

## Restoration of the Greater Everglades Ecosystem

By Stephen D. Parker

With approval by its Governing Board Executive Committee on June 17, the National Research Council is making arrangements to launch an important new activity that will provide scientific guidance to the South Florida Ecosystem Restoration Task Force and multiple agencies charged with restoration and preservation of the greater Florida Everglades and near-shore estuaries.

The Florida Everglades is the largest single wetland in the contiguous United States. In the mid-1800s it covered a little over nine million acres, but since that time the historical Everglades has been drained and half of the area devoted to agriculture and other development. The remaining wetland areas have been altered by human disturbances both around and within them, chiefly by diverting water for human uses, lowering water flows to protect against floods, and greatly increasing the nutrient supply to the wetlands by runoff from agricultural fields and urban areas. As a result, the Everglades have been invaded by non-native plants and animals that out-compete native species. Populations of wading birds have declined by 85 to 90 percent in the last half-century. Many species of South Florida's mammals, birds, reptiles, amphibians, and plants are either threatened or endangered. The present management system of canals, pumps, and levees will not be able to provide adequate water supplies to agricultural and urban areas, or sufficient flood protection, let alone to support the natural (but damaged) ecosystems remaining as wetlands. That is, the system is not sustainable.

To meet the needs of the burgeoning South Florida population and increasing agricultural demands for water, and to begin restoring the Everglades ecosystem to a more natural regime, a plan (the Restudy) has been developed by the U.S. Army Corps of Engineers and its local sponsor, the South Florida Water Management District. It was assisted by the South Florida Ecosystem Restoration Task Force, a team of federal and state agencies and Indian tribes. The Restudy, submitted to Congress on July 1, 1999, is estimated to cost nearly \$8 billion over 20 years (see <http://www.restudy.org>).

Implementation of the Restudy poses numerous scientific and technical challenges as it attempts to meet the needs of multiple interests, such as farmers, urban dwellers, and wildlife. The plan involves changing the current hydrologic regime in the remnant Everglades to one that resembles a more natural one, reestablishing marshes and wetlands, implementing agricultural best management practices, enhancing wildlife and recreation opportunities, and providing water supply and flood control. One of its more ambitious goal is the creation of several large surface and subsurface storage areas to capture much of the water now drained by ditches and canals directly to the ocean. In addition, new wetlands are planned to trap agricultural and urban pollutants before their discharge to the natural wetlands and estuaries, flows will be supplemented with "reclaimed" water, and water releases to the natural wetlands will be altered.

The restoration effort requires application of state-of-the-art large systems analysis concepts, hydrological and hydroecological data collection and modeling, sophisticated decision-support systems, integration of

### 1999 Abel Wolman Distinguished Lecture

The Water Science and Technology Board of the National Research Council proudly invites you to attend the ninth Abel Wolman Distinguished Lecture on Friday, November 5, 1999. The lecture will be delivered by **Dr. Gilbert White**, distinguished professor emeritus of geography at the University of Colorado, Boulder and a member of the National Academy of Sciences. Dr. White will discuss the future integration of environmental policy with policy on human development.

The program will begin at 11:00 a.m. in the Auditorium of the National Academies, 2101 Constitution Avenue, NW, Washington, D.C. A reception will follow the Lecture in the Great Hall. The event is free and open to the public. We hope you and your colleagues plan to attend. In order to accommodate our audience, please RSVP to Anita Hall at the WSTB at either (202) 334-3422 or [ahall@nas.edu](mailto:ahall@nas.edu).

## Water Science and Technology Board

The Water Science and Technology Board (WSTB) is a unit of the National Research Council, which serves as an independent advisor to the federal government on scientific and technical questions of national importance. The National Research Council, jointly administered by the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine, brings the resources of the scientific and technical community to bear on national problems through its volunteer advisory committees.

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social sciences, and monitoring for planning and evaluation of performance in an adaptive management context. These large, complex challenges demand the most advanced, interdisciplinary, and scientifically sound capabilities that the nation has to offer.

The NRC activity, being organized as a joint venture by the WSTB and the Board on Environmental Studies and Toxicology (BEST), will provide a scientific overview and technical assessment of the many complicated, interrelated activities that are occurring at the federal, state, local, and non-governmental levels. In addition to strategic assessments and guidance, it is expected that the NRC will provide more focused advice on technical topics of importance to the restoration efforts, such as the following: program goals, objectives, and planning approach; data and information aspects, including needs for basic hydrologic and water quality data, environmental resources information, display and dissemination, and monitoring needs; use of hydrological and hydroecological simulation models; engineering/construction and geological aspects of the restoration plans; agricultural best management practices; ecosystem restoration theory; wildlife management; decision support systems; and relevant research.

Presently, contracting arrangements are being made to support this new activity, and it is anticipated that work will be under way within the next couple months. In parallel, formation of the responsible multidisciplinary advisory committee of about 15 members is proceeding. The committee will require extensive briefings from restoration program managers and scientists, a variety of stakeholders, and other interested parties. It appears that an open colloquium might be an effective format for the first meeting of the committee, where the objective will be to become informed about program history, organization, scientific components, public and stakeholder interests and views, and other aspects. From this initial meeting, the committee will begin to provide an assessment of overall program strategy and direction, and it will likely plan and organize assessments of particular topics to be addressed by ad hoc panels or committee-hosted workshops.

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*Stephen Parker is the Director of the Water Science and Technology Board.*

### **WSTB Seeks Candidates for Staff Officer Position(s)**

The WSTB is seeking technical staff members to direct and assist with studies related to ecosystem restoration, environmental engineering, environmental remediation, environmental monitoring, water resources management, and hydrologic science.

Requires a Ph.D. or equivalent in environmental engineering, hydrology, or a related field of water science and technology plus broad technical experience. Also requires a demonstrated ability to write clearly and succinctly for technical and non-technical audiences; analyze quantitative and technical material; communicate effectively; and plan and organize technical meetings and workshops.

For consideration, please submit resume in confidence to:

*Water Science and Technology Board*  
Attn: SP  
HA 462  
2101 Constitution Avenue, NW  
Washington, DC 20418  
Fax: (202) 334-1961

## **NEW REPORTS**

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### **Downstream: Adaptive Management of Glen Canyon Dam and the Colorado River Ecosystem**

*by Jeffrey Jacobs*

Since the early 1980s, the effect of Glen Canyon Dam operations on downstream resources in the Colorado River ecosystem has been the subject of multiple studies. As part of that continuing effort, in 1995 the U.S. Department of the Interior established the Grand Canyon Monitoring and Research Center ("Center"), which is part of a larger Adaptive Management Program ("Program"). Another important organizational component of the Program is the Adaptive Management Work Group, which is composed of representatives from federal and state agencies, Native American tribes, and nongovernmental organizations with interests in Grand Canyon ecosystem management. The Center, with the help of other federal entities, began long-term strategic planning shortly after its inception, and in 1997 it produced a *Long-Term Monitoring and Research Strategic Plan*. A new WSTB report, *Downstream:*

*Adaptive Management of Glen Canyon Dam and the Colorado River Ecosystem*, comments on the Plan's likely effectiveness in promoting the Center's research and monitoring programs.

The concept of adaptive management is central to the Program and the Center's five resource programs—biological, cultural, information technology, physical, and socioeconomic. While the Center's small cadre of scientists has a good grasp of the concepts and definitions of adaptive management, it is not clear that these concepts are widely shared among Adaptive Management Work Group members, or whether scientists and stakeholders have similar definitions. One idea common to most definitions of adaptive management is that experiments should be part of resource management. Through careful monitoring, results of management experiments are then used to help inform future management decisions. The committee noted that an adaptive management experiment is currently being conducted with the operating criteria of Glen Canyon Dam. These criteria are codified in the Secretary of the Interior's Record of Decision (1996), which mandated maximum and minimum release rates from the dam. Within the Adaptive Management Program or Strategic Plan, however, there is no clear articulation of this current "experiment," which may impede a better understanding of the relations between dam operations, ecosystem responses, cultural effects, and tradeoffs among socioeconomic outcomes. The committee thus recommended that the Center and Adaptive Management Program stakeholders work toward a common definition of adaptive management and clearly articulate this ongoing experiment.

Neither the Center's Strategic Plan nor the stakeholders have defined a common vision for the future state of the Grand Canyon ecosystem. As the Program is in its formative stages, it may be unrealistic to expect scientists and stakeholders to have agreed upon a single vision. Until some common objectives for Grand Canyon ecosystem management are defined, however, the Center's ability to effectively coordinate its five resource programs and to employ certain scientific methods, such as rule-based simulation exercises, will be constrained. The committee thus recommended that the Center and Program stakeholders recognize the current pluralistic situation and its limitations, and that the Strategic Plan present a strategy for moving toward a set of common objectives and reference conditions for the ecosystem over the next five years.

The Center has made good progress toward a more coherent understanding of the Grand Canyon ecosystem, especially through work on a conceptual model. However, the Center has yet to clearly define and implement a long-term monitoring program for the Canyon, which the committee recommends be started soon. The strengths and weaknesses of the Center's five resource programs are variable. The Biological

Resources Program should move toward monitoring and research of ecosystems and communities and away from its present species-oriented emphasis. The Cultural Resources Program is well organized; the notion of cultural groups should be expanded beyond tribal groups, and the values of ethnographical perspectives and archaeological evidence for adaptive management in the Grand Canyon should be more broadly recognized. The Information Technology Program also appears to be functioning well, although its role could be strengthened through the development of decision support systems for the Center. Research in the Physical Resources Program, framed within a sediment budget model, appears to be operating effectively and is well integrated with the larger Program. The Socioeconomic Resources Program needs to be significantly broadened (beyond recreational and hydropower concerns) and strengthened. Research should be conducted to determine the value of ecosystem features and activities in the Grand Canyon, which should be useful in weighing tradeoffs of future management decisions.

To enable the Center to effectively conduct its monitoring and research activities, the committee recommended that the operational responsibilities within the Adaptive Management Program be reviewed and reconsidered. The Center has been very responsive to stakeholder requests, which may be compromising the Center's ability to conduct monitoring and research. The committee also recommended adding a senior scientist and adaptive management specialist to the Center, along with staff for the cultural, physical, and socioeconomics programs; securing resources to ensure the participation of tribal groups in the Program; and defining criteria for locating the Center in a new "institutional home."

The study was funded by the U.S. Department of the Interior and chaired by James Wescoat of the University of Colorado, Boulder. To order the report, contact the National Academy Press at 800-624-6242 or visit their website at <http://www.nap.edu>.

### **Identifying Future Drinking Water Contaminants**

*By Mark Gibson*

With a growing population, the use of new and diverse chemicals that can enter the water supply, and the emergence of new microbial pathogens, the U.S. federal government is faced with a regulatory dilemma: where should it focus its attention and limited resources to best ensure safe drinking water supplies for the future? The availability of increasingly powerful analytical methods for the detection and identification of small amounts of chemicals and microorganisms in the environment complicates these decisions. A new report from the WSTB *Identifying Future Drinking Water Contaminants* should help ensure that drinking water contaminants,

especially new and emerging ones, are identified and that their health risks are appropriately addressed.

1996 amendments to the Safe Drinking Water Act require the U.S. Environmental Protection Agency (EPA) to publish, every five years, a list of unregulated chemical and microbial contaminants that are known or anticipated to occur in public water systems and that may pose human health risks. The first such list, the Drinking Water Contaminant Candidate List (CCL), was published in March 1998. Every five years, the EPA must decide whether to regulate at least five new contaminants from the CCL. Because additional research and monitoring need to be conducted for most of the contaminants on the current CCL, the CCL can be used to help prioritize research activities.

At the EPA's request, WSTB and BEST jointly formed the Committee on Drinking Water Contaminants to help the EPA develop and use the first and successive CCLs in a scientifically defensible manner. Specifically, the EPA asked the committee to accomplish three related tasks: (1) develop a scientifically sound approach for deciding whether or not to regulate contaminants on current and future CCLs, (2) convene a workshop focusing on emerging drinking water contaminants and the database that should be created to support future decision-making on such contaminants, and (3) outline an approach for developing future CCLs.

The committee's first report, *Setting Priorities for Drinking Water Contaminants*, provides a phased decision-making process for determining which contaminants on a CCL are appropriate candidates for regulatory decisions and which will require additional research or monitoring. (It is summarized in the November/ December 1998 issue of the WSTB newsletter.) *Identifying Future Drinking Water Contaminants* addresses the second and third topics and is based on a series of presentations and subsequent committee deliberations that occurred at a December 1998 workshop on emerging drinking water contaminants. At the workshop, a dozen papers were presented on emerging microbiological and chemical drinking water contaminants, associated analytical and treatment methods, and existing and proposed environmental databases for their proactive identification and regulation.

Following the presentations, the committee developed a consensus-based approach and related recommendations for the creation of future CCLs. Due to the limited time available for committee deliberations, the recommended approach for the development of future CCLs is a conceptual, two-step process. Under this two-step approach, the "universe" of potential contaminants derived from a wide variety of sources would first be combined and culled using simple criteria and expert judgment to prepare a "preliminary CCL" (PCCL). (In this regard, the committee recommends that the EPA

evaluate several types of related potential drinking water contaminants that were not considered for inclusion on the first CCL, such as pharmaceuticals, biological toxins, and fibers.) Next, the PCCL would be processed, using more information in conjunction with a quantitative screening tool and expert judgment, to prioritize which contaminants should be listed on the CCL. The process would be repeated for each CCL development cycle to account for new data and contaminants that are identified over time. In addition, all contaminants that have not been regulated or removed from the existing CCL would be automatically retained on each subsequent CCL. As in the previous report, the committee recognized the need for EPA policy judgments, which cannot and should not be removed from the CCL development process.

The report was written by the Committee on Drinking Water Contaminants and chaired by Warren Muir, formerly of the Hampshire Research Institute, now Executive Director of NRC's Commission on Life Sciences. Funding for the report was provided by the EPA's Office of Ground Water and Drinking Water. To order a prepublication copy of the report, contact the National Academy Press at 800-624-6242, or <http://www.nap.edu>.

## UPDATE:

### CURRENT PROJECTS

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#### **Riparian Zones: Functions and Strategies for Management**

The joint WSTB/BEST study of the functions of riparian zones and strategies for improved management of these areas will hold its first committee meeting in early fall 1999. Unlike wetlands and waterbodies, riparian zones are not specifically regulated. And because they are frequently well oxygenated, they do not qualify for categorization as wetlands. This study will describe the nature and functions of riparian zones and assess the condition and trends of riparian habitats with respect to water quantity and quality. It will also review criteria for the improved management of riparian lands and for mitigation of impacts on such habitats by identifying conflicting policies or objectives and suggesting methods for resolving them. Funding has been secured from EPA, USGS, USDA, the Bureau of Reclamation, and the National Science Foundation (NSF). The study is likely to include four meetings over 18 months. The committee is currently being formed and should be approved by the NRC at the end of July. For further information, contact study director Laura Ehlers at 202-334-3422 or [lehlers@nas.edu](mailto:lehlers@nas.edu).

#### **Committee on Drinking Water Contaminants**

The joint WSTB/BEST Committee on Drinking Water Contaminants is beginning a second phase of study that will extend through September 30, 2000. EPA's Office of Ground Water and Drinking Water has requested that the committee develop and recommend a process to prioritize potential drinking water contaminants (chemical and microbiological) for inclusion on future Drinking Water Contaminant Candidate Lists. The process will include a simple, semi-quantitative prioritization tool as recommended by the committee in their first two reports, *Setting Priorities for Drinking Water Contaminants* and *Identifying Future Drinking Water Contaminants*. In addition, the committee will provide further guidance on the development of mechanisms for grouping related microbial contaminants into categories for research and regulation. The committee was chaired by Warren Muir, founder and president of the Hampshire Research Institute and now executive director of the NRC Commission on Life Sciences. A new chair is currently being selected. For more information, contact Mark Gibson at 202-334-3422 or [mgibson@nas.edu](mailto:mgibson@nas.edu).

#### **Studies in Hydrologic Science**

Early in 1999, a new standing activity was launched by the WSTB in cooperation with the NRC's Board on Atmospheric Sciences and Climate. The Committee on Hydrologic Science, with support from USGS, NASA, NOAA and NWS, NSF, and the Army, will review and provide advice on scientific activities of U.S. federal agencies and U.S. contributions to international programs in hydrologic science including research, observation systems, and data collection. The NRC hopes to help assure the best and most appropriate hydrologic input to U.S. and international programs with hydrologic components and guide the proper development of the field of hydrologic science to be of maximum value to the national and international scientific enterprise.

After two meetings, the committee has drafted its first report, which focuses on hydrologic science priorities in global change research. The report is currently undergoing external review and should be published by mid-August. The report will be the subject of briefings and serve as a basis for planning future activities at the committee's next meeting, to be held in Washington DC on September 9-10, 1999. Dara Entekhabi of the Massachusetts Institute of Technology chairs the committee. For information, contact WSTB director Stephen Parker at 202-334-3422 or [sdparker@nas.edu](mailto:sdparker@nas.edu).

#### **Optimizing Water and Wastewater Service: Public and Private Models**

The WSTB has approved an initiative that would evaluate various arrangements used in the privatization of water services (water supply and sewage and wastewater treatment) systems in the U.S. There are several possible privatization arrangements, ranging from the contracting of some services and repairs to the private sector, to the sales of entire public water systems to a private vendor. Although there is great interest in the theories and practices of privatization of public water utility systems in the U.S., studies of the long-term implications of privatization of these systems have been few. The likelihood of full funding for this NRC study is high. For further information, contact study director Jeffrey Jacobs at 202-334-3422 or [jjacobs@nas.edu](mailto:jjacobs@nas.edu).

### **Environmental Remediation at Naval Facilities**

The Navy has given approval for the second phase of this project, meant to provide ongoing advice to their Environmental Restoration Program. The first phase of the project evaluated the use of new risk-based methods for cleaning up contaminated groundwater and soil at Navy facilities. In order to identify the Phase 2 study topic and draft a work statement, a planning meeting will be held in Washington DC on August 25. NRC staff, committee members, and Navy personnel from all levels will likely choose one of the following study topics: (1) development of a quantitative framework for evaluating the cost and effectiveness of cleanup remedies, (2) in-depth evaluation of long-term monitoring of contaminated sites, or (3) development of methods for reducing uncertainty through the use of formal uncertainty analyses and other mechanisms. Depending on the study topic chosen, some members of the original committee will be retained and additional committee members will be chosen to fill gaps in expertise needed for Phase 2. Edward J. Bouwer of the Johns Hopkins University chairs the committee. For more information, or to nominate new committee members, contact study director Laura Ehlers at 202-334-3422 or [lehlers@nas.edu](mailto:lehlers@nas.edu).

### **Risk-Based Analyses for Flood Damage Reduction Studies**

The U.S. Army Corps of Engineers is the federal agency primarily responsible for constructing the nation's flood damage reduction projects. In order to account for uncertainties in fundamental data and statistical relationships, the Corps has begun using risk-based analysis (RBA) to make decisions regarding project performance and design parameters. This committee is reviewing the Corps' use of RBA methodology and its implications regarding project formulation, economic justification, value added, and engineering and safety implications. It is also reviewing Corps studies that have used RBA, examining both the scientific validity of RBA

and implications of its use for Corps policies and procedures. The committee held its third meeting in Irvine, CA on May 10-11, and will hold its fourth meeting in Woods Hole, MA on September 13-14. Greg Baecher of the University of Maryland chairs the committee. For further information, contact study director Jeffrey Jacobs at 202-334-3422 or [jjacobs@nas.edu](mailto:jjacobs@nas.edu).

### **Committee on USGS Water Resources Research**

The Committee on USGS Water Resources Research is midway through a study that will lead to publication of the report *Investigating Groundwater Systems on Regional and National Scales* in the spring of 2000. The report will provide guidance to the USGS on direction, scope, and emphasis of future regional and national groundwater studies carried out by the Water Resources Division. Questions such as the following are forming the basis for the study. What are the nation's major emerging groundwater problems and research needs? What constitutes a regional assessment and how can it best be presented? The committee is chaired by Kenneth Bradbury, Wisconsin Geological and Natural History Survey, University of Wisconsin. The committee last met in Tucson, AZ on April 18-20, to work on the report and tour relevant field sites in the area. The next meeting is scheduled for September 27-28 in Washington, DC. For more information, contact WSTB director Stephen Parker at 202-334-3422 or [sdparker@nas.edu](mailto:sdparker@nas.edu).

### **Subsurface Contamination at DOE Complex Sites**

The Committee on Subsurface Contamination at DOE Complex Sites: Research Needs and Opportunities is tasked with advising the U.S. Department of Energy (DOE) on a science plan for subsurface contamination research sponsored by the DOE's Environmental Management Science Program. The committee's final report will describe the significant subsurface contamination problems at DOE sites that cannot be addressed with current technologies, identify the knowledge gaps relevant to these problems, and suggest elements of a research plan to help fill these gaps. The study is jointly conducted by the WSTB and the Board on Radioactive Waste Management (BRWM).

The fifth committee meeting was primarily a report writing session in Irvine, CA on May 6-7, 1999. The final meeting (July 1-2) will be a closed meeting during which the committee will finalize its report. A prepublication copy of this report is expected in mid-September. The committee published an interim report in December 1998, which offered advice to the DOE on the technical content of their FY99 call for proposals. For additional information, contact BRWM director Kevin Crowley at 202-334-3066 or [kcrowley@nas.edu](mailto:kcrowley@nas.edu).

## **Committee on Eutrophication, Coastal Processes, and Watershed Management**

Coastal ecosystems face a variety of serious environmental problems, ranging from habitat loss and hydrodynamic disruptions to toxic contamination and introduction of nonindigenous species. One of the most significant problems is eutrophication—the process of organic enrichment that can lead to excessive (and sometimes noxious) production of algal biomass, seagrass loss due to light reduction, changes in marine biodiversity, and, ultimately, depletion of dissolved oxygen and associated fish kills.

This joint WSTB/Ocean Studies Board (OSB) effort is designed to (1) assess how coastal and watershed processes affect eutrophication of coastal ecosystems; (2) recommend ways to improve coordination and effectiveness of research, monitoring, and management being conducted at the federal, state, and local levels; and (3) identify means to remove barriers that impeded implementation of techniques to reduce coastal eutrophication. The committee has met five times, with one meeting remaining, and it is well on its way toward completion of its final report. The draft deals with the causes, symptoms, and impacts of eutrophication; nutrient sources; estuarine susceptibility; monitoring and assessment; modeling; source reduction and control; policy design and goal setting; and other related issues. The report is expected to go to outside review in the fall and be ready for public release by the end of the year. Study sponsors include NOAA, EPA, USGS, and the Electric Power Research Institute. For further information, contact Dan Walker (OSB) at 202-334-1798 or Chris Elfring (WSTB) at 202-334-3426.

### **Natural Attenuation of Subsurface Contaminants**

The Committee on Intrinsic Remediation is finishing work on its report, an in-depth evaluation of the scientific basis for natural attenuation of contaminants in groundwater. The report analyzes the extent of scientific knowledge of natural attenuation for a wide variety of contaminants. It recommends ways to analyze waste sites to determine whether natural attenuation can effectively control contamination. It also evaluates in detail most of the existing natural attenuation protocols developed by a range of organizations, from the EPA to the American Society for Testing and Materials. Also included is a chapter assessing community concerns about natural attenuation. The report will be peer reviewed this summer and released in the fall. The committee is chaired by Bruce Rittmann of Northwestern University. For additional information, contact study director Jackie MacDonald at 202-334-3422 or [jmacdona@nas.edu](mailto:jmacdona@nas.edu).

## **New York City's Watershed Management Strategy**

The Committee to Review the New York City Watershed Management Strategy held its final meeting April 8-10 in Woods Hole, MA. This study, which is funded by the New York City Office of the Comptroller, involves a scientific evaluation of the New York City Watershed Memorandum of Agreement. This document establishes a comprehensive watershed protection program to protect drinking water reservoirs in the Catskill/Delaware watershed and enable New York City to avoid filtering its drinking water supply. The final meeting was spent in closed session evaluating report chapters and debating conclusions and recommendations. The report is currently undergoing external review, and a prepublication version of the final report should be available in late summer or early fall 1999. Charles O'Melia of the Johns Hopkins University chairs the committee. For more information, contact study director Laura Ehlers at 202-334-3422 or [lehlers@nas.edu](mailto:lehlers@nas.edu).

### **Indicators for Monitoring Aquatic and Terrestrial Environments**

The Committee to Evaluate Indicators for Monitoring Aquatic and Terrestrial Environments is assessing a range of issues surrounding the selection of indicators useful for monitoring ecosystems. The committee is addressing the potential value of biological indicators and indices, key ecosystem properties for establishing indicators, and different sources and methods used in identifying useful indicators. The study is managed jointly by WSTB and BEST and is sponsored by the EPA. The report is currently undergoing external review, with a prepublication version expected in fall 1999. Gordon Orians of the University of Washington chairs the committee. For more information, contact David Policansky at 202-334-2234 or [dpolican@nas.edu](mailto:dpolican@nas.edu) or Jeffrey Jacobs at 202-334-3422 or [jjacobs@nas.edu](mailto:jjacobs@nas.edu).

### **Site (Seeing Into The Earth)**

A committee overseen by the Board on Earth Sciences and Resources (BESR), with assistance from the WSTB, should soon be completing its study of noninvasive methods for characterizing the shallow subsurface of the earth. The ability to characterize the shallow subsurface is essential for many environmental and engineering concerns. The committee is evaluating new and improved noninvasive characterization methods as well as addressing technical and institutional barriers to implementing new methods. The committee's report, *Seeing Into the Earth: Characterization of the Shallow Subsurface for Environmental and Engineering Applications*, is presently awaiting clearance following review and should be distributed this summer. Phillip

Romig of the Colorado School of Mines chairs the committee. For information, contact study director Thomas Usselman at 202-334-2744.

## PREVIEW: FUTURE PROJECTS

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### **Missouri River Basin: Improving the Scientific Basis for Adaptive Management**

The U.S. Army Corps of Engineers operates six mainstem dams on the Missouri River. Because of drought in the late 1980s and early 1990s and concerns over degradation of aquatic habitat, the Corps has been considering revising its Missouri River dam operations policies. The Corps has fielded a range of suggestions regarding possible changes in water release schedules. One recommendation, from the Missouri River Basin Association, was that better scientific knowledge was needed to support management decisions, including those that have ecosystem restoration as their goal.

With sponsorship from the U.S. EPA (Denver office), the WSTB will conduct a study to characterize the historical and current ecological status of the Missouri River and floodplain ecosystem. The committee will identify existing scientific information and identify information needs related to river management. A planning meeting for this study is scheduled for fall 1998, and the committee will be appointed soon thereafter. For more information, contact Jeffrey Jacobs at 202-334-3422 or [jjacobs@nas.edu](mailto:jjacobs@nas.edu).

### **Bioavailability of Contaminants in Soil and Ground Water**

The WSTB has raised approximately half the funding needed to launch a new study of processes that affect availability of contaminants in soils and sediments to humans and ecosystems. A variety of mechanisms—from sorption on solid materials to biological and chemical transformations—can render contaminants present in the environment virtually harmless to human and ecological systems. Yet existing risk assessment tools do not adequately account for these mechanisms. This study will provide a review of tools for assessing bioavailability of contaminants and how to use them in risk assessment. It will also examine the effects of contaminant treatment methods on bioavailability.

The proposal for the study is the result of a November 1998 planning workshop chaired by WSTB member Richard Luthy of Carnegie Mellon University. The workshop involved approximately two dozen scientists with expertise in bioavailability from academia, government agencies, consulting firms, and industry. If

you are interested in sponsoring this project or have questions about the study, contact Stephen Parker at 202-334-3422 or [lehlrs@nas.edu](mailto:lehlrs@nas.edu).

### **Opportunities to Improve the National Water Quality Assessment (NAWQA) Program**

The NRC will soon be convening a committee to review the USGS National Water Quality Assessment Program (NAWQA). This seven-year-old, \$70 million/year national program was designed to describe the status of, trends in, and factors affecting surface and groundwater quality in the U.S. The WSTB has provided advice to the USGS regarding NAWQA on three occasions in the past. The current effort would focus on four particular areas of NAWQA and make suggestions for improvement. First, it will suggest methodologies to improve understanding of the causative factors affecting water quality conditions. Second, it will assess whether information produced in the program can be extrapolated to areas not studied intensely under NAWQA. Third, the project will examine current priority pollutants (e.g., pesticides, nutrients, volatile organic compounds, and trace elements) selected for broad investigation under NAWQA for completeness. Finally, the project will make recommendations on aggregation and presentation of information generated at the study unit scale so that it is meaningful at the regional and national levels.

The study will be carried out over a 16-month period, during which the committee will meet three to four times. The first committee meeting is expected in fall 1999. For more information or to suggest committee membership, contact Laura Ehlers at 202-334-3422 or [lehlrs@nas.edu](mailto:lehlrs@nas.edu).

### **Functions and Values of Aquatic Ecosystems**

The WSTB has received a grant from the NRC to develop a study of methods for assessing functions and values of aquatic ecosystems. Aquatic ecosystems perform numerous valuable environmental functions, such as recycling nutrients, purifying water, attenuating floods, recharging groundwater, and forming habitats for wildlife. In some cases, those functions provide services that benefit people, making them valuable to society. Unfortunately, increasing use and demands on aquatic ecosystems have often resulted in their devaluation through pollution, channelization, and development.

The planning grant will allow the WSTB to hold a workshop involving experts in aquatic ecosystems and environmental economics from government agencies, academia, consulting firms, industry, and public interest groups to plan an appropriate scope for the study. After the planning session, the WSTB will write a proposal and begin seeking sponsorship. For information, or if you are

interested in sponsoring the study, contact Mark Gibson at (202) 334-3422 or [mgibson@nas.edu](mailto:mgibson@nas.edu).

### Mitigating Wetland Losses

At the request of the EPA, the WSTB and BEST have begun to plan for a new study that will evaluate the effectiveness of wetland restoration and mitigation practices in replicating pre-disturbed wetland functions and ecological attributes. Under Section 404 of the federal Clean Water Act, compensatory mitigation of wetlands is required to offset any unavoidable adverse impacts on wetlands that cannot otherwise be minimized. Compensatory mitigation usually consists of restoration, enhancement, or creation of new wetlands, where practicable. However, it is not certain how well such mitigation efforts compensate for existing, naturally functioning wetlands. As a result, the degree to which progress is being made in achieving the goal of no net loss of wetland resources is also uncertain.

The study will be undertaken by a multidisciplinary committee, which will review (1) the scientific and technical literature on wetlands structure and functioning, and (2) options for mitigating wetlands loss through restoration, enhancement, creation, and in-lieu fee programs. The study will evaluate the current ability of practitioners to restore various aspects of wetlands functioning in a variety of environments and evaluate options for mitigating wetland loss. Key issues are (1) wetlands' size and place in the landscape, (2) the ecoregion in which they occur, (3) the kinds of animals and plants that comprise them, (4) their hydrological regime, and (5) other factors are likely to affect the success of wetland restoration and mitigation of wetland loss. The main criterion for the evaluation will be the degree to which the structure and functioning of the restored wetland match those of naturally occurring wetlands in the same region. The committee will analyze an illustrative set of wetlands mitigation projects, including individual projects, mitigation banks, and in-lieu fee programs to the extent that they have ecological goals.

It is expected that this study should be underway by the fall of 1999. For more information, contact David Policansky at 202-334-2540 or [dpolican@nas.edu](mailto:dpolican@nas.edu) or Stephen Parker at 202-334-3422 or [sdparker@nas.edu](mailto:sdparker@nas.edu).

### Assessment and Control of Nonpoint Source Pollution

Nonpoint source (NPS) pollution has become the major threat to water quality in the nation's waterbodies, both coastal and inland. NPS pollution is associated with a wide variety of human activities that involve changes in vegetative cover, disturbance of soil, or alteration of hydrology. The consequences of NPS pollution range from minor to very severe, depending on the intensity of

activity, the vulnerability of the natural systems where the activity occurs, and the technologies that are used to mitigate the adverse effects on water quality and aquatic ecosystems. This proposed study would investigate (1) the sufficiency of knowledge about sources of NPS pollution, including land use change and other factors, (2) the state of modeling to predict pollutant loads from these sources, and (3) the effectiveness of regulatory and management approaches in controlling NPS pollution. The study would complement the ongoing efforts of the Committee on Eutrophication, Coastal Processes and Watershed Management by focusing more on inland nonpoint sources of pollution and considering a broader range of pollutant types. It would result in a written report that should have broad appeal to state and federal regulatory agencies. Although several federal agency representatives have expressed interest in funding the study, no firm commitments have been made. To suggest funding sources or possible committee membership, contact Laura Ehlers at (202) 334-3422 or [lehlers@nas.edu](mailto:lehlers@nas.edu).

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## WATERMARKS

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### New WSTB Membership

On July 1, the WSTB underwent several membership changes. Three new members—Gregory Baecher of the University of Maryland, Steven Gloss of the University of Wyoming, and Rhodes Trussell of Montgomery Watson—were appointed to three-year terms. Eville Gorham of the University of Minnesota was reappointed to a second three-year term. Charles Howard of Charles Howard and Associates, British Columbia, William Lewis of the University of Colorado, Boulder, and Charles O'Melia of Johns Hopkins University, Baltimore, Maryland retired from the board. We thank these individuals for their service to the board.

Following is the current WSTB roster:

Henry J. Vaux, Jr., *chair*, Division of Agriculture and Natural Resources, University of California, Oakland  
Carol A. Johnston, *vice-chair*, University of Minnesota, Duluth

Richelle Allen-King, Washington State University, Pullman

Gregory Baecher, University of Maryland, College Park  
John S. Boyer, University of Delaware, Lewes  
John Briscoe, The World Bank, Washington, DC  
Denise Fort, University of New Mexico, Albuquerque  
Steven Gloss, University of Wyoming, Laramie  
Eville Gorham, University of Minnesota, St. Paul  
William A. Jury, University of California, Riverside  
Gary S. Logsdon, Black & Veatch, Cincinnati, Ohio  
Richard G. Luthy, Carnegie Mellon University,

Pittsburgh, Pennsylvania  
John W. Morris, J.W. Morris Ltd., Arlington, Virginia  
Philip A. Palmer, E. I. du Pont de Nemours & Co.,  
Wilmington, Delaware  
Rebecca T. Parkin, The George Washington University,  
Washington, DC  
Joan B. Rose, University of South Florida, St. Petersburg  
R. Rhodes Trussell, Montgomery Watson, Pasadena,  
California  
Eric F. Wood, Princeton University, Princeton, New  
Jersey

### **Departure of Jackie MacDonald**

After nine years of service at the NRC, WSTB Associate Director Jacqueline MacDonald will be leaving to take a position with RAND, a nonprofit research and analysis institution in Washington DC. Her new duties at RAND will involve liaisonship with the White House Office of Science and Technology Policy and environmental consulting. Jackie's last day with the WSTB will officially be July 30, but she will continue as a consultant for the intrinsic remediation study until completion late in 1999.

During her NRC career, Jackie has managed some very important and successful projects, including *Alternatives for Ground Water Cleanup, In Situ Bioremediation, Safe Drinking Water from Every Tap, and Issues in Potable Reuse*. In almost all cases, Jackie greatly increased report visibility by publishing summary articles in leading science and engineering journals and giving presentations at conferences across the country. In addition, Jackie was a frequent contributor to internal NRC training seminars. Receipt of the NRC Individual Staff Award for Distinguished Service in 1996 is just one indicator of the quality and value of Jackie's numerous achievements and diverse contributions to the WSTB, the NRC, and our constituents. The WSTB wishes her the best of luck in her new employment.

### **WSTB Gets Group Award**

At the annual awards ceremony of the Commission on Geosciences, Environment, and Resources (CGER), three WSTB staff members (Jackie MacDonald, Jeff Jacobs, and Anita Hall) won individual awards for their service and the WSTB won the group award for outstanding achievement. Since January 1999, the WSTB has published seven new reports, with five more slated for publication by year's end.

Jeff Jacobs won an individual award for single handedly pulling together the successful report on Water Resources Planning within the U.S. Army Corps of Engineers. The recently completed Grand Canyon report can also be added to his list of accomplishments in 1999.

In addition, Jeff is the primary study director for three ongoing and future projects: the Risk-Based Analysis Study, the Missouri River Basin Study, and the Privatization Study. He has also devoted time to projects conducted under the Board on Natural Disasters.

Anita Hall was acknowledged for her excellent support of several WSTB projects. She has carried a particularly heavy workload that at one point included three reports being simultaneously completed: *Water for the Middle East, New Strategies for America's Watersheds, and Hydrologic Hazards Science at the USGS*. Anita is a wealth of knowledge concerning drafting and formatting of NRC reports, and she serves as a role model for numerous NRC staff.

### **Japanese Editions of WSTB Reports**

Two classic WSTB reports are being published in Japanese: *Restoration of Aquatic Ecosystems*, a 1992 report providing seminal guidance on ways to restore degraded rivers, streams, wetlands, and lakes, and *Safe Water From Every Tap: Improving Water Service to Small Communities*, a 1996 report that provides a comprehensive assessment of strategies for improving the quality of water service in small communities. Other WSTB reports that have been translated into foreign language editions include *Managing Wastewater in Coastal Urban Areas* and *Opportunities in the Hydrologic Sciences*.

## **WSTB REPORTS**

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### **Downstream: Adaptive Management of Glen Canyon Dam and the Colorado River Ecosystem**

This report comments on the Long-Term Monitoring and Research Plan of the Grand Canyon Monitoring and Research Center. It evaluates the effectiveness and weaknesses of the Plan in promoting the Center's research and monitoring programs. Available from the National Academy Press at 800-624-6242 by August (*see order form*).

### **Identifying Future Drinking Water Contaminants**

This report is a result of a workshop to prioritize potential drinking water contaminants (including chemical and microbiological contaminants) for inclusion on future Drinking Water Contaminant Candidate Lists. Available from the National Academy Press at 800-624-6242 by mid-August (*see order form*).

### **Water for the Future: The West Bank and Gaza Strip, Israel, and Jordan**

This report recommends that Israel, Jordan, and the Palestinian Authority work together to preserve aquatic ecosystems in the Middle East to ensure that an adequate supply of fresh, high-quality water is available for future generations. The report offers a range of findings and observations on water resource management options for this area. Available for \$35.00 (*see order form*).

### **New Directions in Water Resources Planning for the U.S. Army Corps of Engineers**

This report identifies several ways in which the Corps might reduce the time required in water project planning. The report also recommends that the federal Principles and Guidelines for Water and Land Resources Implementation Studies be thoroughly reviewed and modernized. Available for \$39.00 (*see order form*).

### **Hydrologic Hazards Science at the U.S. Geological Survey**

This report provides advice to the U.S. Geological Survey in respect to its research, interpretive studies, and data collection efforts in the area of hydrologic hazards, which includes droughts, flooding, and related phenomena. Available in limited quantities from the WSTB at 202-334-3422.

### **Improving American River Flood Frequency Analyses**

This report is a followup study on flood frequency relationships for the American River. It evaluates the usefulness of various kinds of data, including historical and paleoflood data; recommends flood flow frequency distribution for the American River; and reviews recent scientific literature on climate variability and flood frequency. Available in limited quantities from the WSTB at 202-334-3422.

### **New Strategies for America's Watersheds**

This report provides a timely and comprehensive look at the rise of "watershed thinking" among scientists and policymakers and recommends ways to steer the nation toward improved watershed management. The volume defines important terms, identifies fundamental issues, and discusses why now is the time to bring watersheds to the forefront of ecosystem management. Available for \$49.00 (*see order form*).

### **Setting Priorities for Drinking Water Contaminants**

This report provides a phased decision process for determining which contaminants on the Contaminant Candidate List are appropriate for regulatory decisions and which will require research or monitoring. The report is

guided first and foremost by concerns about public health and concludes that there is no replacement for policy judgments by the EPA. Available for \$30.00 (*see order form*).

### **Environmental Cleanup at Navy Facilities: Risk-Based Methods**

The fiscal and technological limitations associated with cleaning up hazardous waste sites to background conditions have prompted responsible parties to turn to risk-based methods for environmental remediation. This report reviews and critiques risk-based methods, including those developed by the EPA and the American Society of Testing and Materials. These critiques lead to the identification of eleven criteria that must be part of any risk-based methodology adopted by the Navy, a responsible party with a large number of complex and heavily contaminated waste sites. Available from the WSTB at 202-334-3422.

### **Hydrologic Sciences: Taking Stock and Looking Ahead**

Hydrologic science is an important, interdisciplinary science dealing with the occurrence, distribution, and properties of water on Earth. The WSTB used the opportunity of its 1997 Abel Wolman Distinguished Lecture to assess the vitality of the hydrologic sciences by the hydrologic community. *Hydrologic Sciences: Taking Stock and Looking Ahead* is a compilation of the Wolman Lecture and four invited papers, preceded by a summarizing overview. The proceedings stress a number of needs for furtherance of hydrologic science: development of a coherent body of transferable theory and an intellectual center for the science; communication across multiple geological and environmental science disciplines; appropriate measurements and observations; and the provision of central guidance for the field. Available for \$35.00 (*see order form*).

### **Issues in Potable Reuse: The Viability of Augmenting Drinking Water Supplies With Reclaimed Water**

This report looks at the issues involving the use of reclaimed water to supplement drinking water supplies. It discusses issues of water treatment technology, monitoring, and testing of reclaimed water to ensure public safety. Available for \$44.95 (*see order form*).

### **Innovations in Ground Water and Soil Cleanup**

This report provides a comprehensive review of the status of innovative technologies for subsurface cleanup. It also recommends strategies for increasing market demand for innovative remediation technologies, standardizing the collection of pilot and field test data on these technologies, and evaluating cost data. Hardbound copy available for \$44.95 (*see order form*).

### **Valuing Ground Water**

This report examines approaches for assessing the economic value of ground water and the costs of contaminating or depleting this resource. It suggests a framework for policymakers and managers to use in evaluating tradeoffs when there are competing uses for ground water. Available for \$39.95 (*see order form*).

### **Building a Foundation for Environmental Research**

This report outlines a new framework for organizing the research program at EPA's Office of Research and Development (ORD). The report calls for the establishment of two kinds of research at ORD: *problem-driven* research and *core* research. In addition, recommendations are made about how EPA can leverage its limited resources by working with the other agencies and organizations involved in environmental research. Available from the WSTB at 202-334-3422.

### **Watershed Research in the U.S. Geological Survey**

This report is intended to assist the USGS in improving its overall strategy for watershed research. The report identifies opportunities for further scientific research and emphasizes the importance of collaboration with others in maximizing the effectiveness of the agency's research efforts. Available from the WSTB at 202-334-3422.

### **Alluvial Fan Flooding**

This report provides an updated regulatory definition of alluvial fan flooding, presents criteria for assessing whether an area is or is not subject to such flooding, and provides examples of applying the definition and criteria to real situations. Available from the WSTB at 202-334-3422.

### **Safe Water from Every Tap: Improving Water Service to Small Communities**

This report assesses the quality of drinking water in small communities and recommends a three-part strategy for improving it. Available for \$44.95 (*see order form*).

### **Freshwater Ecosystems: Revitalizing Educational Programs in Limnology**

This report provides an overview of the status of inland waters, reviews the history of limnology, describes the key future problems that may face water resource managers, and recommends changes in limnology education and research funding to meet the needs of water resource management. Available for \$54.95 (*see order form*).

### **A New Era for Irrigation**

This report explores the impacts of changing supply and demand conditions, assesses current and potential technologies that might help water users adapt to changing conditions, and considers how to mitigate short- and long-term problems associated with irrigation. Available for \$39.95 (*see order form*).

### **Hazardous Materials in the Hydrologic Environment: The Role of the U.S. Geological Survey**

This report attempts to help shape the overall framework of the U.S. Geological Survey's research in hazardous materials science and technology and identifies general areas of scientific opportunity. Available from the WSTB at 202-334-3422.

### **River Resource Management in the Grand Canyon**

This report assesses the achievements and shortcomings of the Bureau of Reclamation's Glen Canyon Environmental Studies and reviews the final research done under the program. Available for \$35.00 (*see order form*).

### **Use of Reclaimed Water and Sludge in Food Crop Production**

This report reviews the current state-of-the-practice, public health concerns, existing guidelines and regulations, and implementations issues of using municipal wastewater and sludge in food crop production. Available for \$34.00 (*see order form*).

### **Wetlands: Characteristics and Boundaries**

This report analyzes present regulatory practice related to wetlands delineation and recommends changes that should bolster the objectivity and scientific validity of wetlands delineation and identification. Available for \$42.95 (*see order form*).

### **Flood Risk Management and the American River Basin: An Evaluation**

This book reviews the U.S. Army Corps of Engineers' investigations of flood control options for the American River basin and evaluates flood control feasibility studies for the watershed. Available for \$29.00 (*see order form*).

### **Mexico City's Water Supply: Improving the Outlook for Sustainability**

This bilingual report addresses the technical, health, regulatory, and social aspects of ground water with-drawals, water use, and water quality in the Mexico City metropolitan area and recommends ways to improve the balance of water supply, demand, and conservation. Available for \$30.00 (*see order form*).

#### **Review of EPA's Environmental Monitoring and Assessment Program: Overall Evaluation**

This final review of EPA's Environmental Monitoring and Assessment Program (EMAP) evaluates whether EMAP's goals of assessing the status of and trends in the nation's ecosystems are achievable, given the difficult scientific, practical, and management challenges of implementing them. Available for \$35.00 (*see order form*).

#### **Alternatives for Ground Water Cleanup**

This report provides guidance on how the nation can balance public health and technological realities when addressing ground water contamination. Included is a listing of nearly 80 contaminated sites that the committee reviewed and detailed case studies for several of the sites. Available for \$39.95 (*see order form; print on demand*).

#### **Ground Water Recharge: Using Waters of Impaired Quality**

This report examines the use of waters of less-than-ideal quality, such as treated municipal wastewater and urban stormwater runoff, as sources for artificial ground water recharge projects. Available for \$39.00 (*see order form; print on demand*).

#### **Managing Wastewater in Coastal Urban Areas**

This report examines the problems of wastewater and stormwater management in coastal urban settings, recommending a system of integrated coastal management. Available for \$54.95 (*see order form*).

#### **In Situ Bioremediation: When Does It Work?**

This report provides direction for decision-makers and offers detailed explanations of the processes involved in *in situ* bioremediation, circumstances in which it is best used, and methods for evaluating the results of bioremediation projects. Available for \$34.95 (*see order form*).

### **NATIONAL RESEARCH COUNCIL MEETINGS**

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**July, 9-10, 1999** Water Science and Technology Board Meeting, Woods Hole, MA

**August 25, 1999** Committee on Environmental Remediation at Naval Facilities, Washington, DC

**September 9-10, 1999** Committee on Hydrologic Science, Washington, DC

**September 13-14, 1999** Committee on Risk-Based Analysis, Woods Hole, MA

**September 27-28, 1999** Committee on USGS Water Resources Research, Washington, DC