aiken, South Carolina
and
University of Georgia, Atlanta
(botany/ecology)

John Vecchioli
U.S. Geological Survey
Tallahassee, Florida (Ret.)
(hydrogeology)

NRC STAFF
Stephen D. Parker
Director, WSTB
sdparker@nas.edu

David Policansky
Associate Director, BEST
dpolican@nas.edu

William S. Logan
Staff Officer
wlogan@nas.edu

Patricia A. Jones
Staff Associate
pjones@nas.edu

Attachment B

Committee Biographical Information

COMMITTEE ON RESTORATION
OF THE GREATER EVERGLADES ECOSYSTEM

JAMES M. DAVIDSON, CHAIR, recently retired as vice president for agriculture and natural resources at the University of Florida, a position he had held since 1992. From 1979 to 1992 Davidson served as assistant dean and dean for research for the University of Florida's Institute of Food and Agricultural Sciences (UF/IFAS). He arrived at the UF/IFAS in 1972, as a visiting associate professor and joined the faculty as a soil science professor in 1974. Davidson previously taught at Oklahoma State University and held laboratory research positions at Oregon State University and at the University of California, Davis. A widely recognized expert in hydrology and agronomy, he has served on numerous committees investigating groundwater quality, including the Water Science and Technology Board (1986-1990). He earned a bachelors degree in soil science and a masters degree in soil physics from Oregon State University and a doctorate in soil physics from the University of California, Davis.

JEAN M. BAHR is professor the Department of Geology and Geophysics at the University of Wisconsin-Madison where she has been a faculty member since 1987. She served as chair of the Water Resources Management Program, UW Institute for Environmental Studies, from 1995-99 and she is also a member of the Geological Engineering Program faculty. Her current research focuses on the interactions between physical and chemical processes that control mass transport in ground water. She earned a B.A in geology from Yale University and M.S. and Ph.D. degrees in applied earth sciences (hydrogeology) from Stanford University. She has served as a member of the National Research Council's Board on Radioactive Waste Management and several of its committees.

LINDA K. BLUM is research associate professor in the Department of Environmental Sciences at the University of Virginia. Her current research projects include study of mechanisms controlling bacterial community abundance, productivity, and structure in tidal marsh creeks; impacts of microbial processes on water quality; organic matter accretion in salt marsh sediments; and rhizosphere effects on organic matter decay in anaerobic sediments. Dr. Blum earned a B.S. and M.S. in forestry from Michigan Technological University and a Ph.D. in soil science from Cornell University.

PATRICK L. BREZONIK is professor of environmental engineering and director of the Water Resources Research Center at the University of Minnesota. Prior to his appointment at the University of Minnesota in the mid-1980's, Dr. Brezonik was professor of water chemistry and environmental science at the University of Florida. His research interests focus on biogeochemical processes in aquatic systems, with special emphasis on the impacts of human activity on water quality and element cycles in lakes. He has served as a member of the National Research Council's Water Science and Technology Board and as a member of several of its committees. He earned a B.S.

in chemistry from Marquette University and a M.S. and Ph.D. in water chemistry from the University of Wisconsin-Madison.

FRANK W. DAVIS is a Professor at the University of California Santa Barbara (USCB) with appointments in the Donald Bren School of Environmental Science and Management and the Department of Geography. He received his B.A. in biology from Williams College and a Ph.D. from the Department of Geography and Environmental Engineering at The Johns Hopkins University. He joined the Department of Geography at UCSB in 1983, and established the UCSB Biogeography Lab in 1991. His research focuses on the ecology and management of California chaparral and oak woodlands, landscape ecology, regional conservation planning, and spatial decision support sytems. He was Deputy Director of the National Center for Ecological Analysis and Synthesis between 1995 and 1998, and currently directs the Sierra Nevada Network for Education and Research Page. Dr. Davis has been a member of three prior NRC committees.

WAYNE C. HUBER is professor and head of the Department of Civil, Construction, and Environmental Engineering at Oregon State University. Prior to moving to Oregon State in 1991, he served 23 years on the faculty of the Department of Environmental Engineering Sciences at the University of Florida where he engaged in several studies involving the hydrology and water quality of South Florida regions. His technical interests are principally in the areas of surface hydrology, stormwater management, nonpoint source pollution, and transport processes related to water quality. He is one of the original authors of the Environmental Protection Agency's Storm Water Management Model (SWMM) and continues to maintain the model for the EPA. Dr. Huber holds a B.S. in engineering from the California Institute of Technology and an M.S. and Ph.D. in civil engineering from the Massachusetts Institute of Technology. He is currently a member of the NRC's Committee on Causes and Management of Coastal Eutrophication.

STEPHEN R. HUMPHREY is dean of the College of Natural Resources and Environment at the University of Florida where he also serves as affiliate professor of Latin American studies, wildlife ecology, and zoology. He also has been the curator in ecology for the Florida Museum of Natural History since 1980. Dr. Humphrey has authored and co-authored numerous articles and books on the effects of urbanization on wildlife. He holds B.A. in biology from Earlham College in Richmond, Indiana and a Ph.D. in zoology from Oklahoma State University. He is fomer chair of the Environmental Regulatory Commission of the Florida Department of Environmental Regulation and a member of the Florida Panther Technical Advisory Council of the Florida Game Commission.

DANIEL P. LOUCKS is professor of civil and environmental engineering at Cornell University. His research, teaching, and consulting interests are in the application of economics, engineering, and systems theory to problems involving environmental and water resources development and management. Dr. Loucks has taught at a number of

universities in the United States and abroad and has worked for the World Bank, and the International Institute for Applied Systems Analysis. He aslo served as a consultant to a variety of government and international organizations concerned with resource development and management. He is a member of the National Academy of Engineering and is currently a member of the National Research Council's Committee on Risk-Based Analyses for Flood Damage Reduction Studies.

SCOTT W. NIXON is professor of oceanography and director of the Rhode Island Sea Grant College Program at the University of Rhode Island. He currently teaches both graduate and undergraduate classes in oceanography and ecology. His current research interests include coastal ecology, with emphasis on estuaries, lagoons, and wetlands. He has served on three National Research Council committees including, most recently, the Committee on Coastal Oceans. Dr. Nixon received a B.A. in biology from the University of Delaware and a Ph.D. in botany/ecology from the University of North Carolina-Chapel Hill.

GORDON H. ORIANS (NAS) is professor emeritus of zoology at the University of Washington. Dr. Orians began teaching at the University of Washington in 1960 as an assistant professor of zoology and was director of the Institute for Environmental Studies 1976-1986. Dr. Orians has done pioneering research on the evolution of vertebrate social systems, both developing theory and testing a rich assortment of ideas. His research embodies studies on interspecific territoriality and optimal and central place foraging and integrates the concepts of environmental quality and habitat selection. Dr. Orians is a member of many professional societies and academies including the National Academy of Sciences. He has served on numerous National Research Council committees, including his current service as chair of the Board on Environmental Studies and Toxicology. He holds a B.S. from the University of Wisconsin and a Ph.D. from the University of California, Berkeley in zoology.

KENNETH W. POTTER is professor of civil and environmental engineering at the University of Wisconsin-Madison. His expertise is in hydrology and water resources, including hydrologic modeling, estimation of hydrologic risk, estimation of hydrologic budgets, watershed monitoring and assessment, and aquatic ecosystem restoration. He received his B.S. in geology from Louisiana State University and his Ph.D. in geography and environmental engineering from The Johns Hopkins University. He has served as a member of the NRC's Water Science and Technology Board and several of its committees.

LARRY ROBINSON is director of the Environmental Sciences Institute at Florida A&M University where he is also a professor. At Florida A&M University he has led efforts to establish B.S. and Ph.D. programs in environmental science in 1998 and 1999, respectively. His research interests include environmental chemistry and the application of nuclear methods to detect trace elements in environmental matrices and environmental policy and management. Previously he was group leader of a neutron

activation analysis laboratory at Oak Ridge National Laboratory (ORNL). At ORNL he served on the National Laboratory Diversity Council and was President of the Oak Ridge Branch of the NAACP. Dr. Robinson earned a B.S. in chemistry, summa cum laude, from Memphis State University and a Ph.D. in nuclear chemistry from Washington University in St. Louis, Missouri.

STEVEN E. SANDERSON is Vice President for Arts and Sciences and Dean of Emory College at Emory University in Atlanta, Georgia. In the mid-1980s, Dr. Sanderson served as Ford Foundation Program Officer for Rural Poverty and Resources in Brazil, where he designed and implemented the foundation's Amazon Program. He served on the faculty of the University of Florida from 1979 to 1997, chairing the Department of Political Science and directing the Tropical Conservation and Development Program. From 1994-97 he chaired the Social Science Research Council Committee for Research on Global Environmental Change. He served on the National Research Council's Committee on Human Dimensions of Global Change from 1993-1996. Dr. Sanderson earned a B.A. in history from the University of Central Arkansas, and an M.A. in political science from the University of Arkansas. He earned a second M.A. and Ph.D. in political science from Stanford University.

REBECCA R. SHARITZ is professor of botany at the University of Georgia and senior scientist at the Savannah River Ecology Laboratory in Aiken, South Carolina, where she has been the Head of the Division of Wetlands Ecology. Her research focuses on ecological processes in wetlands, including factors affecting the structure and function of bottomland hardwood and swamp forest ecosystems, responses of wetland communities to environmental disturbances, and effects of land management practices on nearby wetland systems. Dr. Sharitz has served on several NRC committees including, The Committee on Restoraton of Aquatic Ecosystems: Science, Technology and Public Policy. She received a B.S. in biology from Roanoke College and a Ph.D. in botany and plant ecology from the University of North Carolina.

JOHN VECCHIOLI recently retired as a hydrologist with the U.S. Geological Survey's Water Resources Division in Tallahassee, Florida and as chief of the Florida District Program. Previously, he was responsible for quality assurance of all technical aspects of ground water programs in Florida. His research interests have included study of hydraulic and geochemical aspects of waste injection in Florida and of artificial recharge in Long Island, N.Y. He has also done research on ground water-surface water interactions in New Jersey and Florida. Mr. Vecchioli received his B.S. and M.S. in geology from Rutgers University. Mr. Vecchioli previously served on the NRC's Committee on Ground Water Recharge.

Attachment C

Committee on Restoration of the Greater Everglades Ecosystem

First Meeting*
Hollywood, Florida
December 2-4, 1999

Agenda

Thursday, December 2

8:30 a.m. – 11:00 a.m. CLOSED SESSION (Committee and NRC Staff Only)

11:00 a.m. BREAK

OPEN MEETING

Getting Acquainted

11:15 a.m.	• Welcome, introductions, role of committee, plans and objectives of meeting	J. Davidson
11:25 a.m.	• SFERTF Welcome/introduction	R. Salt
11:30 a.m.	• Introduction to the NRC and overview of study process	S. Parker
11:50 a.m.	• Questions/discussion	

12:00 noon LUNCH[1]

Restoration Program Briefings

1:00 p.m.	• Introduction	B. Brown
1:05 p.m.	• Overview of restoration process	R. Salt
1:15 p.m.	• Description of natural system	S. Davis

* The meeting will take place at the Anne Kolb Nature Center, West Lake Park, 751 Sheridan Street, Hollywood, Florida 33019. Phone: (954) 926-2410.

[1] Members of the public who would like lunch provided should RSVP by Monday, November 29, by calling 202-334-1964. A check payable to the National Academy of Sciences in the amount of $13.50 will be required—cash will not be accepted.

1:45 p.m.	• Description of altered system	B. Kranzer T. Fontaine J. Browder
2:25 p.m.	• Questions and panel discussion	
2:45 p.m.	BREAK	

Restoration: Making It Right

3:05 p.m.	• Introduction	B. Brown
3:15 p.m.	• Water restoration projects	S. Appelbaum T. Teets
3:45 p.m.	• Land purchases	R. Smith
4:00 p.m.	• The science of restoration	J. Ogden S. Davis
4:30 p.m.	• Questions and panel discussion	

5:00 p.m. Meeting adjourns for the day and return to hotel

6:30 p.m. Committee dinner[2], followed by keynote talk, "Back to the Future—Perspectives on Everglades Restoration", by Lance Gunderson, Emory University (the public is invited for the talk at approximately 7:15 p.m.)

Friday, December 3, 1999

OPEN MEETING

8:00 a.m. Preliminaries

- Call to order
- Plans for day
- Announcements

[2] To be held at the Sheraton Ft. Lauderdale Airport Hotel (1825 Griffin Road, Dania, FL, 33004) in the "Windows" conference room on the first floor.

Restoration: Making it Right

Assessing the Science of Restoration

8:10 a.m.	• Panel presentation—Getting the water right ➢ Quality ➢ Quantity ➢ Timing ➢ Distribution	Leader: A. Higer
8:35 a.m.	➢ Questions and discussion	
8:45 a.m.	• Panel presentation—Restoring the natural system ➢ Spatial extent and heterogeneity ➢ Invasive exotics ➢ Endangered species ➢ Marine issues	Leader: R. Best
9:10 a.m.	➢ Questions and discussion	
9:20 a.m.	• Panel presentation—Transforming the built environment ➢ Sustainable agriculture ➢ Urban planning ➢ Social science	Leader: B. Kranzer
9:45 a.m.	➢ Questions and discussion	
9:55 a.m.	• Miccosukee Tribe of Florida	T. Rice
10:05 a.m.	➢ Questions and discussion	
10:10 a.m.	• Seminole Tribe of Florida	B. Dunson
10:20 a.m.	➢ Questions and discussion	

10:25 a.m.
- Summary
  - ➢ Wrap up and work plan comment
  - ➢ Discussion

10:35 a.m. BREAK

10:45 a.m. Prepared statements (10 minutes each):

- Environmental groups (D. Guggenheim, Everglades Coalition)
- Sugar growers (P. Rosendahl, Florida Crystals)
- South Dade agriculture (T. McVicar, McVicar Federico & Lamb)
- Others: (5 minutes each)

Sierra Club (C. Diamond)

Arthur R. Marshall Foundation (J. Marshall)
Friends of the Everglades (J. McMasters)
Florida International University (M. Bhat)

- Public comments (20 minutes)
  (members of the public interested in addressing the committee for 2-3 minutes should sign up at the meeting)

11:55 a.m. Open discussion of issues with committee, SFERTF, and public

12:30 p.m. Open meeting adjourns

OPEN BRIEFING

6:00 p.m. Field trip pre-briefings by SFERTF (at Sheraton Ft. Lauderdale, room: Citrus 3)

Saturday, December 4, 1999

Field Trip for Committee

Attachment D

Committee on Restoration of the Greater Everglades Ecosystem

Minutes
First Meeting: December 2-4, 1999

Anne Kolb Nature Center
Hollywood, Florida

ATTENDANCE

Committee Members

James M. Davidson, Chair
Scott W. Nixon, Vice Chair
Jean M. Bahr
Linda K. Blum
Frank W. Davis
Wayne C. Huber
Stephen R. Humphrey (Dec. 2-3)
Daniel P. ("Pete") Loucks
Gordon H. Orians
Kenneth W. Potter
Larry Robinson
Steven E. Sanderson
Rebecca R. Sharitz
John Vecchioli

Staff

Stephen Parker, Director, WSTB and Project Study Director
David Policansky, Associate Director, BEST
William Logan, Staff Officer, WSTB
Patricia Jones, Staff Associate, WSTB

Invited Guest Speakers

Stuart J. Appelbaum, Ecosystem Restoration Section, USACE
G. Ronnie Best, Working Group Member, USGS BRD
Mahadev G. Bhat, Florida International University
Joan Browder, NOAA
Bradford E. Brown, Working Group Member, NOAA/NMFS SE Fisheries Center
Steve Davis, SFWMD
Craig Diamond, Tallahassee - Sierra Club (and Leon County Planning Dept.)
Robert Doren, NPS
William A. Dunson, Water Resource Management Div., Seminole Tribe of Florida
Tom Fontaine, SFWMD
David Guggenheim, Everglades Coalition, The Conservancy of SW Florida
Lance H. Gunderson, Dept. of Environmental Studies, Emory University
Aaron L. Higer, USGS/WRD
Bonnie Kranzer, Executive Director, Governor's Commission for a Sustainable South Florida
John A. Marshall, Arthur R. Marshall Foundation
J. McMasters, Friends of the Everglades
T. MacVicar, MacVicar, Federico & Lamb Inc.
Jim Murley, Director, FAU/FIU Joint Center for Environmental & Urban Problems
Obeysekera, Jayantha, Director, Hydrologic Systems Modeling, SFWMD
John C. Ogden, SFWMD
Richard Punnett, USACE
Terry Rice, Miccosukee Tribe of Indians of Florida
Peter Rosendahl, Florida Crystals
Terrence "Rock" Salt, SFERTF
Rick Smith, Office of the Governor of Florida
Tom Teets, SFWMD

THURSDAY, DECEMBER 2, 1999: OPEN SESSION

After a closed session held from 8:30 to 11:00 a.m., the open session was opened at 11:20. Davidson summarized the purpose of the committee, and the committee members introduced themselves.

Terrence “Rock” Salt, Executive Director of the Task Force, gave an overview of the Task Force - its creation and function. From the beginning, it was emphasized that the restoration effort was supposed to be science-based. In 1996, Congress broadened the TF to include seven non-federal entities. They were directed to create a working group, which in turn created a science coordination team to integrate the various science initiatives and protocols. They have always supported the idea of having an outside entity to review the process, and that has culminated in the creation of the NRC Committee.

Parker then gave another introduction to the NRC and overview of study process, this time for the benefit of the observers. He emphasized the NRC's role as an advisor to the government, yet independent of the government. He explained that committee members receive no remuneration for their services to the NRC, and have disclosed any potential conflict of interest. Members are reimbursed for expenses; however, they receive no remuneration for their services or time spent on NRC business. He also explained the function of closed vs. open sessions.

A representative of the governor's office raised the issue of the Sunshine Law in that no employee of the State would be allowed to speak to the committee in closed session. Policansky replied that this was also against the NRC's own policies, and would, therefore, not be a problem. He also noted that we welcomed input from any and all parties by letter or e-mail; however, any input to the committee as a whole must, by law, be made available to the public.

The meeting was recessed for lunch at 12:05. It reconvened at 1:05 p.m. for a session titled “***Restoration Program Briefings***.” This consisted of a series of talks followed by discussion. Bradford E. Brown of NOAA, a member of the working group and its liaison to the committee, introduced the session.

Overview of the restoration process

This talk was given by Rock Salt of the Task Force. From the beginning, the Task Force was charged with developing an *integrated* plan. *Success in the Making* was the first major attempt at this. He noted that the Restudy is not the same as the Plan. Getting the water right is more than just the Restudy; many water quality aspects such as wastewater treatment are not in the domain of the USACE. They have defined their study to include the Kissimmee and the near-shore estuaries. The water is seen as the precursor to the second goal -

restoring and enhancing the natural system. Land acquisition is a major part of this. Their third goal is transforming the built environment by linking conservation plans with land-use plans.

Description of the natural system

Steve Davis, senior ecologist for the SFWMD, gave this presentation. He acknowledged his co-author, John Ogden. He reviewed the physical characteristics of the Everglades, emphasizing the large scale, seasonal and annual variations in the hydrology, small topographic gradients, sheet flow, and dynamic water storage.

He then reviewed the defining ecological characteristics of the system: (1) it has a major estuarine component, and much of the degradation has been in the estuarine environment; (2) it is nutrient poor, and supplied by rainfall; (3) natural P levels are often close to detection limits; (4) it is a complex system, with a mosaic of different physiographic regions and unique habitats; (5) it has animals with large spatial requirements; and (6) it has historically supported large numbers of aquatic vertebrates, such as alligators and wading birds. He then reviewed the system on a region-by-region basis.

Finally, he defined the goal of restoration as to "recover and protect the physical and ecological characteristics of the ecosystem", that is, those characteristics that define "the Everglades."

Description of the altered system

Bonnie Kranzer (Executive Director, Governor's Commission for a Sustainable South Florida) discussed the human aspects of the system. The region is home to some of the poorest sections in the nation, and some of the richest. Population is projected to grow from six million today to twelve million in half a century. There is a large population of elderly, minorities, winter residents, and international immigrants. Urban land has expanded westward from the Miami-West Palm Beach area, consuming nearly half of the natural system. The present system of canals and levees was designed for two million people rather than the six million that we have today, and water demands for urban and agricultural use are both increasing.

Tom Fontaine, director of the Everglades Systems Research Division for the SFWMD, discussed the development of the water management system, and some of the consequent changes that have occurred to the natural system. Four major canals were built in the early 1900s. A major N-S levee was built. The agricultural area was isolated. Water that originally was headed toward Shark River Slough was diverted westward, leading to high salinities in the coastal area

south of Shark River Slough, and possibly to the die-off of sea grasses in Florida Bay. These structures dropped water levels in the organic soil regions previously flooded (Everglades Agricultural Area), causing the soils to oxidize, compact, and sometimes catch fire. This process is generally referred to as subsidence. In other areas, tree islands have been lost as water levels rose, decreasing nesting and feeding areas for wading birds. Melaleuca, an invasive species, has spread over many areas. High P concentrations are found in many areas, and in general these correspond with the presence of cattails (especially with P present above 10-20 ppb).

Joan Browder (National Marine Fisheries Service) presented data on Florida Bay. The South Florida coastal waters have been severely impacted by changes in the regional hydrology, especially the lower flows from Shark River Slough and Taylor Slough due to the canal and levee system and seepage into groundwater. Circulation is poor in portions of Florida Bay, and the central part can experience hypersaline conditions in times of drought. The salinity appears to have increased around 1910, when the Tamiami Trail was built. This affects the distribution and population of mollusks, crustaceans and fish in the Bay, as well as the health of the sea grass. Finally, she concluded that variations in rainfall and freshwater inflow are magnified within the Bay.

Land purchases

Rick Smith gave this presentation. The state and federal governments cost-share these purchases. Within the Kissimmee basin, they have acquired 120,000 acres, most of it in the headwaters and floodplain of the Kissimmee River. The state of Florida has spent >$4 billion on restoration since 1948. The U.S. government has spent over $1 billion. Smith presented a table showing project title, size, the number of acres acquired to date by the state and federal government, the number of acres still to be acquired, and the costs. Over four million of the over five million acres proposed to be acquired have already been purchased.

The next session was titled "***Restoration: Making It Right***."

Water restoration projects

This talk was given by Stuart J. Appelbaum (USACE). He stated that the main problems of the existing system are: too much or too little water, fragmentation of the natural areas, population growth and increased water demand, and the loss to the system of 1.7 billion gallons of fresh water per day that flow directly to the ocean without moving through the Everglades.

The Restudy was a response to these problems. The primary goal of the Restudy is "getting the water right", that is, to increase the amount of water available, and improve timing and distribution of the water. Appelbaum summarized three major Restudy models: the South Florida Water Management Model (today's system), the Natural System Model, and an ecological model. The Restudy team developed conceptual models for each of the regions, and created performance targets based on these models.

He described the major features of the restoration plan, whose estimated cost is $7.8 billion. He emphasized that as the plan is implemented, it will be assessed and modified as necessary, through many different forums for public participation. The report itself and other info is on their web site. Of the "wasted" water that will be captured, 80% will go to the natural system, 20% to urban use. He noted six pilot projects, including three ASR projects, seepage management, the Lake Belt Project, and wastewater reuse technology, estimated to cost $97 million.

The science of restoration

This talk was presented by John Ogden. The overall theme was: How should science be organized to be maximally effective in supporting the South Florida ecosystem restoration programs? He noted that this is not a trivial question; the scale is large, our knowledge of ecosystem is incomplete, the data are scattered temporally and spatially, and it is not clear how success or failure can be evaluated. Results must be converted to objectives, and integrated into policy.

A set of conceptual ecological models (a set of relations believed to lead to a target condition) is at the heart of the applied science strategy adopted by the Restudy team and the Science Coordination Team of the Working Group. *Drivers* (external driving forces) create *stressors* (physical or chemical changes in the system) that cause *ecological effects*, a subset of which are termed *attributes*. The specific features of these attributes that can be monitored to determine the success of restoration efforts are *measures*. He used the conceptual model for the Ridge and Slough area as an example. The restoration measures include hydroperiods, depth patterns, groundwater and surface water flow patterns.

Questions and panel discussion

The discussion generally focused on three topics:

1. Demographics, land-use and water-use trends and assumptions - Some of questions and comments focused on population growth and consumption

patterns and how that had been incorporated into the model as socioeconomic drivers. It was noted that these were not political/ethical questions; rather, the long-term success of the restoration plan depends on taking these factors into account.

The response (from panelists Appelbaum, Kranzer, and Brown) was that little work has been done on these kinds of social issues, partly because it falls between agencies' purviews, and no one wants to fund it. They tended to just make sure that given the projected growth, they had enough water to supply the population. Future water use is based almost completely on population projections. There has been little or no economic modeling done on the effects of water pricing issues, technological advancement or voluntary conservation on water use. (They did look at some of the basic scenarios assuming that consumption was capped.) On the positive side, they said that from a water supply perspective, this produces conservative water-use numbers. Brown stated his belief that much of the future is unpredictable. Who, for example, would have predicted the massive Cuban immigration 50 years ago?

Related questions dealt with land purchases and land use. It was noted that the Restudy and Task Force operate on a regional scale, whereas land-use planning and zoning decisions tend to occur on a local scale level. The question was also raised of the effects of land-use change to hydrologic and ecosystem modeling scenarios. For example, what would be the impacts of urbanization in the Everglades Agricultural Area (EAA), due, for example, to a decrease in agricultural subsidies? The response (Kranzer, Salt) was that these issues had not been studied in any depth, and that present scenarios assume continued agricultural land-use in the EAA. They do feel that the idea has merit. Salt also mentioned that from a water quality perspective he would be more concerned about urban land-use than agricultural land use.

There were also questions about the land purchases, and the criteria that govern them. The answer was that the land acquisition programs are "willing seller" programs, not forced buy-out, which poses some limitations. For example, Rick Smith stated that one of the high priorities for land acquisition is a buffer zone along the western edge of the urban strip. But they can offer only $20,000/acre, whereas the land is now valued at >$60,000/acre. Aside from financial considerations, the priorities are established by a council, and the general plan of acquisition has been governed by the Comprehensive Plan.

2. Several other questions targeted the *ecosystem modeling*. There was some concern that most of monitoring that is planned is oriented toward making adjustments in the hypothesized ecological model, rather than checking the possible validity of other models. “You can't find what you aren't looking for.” Ogden and Davis responded that they were still in the process of defining ecological targets. They admitted that great uncertainties and disagreements exist with respect to how long the restoration might take, and what "success"

means. They were also asked whether they planned to bifurcate into leading (precursor) indicators vs. long-term indicators, and this was answered in the affirmative.

3. The *hydrologic modeling* attracted a broad range of questions. Most concerned the existence of specific kinds of data or analyses (water budgets, confidence levels, uncertainty analysis, and processes that transfer water from the terrestrial to the marine environment). More general discussions centered on the peer review process for the models, the existence of performance measures for the urban flood protection, and the role of flow rather than depth and hydroperiods as an indicator. In particular, the pilot programs were of great interest to the committee. They asked, for example, how priority items for pilot projects were determined. Appelbaum responded that they chose areas where they had the greatest uncertainty – for example, groundwater injection, seepage, and wastewater reuse.

The committee adjourned at approximately 5:30 p.m. Following dinner, there was a Keynote Talk, open to the public, titled "***Back to the Future—Perspectives on Everglades Restoration***", by Lance Gunderson of Emory University. Gunderson presented an overview of the natural history, water management history, and adaptive management of the ecosystem. For the first part, he emphasized the importance of scale in the observation and interpretation of processes by progressing from a one meter squared view of sawgrass to a worldview. He then documented some of the critical events in the water management history, from the initial canals in the 1880s to the massive floods of 1926, 1928 and 1947 to the droughts of 1960 and 1971 to the present era of restoration. The current adaptive management approach arose out of a series of multi-disciplinary workshops from 1989-92.

In his opinion, some of the important conclusions to be drawn from work of the last decade are that neither tinkering with the system nor singular actions will be effective, and that water quality and quantity must both be considered. In conclusion, he believes that there is enough water in the system to support some experimentation in our management strategy. Likewise, there is resilience in some of the key ecosystem components. He closed with the question of whether the same resilience and flexibility might also be found among the primary stakeholders of the system.

Major points of discussion following the talk were:

- Whether there were ways to maximize the testing of various conceptual models of each region, rather than only testing a single hypothesis.
- What the impact of rising sea level might be on the model (unknown).
- The attitudes of the general public on the issues.

FRIDAY, DECEMBER 3, 1999: OPEN SESSION

The meeting was called to order by the Chair at 8:05 a.m.

Three brief panel discussions followed, under the general heading of ***Restoration: Making it Right - Assessing the Science of Restoration***

Getting the water right (introduced by Aaron Higer, USGS/WRD)

The first speaker was Jayantha Obeysekera (director, hydrologic systems modeling, SFWMD). He summarized the hydrology of the present system, gave a simplified water budget, and described the hydrologic modeling tools. He noted changes in the timing of flows, and the spatial and seasonal distribution of surface water.

Two hydrologic models are used – (1) the natural system model (NSM) and (2) the managed system model (MSM), which also goes by the term South Florida Water Management Model (SFWMM). They use the same drivers/stresses for the two models. That is, they recognize that the NSM cannot be calibrated, and instead model how the natural system might have responded under modern day climatic conditions. Both models use a finite difference mesh with two mile by two mile grid cells, one day time steps, and 1965-95 climatic data. They are primarily oriented toward surface water, but account for seepage in some areas. They have calibrated the SFWMM for hundreds of areas, and claim to have achieved calibration that is excellent in the natural areas, but poor in urbanized areas. The NSM was reviewed by Bales et al. (1997) and the SFWMM was reviewed by Pete Loucks (of the CROGEE) et al. (1998). Obeysekera did not mention what the reviewers comments were, nor how he had responded to the reviews.

A discussion ensued on numerous aspects of the model. Topics included:

- Whether sensitivity and uncertainty analysis has been performed. (Uncertainty analysis, yes. The 90% error band is about 6 inches of water depth for most of the system.)
- The precipitation input function (daily values interpolated on a cell-by-cell basis).
- The relevance of the model to predicting salinity and circulation patterns in the estuaries and bays. (They have had various challenges in this area. The salinity of the bays is a function of the flow, which is more poorly constrained than water depth. Also, there are some inaccuracies because they have been focussing on the point discharges rather than diffuse flow. They are trying to work with the coastal people to optimize the timing and discharge to the estuaries.)

Restoring the natural system (introduced by Ronnie Best)

The first talk was by Nick Aumen of the NPS, who spoke on restoring the spatial extent and heterogeneity. Any solution must deal with the whole system. The predrainage system had animals with large feeding ranges and narrow habitat requirements, large numbers of vertebrates, and very low nutrient levels. Biotic diversity was high due to diversity of habitat. The present goals are to recover threatened and endangered species populations, restore diversity, wading birds, natural vegetation, restoring corridors, minimize compartmentalization, and reintroduce several bird species.

Robert Doren (NPS) spoke on the problems associated with invasive, non-native species to the Everglades. He emphasized that these species are more of a problem in the modern world because most of the traditional natural barriers (oceans, mountains, etc.) are circumvented by modern travel patterns. Through this process, we are facing a decrease in the number of total species. Most of invasive species in Florida were brought in as ornamental plants, of which the port of Miami is a huge importer. The eradication of non-native plant and animal species is expensive; perhaps $100 million/year is spent on this in Florida alone.

Kalani Cairns (FWS) then described the South Florida Multi-Species Recovery Plan (MSRP). This document, which was put together by the U.S. Fish and Wildlife Service, was designed to recover the 68 federally listed species through the creation of numerous ecological communities. Species of mammals, birds, reptiles, invertebrates and plants are all included. It is an integral part of the South Florida Ecosystem Restoration initiative, and the survival of many of the listed species will depend on the success of the restoration effort. The report was completed in May 1999 and endorsed by DOI Secretary Bruce Babbitt shortly thereafter. The implementation of the plan, however, depends on timing and amounts of funding.

John Hunt (Florida Department of Environmental Protection) gave an overview of some of the ongoing Florida Bay science. Their strategic plan involves research and long-term monitoring, and focuses on issues related to the controls on circulation and salinity, nutrient cycling, algal blooms, changes in the seagrass community, and growth and survivorship of animals in Florida Bay.

From modeling they learned that they had problems going from a 2 $mi.^2$ grid surface water model to the Florida Bay model. Much of the flow, for example, is diffuse and calculations depend on detailed knowledge of topographic modeling. He described some of the performance indicators for the bay. Recent work is attempting to statistically link the SAV distribution to the water quality database to lead to performance measures for water quality.

A short discussion period followed, and touched on the following themes:

- The relative importance of getting the flow and water quality right vs. getting the hydroperiod right. This relates to the interface between ecological and hydrological modeling. For example, flow is not an input to the ecosystem models. There is, however, a project underway to link lower trophic levels to the hydrologic model.

- Contaminant monitoring in the Bays. There is some monitoring of Hg and pesticides in Florida Bay, but they have not done predictive modeling.

- Who will win the war on invasive species? In some cases we have the knowledge and ability to kill them; we just need to spend more money. In other cases we do not understand their growth and dispersal well enough to predict success.

Transforming the built environment (introduced by Bonnie Kranzer)

Barbara Miedema presented the position of the Sugar Cane Growers Cooperative of Florida. She mentioned that 450,000 acres of the EAA are in sugar cane. The Cooperative has already raised $25 million through farm assessments to fund environmental research. For example, they helped fund the Everglades Nutrient Removal (ENR) project - a prototype stormwater treatment area (STA). The Everglades Forever Act (1994) taxes them at $25/acre to continue paying for the STAs. In addition, the Act only required them to lower P levels by 25%, but through Best Management Practices (BMPs) they have decreased P runoff by 53% in three years.

In general, they support the plan that was submitted to Congress this year, and they support the pilot projects. They do have concerns about the feasibility of some of the projects (the ASR, seepage barriers, and the Lake Belt project). Their position is to “get it right the first time” by moving ahead cautiously without getting ahead of the science.

Jim Murley (Director, FAU/FIU Joint Center for Environmental & Urban Problems) spoke on urban planning issues. The State of Florida, unlike most states, has a comprehensive plan. There are also 11 regional, multi-county, policy plans. However, Florida expects growth, and they are not trying to prevent it from occurring. Rather, they are trying to manage it. Unfortunately, while the system looks good on paper, but it hasn't delivered the kind of results that will keep up with the Everglades science. No significant regional modeling has gone on.

He spoke briefly about Robert Burchell's book *Eastward Ho!* This looked at the projected population growth in SE Florida of 2.4 million over the 1995-2020 time period, and estimated the cost of providing services to these people based on different growth scenarios. He concluded that if some of the growth were directed eastward through infill development and redevelopment, the cost saving would be on the order of billions of dollars. He also mentioned another publication of the Governor's Commission, *Planning for 2050*. In this report, they state that the three most important objectives on the urban planning side are "full, rewarding employment, efficient transportation and excellent education."

Bonnie Kranzer then spoke on some of the social science efforts related to the South Florida Ecosystem Restoration. As a result of a February 1998 symposium, the Governor's Commission developed an action plan to incorporate cultural, social and economic research into restoration initiatives. They did this not only because it was mandated by law, but also to introduce cost/benefit analysis into the restoration efforts, and to build public and legislative support for the process. The specific projects generated fell into five general themes: agriculture, demographics and community studies, economics, planning and environmental justice, and public outreach. Some projects have broad application; others are site-specific. They hope that the working group and Task Force will sign on; the next steps would be to link up the projects with ongoing activities, and to line up additional funding.

Several committee members and staff asked follow-up questions, such as how the eastward growth would save money and what incentives were planned (Answer: much of the infrastructure is already in place in these areas. They hope to use brownfields legislation and a streamlined permitting process). There were also questions concerning the conditions under which the EAA could be urbanized. The response was that sugar is already at a fairly low price. The sugar industry believes that it could probably cope with free market trading, but not with "dumping." If sugar cane becomes unprofitable, urban sprawl is possible in the EAA, although this would require major changes in the zoning laws. Crop substitution (e.g., to citrus or ornamental plants) would also be a likely consequence of low sugar prices.

Col. Terry Rice of Florida International University then gave a brief presentation on behalf of the Miccosukee Tribe of Indians of Florida. He emphasized three points: (1) The tribe is committed to restoration, (2) the tribe is one of four sovereigns in the region (the federal government, the state of Florida, and the Seminole Tribe being the other three), and (3) they believe that science is an important part of the process.

The Miccosukees *live* in the Everglades. They believe in the traditional way of life. They understand that the Everglades must be restored in order to maintain

this lifestyle in perpetuity. They understand the interconnectedness of the system. Also, they feel that traditional activities such as hunting, gathering and burning form part of the ecosystem, rather than being outside of it, and that this topic has not been sufficiently addressed. They have particular interest in the sawgrass area, part of which is held for them in perpetuity.
From a water quantity perspective, the tribe has few serious concerns about the Restudy. But they feel that water quality issues have not been adequately addressed. The tribe is a bit skeptical of the CROGEE's role in this. They have seen management drive science rather than vice versa. They support the science.

Col. Rice was asked to give an example of policy driving science. He gave an example in which he says the Miccosukee have scientifically-based water quality standards for their lands. However, their neighbors who emit the pollutants are not required to meet the same standards, because their standards aren't science-based. He was also asked if he wanted science to model the effects of traditional lifestyle in the Everglades. He responded that he would like more effort spent on understanding the magnitude of the effects in the past to see what could be justified today.

Bill Dunson then discussed some of his research for the Seminole Tribe of Florida. Their lands (55,000 acres) are at the juxtaposition of sawgrass and Big Cypress. There are archeological sites from at least the last 5,000 years. He briefly summarized the physiography and ecology of the land. They have the full complement of vertebrates, including Florida panthers.

His projects are looking at the effects of land use on water quality. He has a water quality database with nine years of data on phosphorus. Concentrations of P are very episodic. Some spikes go as high as 2000 ppb. They see only minor uptake (~10%) of P in several of their wetland areas. This led him to say that he thinks more time and money should be spent on source reduction rather than water treatment. He doesn't entirely blame row crops, however. He believes that cattle grazing on lands that the Miccosukee rent from the Seminoles are also P producers. No BMPs have been put into practice in these areas. While most of his work to date has been on P and NO_3, he hopes to do more work on the monitoring and ecotoxicology of agricultural chemicals.

Prepared statements

David Guggenheim spoke on behalf of the Everglades Coalition, a group of 40 organizations working on behalf of the Everglades. They strongly support the formation of the NRC committee. He stated that the primary purpose of the restudy was to restore the natural function of the ecosystem, and secondary goals like flood control MUST be compatible with this. We have to make sure that we reconnect the system both hydrologically and ecologically, and use

scientifically defensible water quality standards. Not only should we halt the decline of endangered species, but increase them.

A well-designed, long-term and pervasive monitoring program is needed to guide the modeling. Consider appropriate temporal and spatial scales. We should think beyond the engineering solutions to climate change and long-term sustainability. They also believe that additional land acquisition could replace some of the engineering solutions. They are interested in urban growth issues, including *western* Florida, and are concerned that zoning laws can be changed in a day.

He mentioned two specific technical issues the we should look at. First, there seem to be many technical issues surrounding the transport of Lake Okeechobee water to the WCAs, the park, and Florida Bay. There is disagreement as to whether some of the central areas, which have subsided, can sustain the high water levels or whether tree islands will disappear entirely. However, the alternative of delivering water to the park from storage areas along the lower East Coast is technology heavy, and raises questions of both expense and water quality.

Second, They recommend acquiring far more acreage in the EAA than the Restudy recommends. This would increase the wetland area, reverse subsidence, increase the surface storage capacity, and improve water quality. Consider the long-term future of the EAA, and how the expansion of urban growth in the EAA would affect the system. Even with the Growth Management Act in place, most zoning decisions are made locally.

Peter Rosendahl, VP - Environmental Relations for Florida Crystals, one of the sugar-growers of the region, organized his talk in terms of key points, namely: (1) their BMPs have lowered P concentrations 50%, down to about 25 ppb. No one knows how to get it lower at the moment. They feel that their work has been a great success. (2) About 40,000 people are involved directly or indirectly in their vertically –integrated industry. (3) They have biomass cogeneration plants (energy for >7000 people). These produce no waste products but gas. They are way ahead of the rest of their industry in this. (4) They produce rice as well. The high water level minimizes subsidence and serves as a natural pest control. (5) We should not drop off the urban, agricultural, and flood protection issues from our study and just focus on restoration. (6) While in general they support the Restudy, they feel we need feasibility studies done before spending too much money. Finally, (7) Any structures built should be flexible, not rigid to enable us to adapt the system if we don't get it right the first time.

Tom MacVicar (MacVicar, Federico & Lamb) made a few brief remarks. He spent 16 years with the SFWMD before becoming a consultant. First, he doesn't think that there is time to totally revamp the system. Some of the stormwater treatment areas in the northern part of the Everglades will be on-line by the

summer, and ENP also has a project coming on line. Second, *there is nothing on the books to evaluate these $3 billion worth of projects before we do the rest of the project*. He is concerned that while everyone talks about adaptive management, there's no money or time to do it. Third, there are various conflicting goals in the restoration effort, with certain areas receiving too much water and others receiving too little. Finally, the USGS peer review comments on the Natural System Model (Bales, 1997) were not used effectively. There is a lawsuit over misapplication of the NSM.

Craig Diamond, representing the Sierra Club, asked the CROGEE to keep three issues in mind. First, look at biggest picture possible. Does the Restudy integrate all existing knowledge? Can its predicted outcomes be tested? Second, look at the fine print. There are many questions about how pathways are defined, the geochemistry, the curtain wall strategies, and long-term adaptive management. Third, ask whether the fine print is consistent with the big picture. Ask whether it hangs together. Test the plan to make sure that restoration will work. Think freely, and keep asking questions.

John Marshall, representing the Environmental Advisory Committee (EAC) to the SFWMD and the Arthur R. Marshall Foundation, summarized some of their objections to the existing plan (he also gave the committee a series of handouts).

The “Marshall Plan” specifically calls for a flow-way from Lake Okeechobee southward, which would minimize need for the ASR project. It emphasizes turning the system back to nature. Marshall claimed that there has been inaction on natural solutions and an emphasis on engineered solutions.

The EAC recommendations, according to Marshall, are consistent with the Marshall Plan precepts, and include:

- increased spatial extent of short hydroperiod wetlands
- emphasis on water quality, natural ecosystems, and limiting impacts of growth.

J. McMasters from Friends of the Everglades said that he was there to endorse what David Guggenheim (Everglades Coalition) said, and to elaborate on the EAA. The Restudy pays little attention to this area. But historically, this is the sawgrass area that was critical to the hydrology of the system. He saw three problems with modern EAA. First, it causes agricultural pollution. Second, it acts as a dam to the water that would flow south through Lake Okeechobee. Finally, it has caused subsidence (up to 5-6 feet). The land of the EAA is disappearing, and parts of the area are down to bare limestone. His questions are: (a) How fast is the subsidence rate? (b) When the rich soil is gone, what should we do with this area? How can it be returned to something approaching its original state?

Mahadev G. Bhat of the Economics and Environmental Studies Depts. of FIU emphasized the need for integrating behavioral sciences research and knowledge into the Everglades planning and restoration. He believes that research is needed on the connections between natural and human systems. However, there has been a lack of research money from federal agencies. He asked us to use our influence with the government to increase this funding.

Public comments

A member of the National Audubon Society introduced himself and offered the assistance of its local chapter.

Barbara Lang (Sierra Club) asked whether we would be independent of the Task Force? (Answer: Yes. It is very difficult to tell a room full of academics what to do.)

J. McMaster, speaking this time as a private citizen, stated his opinion that the EAA will become the new area for urban growth. Zoning will NOT stop this. The South Florida economy runs on construction, and they will get the area rezoned when they want to. He cited New York City's approach of spending their money on watershed management rather than on extensive water treatment. So, the cheaper, low-tech solution is to buy land in the EAA.

Finally, Art Oyala-Yemaiel noted that he recently wrote a doctoral thesis that looked at conflict resolution and consensus-building in the restoration initiative. He thought that it would be important for the committee to address the anthropological and sociological issues relating to the restoration.

The discussion session that followed centered on several themes, including:

- **Storage**. Salt stated that the core of the Restudy is to store as much water as possible in surface storage, and what's left in groundwater. Until you get the storage to replace the water in the dry season, you can't make the system work. So the initial elements (i.e., pilot projects, etc.) tend to be storage oriented.

- **Flow-ways**. Appelbaum noted that flow-ways were looked at early. Hydraulically, he said, they were not supportable. They could not get it to flow naturally. He would like to talk about this with the committee in more detail later. Salt stated that he has never really heard of the ecological benefits of building a flow-way. He also stated that building a flow-way was "not on the table."

- **Funding and timing.** Several committee members wished to state their view that the committee is supposed to do independent scientific inquiry with a broad view to the overall goals. Also, we have to know the implementation plan in order to know when adaptive management could actually be done. Appelbaum said that while the pilot projects were, of course, the first ones, he would have to give us a detailed "nut-and-bolts" briefing some time for the others.

- The committee noted that while the issue of environmental justice had been alluded to in several presentations, no talks on this issue have yet been given. This oversight was acknowledged by several members of Working Group who were present.

The open meeting was adjourned at 1:20 p.m.

A closed meeting was held from 1:45 to 6:00 p.m., and a brief open meeting was convened at that point for field trip pre-briefings by SFERTF. The briefings were given by Ronnie Best and Rock Salt, and focused mostly on logistics of the field trip.

The meeting adjourned around 7:30 p.m.

Saturday, December 4, 1999

All of the committee members present with the exception of Humphrey boarded vans at 7:45 a.m. at the hotel entrance. The airboat tour visited different environments in the Ridge and Slough area of the Everglades, including visits to a tree island and an alligator hole. The helicopter tour included flyovers of the Everglades Agricultural Area, sawgrass plains, and areas of invasion by cattail and melaleuca, and a visit to the Everglades Nutrient Removal Project. The vans returned to the hotel in the late afternoon

Attachment E

POTENTIAL WORKPLAN ITEMS FOR THE COMMITTEE ON RESTORATION OF THE GREATER EVERGLADES ECOSYSTEM (CROGEE)

At its meeting on November 8-9, the WG discussed various candidate topics for consideration by the Task Force and CROGEE as they develop the initial CROGEE workplan. In considering candidate ideas, review tasks that would involve the review of a specific document as part of the baseline work of the committee are listed as *baseline tasks.* Areas that do not have a specific document for review are listed as a *baseline review area*. (Detailed tasks that would be accomplished as part of a separate ad-hoc panel were discussed but are not recommended as part of the initial workplan.) These baseline items would be in addition to the general CROGEE baseline effort to become knowledgeable of ongoing science throughout the region. The first two tasks are listed as the highest priority. The rest are not listed in priority order.

I. Review of the Scientific Underpinning of Conceptual Ecosystem Model report, (*baseline task)*

The "conceptual model" document provides the theoretical basis for the performance indicators and targets in the Restudy. As the Corps proceeds to the detailed design phase for the Restudy, it will use these targets to optimize the performance of each separate component of the plan. This review would be an important contribution to the implementation phase of the Restudy.

II. Review Science Coordination Team (SCT) protocols for science integration and independent review. (*baseline review area*).

The SCT and its member agencies currently sponsor several events that are designed to provide outside review and advice on the science, research and technology effort, including panels on Florida Bay, contaminants and sustainable agriculture and management of the CESI. The advice from the CROGEE would allow the SCT to improve their processes and protocols for integrating science and monitoring into the restoration effort.

FOLLOWING TASK NOT IN PRIORITY ORDER

III. Aquifer Storage and Recovery (ASR) document, (*baseline task*)

The Working Group will complete its ASR review document at the November meeting and it would be useful to receive review comments from the CROGEE. The Corps received Congressional Authorization in WRDA 99 for two demonstration ASR projects. The peer review could assist them in obtaining maximum value from these demonstrations. Pending this review, this could be a good candidate for a special ad-hoc panel to provide a more thorough assessment and recommendations on implementing the ASR portions of the Restudy, including water quality treatment. There are several successful examples of ASR in Florida, but no ASR technology has ever been proposed at the scope and magnitude contained in the Restudy.

IV. Review of the regional assessment of invasive exotic plants (*baseline task*)

Most of the work of the Task Force has focused on the first restoration goal, "Get the Water right." One of the two most significant external threats to the Everglades is the destruction of natural habitats by invasive exotic plants and is covered in the second goal to "protect and maintain natural areas". The Working Group is scheduled to complete its assessment of this threat in January 2000 and the assessment document would be an excellent candidate for peer review by the CROGEE.

V. Seepage/groundwater management (*baseline review area*)

The Corps has proposed a series of demonstration projects to get a handle on seepage and will be developing plans to explore various approaches. The CROGEE could be asked to advise the Corps in this effort as a baseline task. This issue is important enough to also consider asking them to create an ad-hoc panel. The resolution of this issue is key to resolving conditions in the "Dade corners" area that was specifically noted by the Task Force in its initial letter to the Secretary of the Army.

VI. Maximum use of passive controls (*baseline review area*)

The Corps has agreed to a "decompartmentalization" strategy that avoids water management controls if possible and maximizes the use of passive controls when some control is necessary. This task would connect the CROGEE with the Corps planners to review their initial plans and provide advice on maximizing passive water management controls.

VII. Linking Land-use Planning to Conservation Planning, (*baseline review area*).

Over the next 50 years, South Florida will experience growth accompanied by more pressure on the region's delicate environment. Ensuring a beautiful and healthy region demands that we find ways for nature and people to coexist and flourish. This will depend on our ability to better link Land-use planning with conservation planning.

VIII. Restoration Levels and Flows, (*baseline review area*)

The Restudy provides for the capture and storage of water currently wasted to the coasts. The design of the redistribution structures for this stored water is a key implementation task for the Corps. The challenge is to design the management system in a way that mimics the natural hydropatterns without damaging existing natural areas.

IX. Water Quality Improvement, (*baseline review area*)

The design of water quality treatment facilities and best management practices is critical to successful restoration. Science in support of new treatment technologies and management practices is focused on helping us best meet the stringent requirements for the Everglades.

X. Lake Okeechobee Improvement Plan, (*baseline review area*)

There are a number of initiatives underway to restore the health of Lake Okeechobee. They include establishing the Total Maximum Daily Load (TMDL) for contaminants flowing into the lake, plans to reduce existing contaminant loads, proposals to remove contaminated sediments from the lake and an improved lake regulation schedule for improving the health of the lake's littoral zone. The science and technical issues for each of the initiatives are connected and difficult.

Attachment F

Information Needs

Since the end of the Executive Session on Friday, December 3, 1999, CROGEE members and staff have taken the opportunity to learn more about the present and future projects in the Everglades. Most of us participated in the field trip to the northern Everglades and EAA, including the Everglades Nutrient Removal site. Many of us have read the Chief's Report and sections 9 and 10 of the Final Integrated Feasibility Report, in addition to the many handouts that we received before and during the meeting. Naturally, this has stimulated additional questions and areas of interest. Some of these may lead to additional areas of study by the CROGEE; others will simply serve to deepen our understanding of the Everglades system and the issues that surround the restoration efforts.

The overall restoration strategy depends heavily on the output of the Natural System Model (NSM) and the South Florida Water Management Model (SFWMM). Clearly the CROGEE will want to understand these models in much greater depth than they do at present. Some specific questions are related to the models and how they are being used are:

1. What assumptions and independent variables were used in the development and operation of the NSM? It appears the premise for "getting the water right" and being able to mimic water flow prior to the current extensive drainage and water conservation system is based on the accuracy of this model. What were the major criticisms of the model by Bales et al. (1997)? What were the responses of the Hydrologic Systems Modeling team to this peer review? Has recent work comparing the NSM-predicted hydropattern with historical information on pre-drainage hydropatterns provided any relevant data? What kinds of additional information would be useful to increase our confidence in the simulated results?

2. How well does the SFWMM predict the current water depths, hydroperiods and flows in the Central and South Florida project? Where are errors the greatest and why? What uncertainty analysis has already been performed, and what parameters (boundary conditions, etc.) have the largest error bars (e.g., flow velocity through the vegetation, water depth, slope of the water surface, and the type and density of vegetation). What were the major criticisms of the model by Loucks et al. (1998), and what were the responses of the Hydrologic Systems Modeling team? What monitoring sites are already being used for "adaptive management?"

Other questions center on the overall strategy and goals for the implementation plan, and how this is integrated with recently completed projects.

3. While we have a project implementation schedule for the Comprehensive Plan (Chief's Report and Final Integrated Feasibility Report), it would help to have a summary of the projects that have been recently implemented by the USACE and other agencies

that relate directly or indirectly to the restoration plan. What were their goals, and how successful have they been in meeting these goals?

4. It seems that some of the controversy surrounding the restoration plan has to do with the proposed implementation schedule. For example, there are some large surface reservoirs, such as the "North of Lake Okeechobee Storage Reservoir" and phase 2 of the Everglades agricultural storage that are not scheduled to be built until 2010. In contrast, a substantial portion of the initial authorization (particularly many of the Programmatic Authority Projects) seems to be devoted to projects that focus on local restoration without an explicit linkage to restoration of the larger ecosystem. It would be helpful to have someone at our next meeting discuss some of the rationale behind the scheduling, above and beyond the sequencing rules described in Section 10 of the Feasibility Report. A summary of the interdependence among the many proposed engineering projects that comprise the restoration strategy, and any "cost effectiveness analysis" that has been performed so far would also be useful.

5. The committee is very interested in information specific to the relationship of long-term monitoring to adaptive management and modeling, and the adaptive management concepts that are at the core of the effort. Some specific issues raised were the following: Is there already a draft plan for long-term monitoring of the hydrologic and ecologic system? If so, which parameters will be monitored? What statistical techniques will be used to analyze and interpret the data collected? How will sites and sampling intervals be chosen, given the spatial and temporal variability of the Greater Everglades System? What is the proposed budget? Who will be responsible for using the results from monitoring to implement "adaptive management" procedures.

6. It would be useful to hear some further discussion concerning the various interpretations of the phrase *Restoration of the Greater Everglades Ecosystem*. The white paper included in the read-ahead material (*Defining Restoration – I: A Restudy Alternative Evaluation Team White Paper*) justifiably emphasized the areas of agreement. However, it would also be of interest to learn more about the diversity of opinions. For example, the white paper notes that opinions differ "as to which characteristics are most important, how best to represent them in hydrologic models, and how close to the conceptual targets we must be to declare that restoration has been achieved." What are some of the most significant areas of disagreement, and how do these varying interpretations of "restoration" affect the strategies for achieving it?

The field trip to the STA generated much discussion among committee members with respect to levels and forms of phosphorus in the water, and their target concentrations.

7. Does a good review of research and data associated with Stormwater Treatment Areas (STA) exist? Specifically, is there information on the different forms of P entering and leaving the STAs with respect the their biological availability (organic/inorganic, etc.)? Realistically, is the 10 ppb standard attainable using the STAs and what technology will it require to achieve this level? What are the consequences if it cannot be attained? What other water quality parameters are being addressed through

these treatment systems? How will possible treatment alternatives designed to reduce P levels affect other water quality parameters? Independent input on this subject (other than SFWMD personnel) may be helpful.

Finally, there were information requests related to social issues.

8. To what extent have environmental justice and brownfields issues been taken into account in the planning process, and to what extent may these impact—positively or negatively—on the success of the restoration efforts? For example, are the existing or proposed legal, social and political frameworks for infill and brownfields redevelopment (e.g., Sustainable Communities, Front Porch Florida, and Eastward Ho!) adequate? How are the different growth scenarios reflected in the Comprehensive Plan? Will environmental justice issues arise from the fact that the majority of the inhabitants of the "8.5 square mile area", and many of the farmworkers in the EAA and elsewhere, are members of minority groups?

Some of these questions are probably best addressed with oral presentations, others may be better addressed by referring the committee to existing reports, and some probably do not have answers at this point. We would appreciate your input on appropriate strategies as we begin preparations for our next meeting in late February.