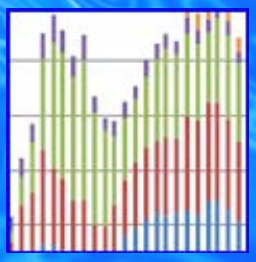
Institute for Water Resources

Institute for Water Resources FY 2011 Annual Report

Chapter 43, Report of the Secretary of the Army on Civil Works Activities for FY 2011



US Army Corps of Engineers®

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INSTITUTE FOR WATER RESOURCES

BACKGROUND

The U.S. Army Engineer Institute for Water Resources (hereafter referred to as the Institute or "IWR") is a Corps of Engineers Field Operating Activity (FOA) under the staff supervision of the Deputy Commanding General for Civil and Emergency Operations (DCG-CEO) and the Director of Civil Works, Headquarters, U.S. Army Corps of Engineers (HQUSACE). The Institute is the USACE knowledge center for integrated water resources management (IWRM), and is recognized as a national center of expertise in water resources planning methods, risk analysis, hydrologic engineering, conflict resolution and public participation, international water resources, global climate change science, and the collection, management and dissemination of Civil Works program information and navigation related infrastructure performance information, including the Nation's waterborne commerce data.

IWR was established by the USACE Chief of Engineers in 1969 with the approval of the House of Representatives and Senate Appropriations Committees and the Subcommittees on Public Works in order "to enhance the capability of the Corps of Engineers to develop and manage the Nation's water resources, within the scope of the Corps' responsibilities, by developing essential improvements in planning to be responsive to the changing concerns of our society."

The Institute's mission is to facilitate the adaptation of the Civil Works program to future needs by providing the USACE with the capability for developing forward-looking analysis and state-of-the-art methodologies. IWR fulfills this mission by supporting the Civil Works Directorate and USACE Major Subordinate Commands (MSCs) and District offices by providing: (a) analysis of emerging water resources trends and issues; (b) state-of-the-art planning, hydrologic engineering, and risk assessment methods, models, training, and custom applications; and (c) national data management of results-oriented program and project information across Civil Works business lines.

The Institute is a member of the Federal Laboratory Consortium for Technology Transfer (FLC), a nationwide network of over 250 federal institutions chartered by the Federal Technology Transfer Act of 1986. IWR also has a cooperative relationship with the National Institutes for Water Resources (NIWR), which represents fifty-four State and U.S. territorial university-based water centers through the U.S. Department of the Interior, U.S. Geological Survey (USGS). The FLC and NIWR provides USACE with the framework for developing technology transfer strategies and opportunities by promoting and facilitating technical cooperation in cooperation with Corps District offices and Planning Centers of Expertise and among federal laboratories, industry, academia, and state and local governments.

IWR CENTERS

IWR has offices at five locations, each of which is a USACE designated center of expertise (DX). The National Capital Region (NCR) office and the Navigation Data Center (NDC) office are located in the Casey Building at the Humphreys Engineer Center in Alexandria, Virginia. The Hydrologic Engineering Center (HEC) is located in Davis, California. The Waterborne Commerce Statistics Center (WCSC), a unit of the Navigation Data Center, is located in New Orleans, Louisiana. The Risk Management Center (RMC) has offices in Denver, Colorado and Pittsburgh, Pennsylvania.

National Capital Region Office: The IWR NCR office is the Corps designated center of expertise for the development of methods, models, and analytical tools used for water resources and water systems planning, investment decision support, conflict resolution and public participation, and international water resources. IWR fulfills this mission through a synergy of water resources planning and socio-economic expertise that blends practice with research, policy development and information.

IWR planners, economists, social scientists, civil engineers and specialists in the physical sciences lead Civil Works strategic planning and technology transfer initiatives; conduct national and focused policy development studies; develop a broad range of partnering and investment decision support techniques, methods and models for integrated water resources management and navigation system applications; interact with national and international members of the water resources community, and partner with the HQUSACE, Corps district offices and laboratories in solving complex technical water resources planning and evaluation problems. In particular, the Institute

provides a critical mass of socio-economic expertise within the Corps and serves as the residence for the USACE Chief Economist position, which is responsible for the leadership of the Corps Economics Community of Practice (CoP).

IWR also provides a cadre of international water specialists who lead the USACE's engagement in water resources partnerships around the globe. In 2007 IWR expanded its collaborative partnerships when it established the International Center for Integrated Water Resources Management (ICIWaRM). ICIWaRM is a consortium of U.S. government agencies, university departments and non-Governmental organizations committed to working together in support of the strategic program objectives of UNESCO's International Hydrologic Programme (IHP) under an agreement between the U.S. and the U.N.

Hydrologic Engineering Center (HEC): From its inception in 1964, the primary goal of the Hydrologic Engineering Center has been to support the Nation in its water resources management responsibilities by increasing the Corps' technical capability in hydrologic engineering and water resources planning and management. An additional goal is to provide leadership for improving the state of the art in hydrologic engineering and analytical methods for water resources planning.

Program efforts in research, training, planning analysis and technical assistance raise awareness of the problems and needs of the Corps and the Nation. HEC is committed to keeping abreast of the latest developments throughout the water resources engineering profession and to make use of this information in a manner best suited to the needs of the USACE nationally and internationally. HEC increases the effectiveness of the Corps and the profession by bridging the gap between the academic community and practicing hydrologic engineers and planning professionals. HEC ground-tests and incorporates state-of-the-art procedures and techniques into manuals and comprehensive computer programs. The procedures are made available to the USACE, United States government (USG) and international professionals through an effective technology transfer system of technical assistance, publications and training.

Technical specialty areas addressed by HEC include: precipitation runoff processes, reservoir regulation, reservoir systems analysis, hydrologic statistics and risk analysis, river hydraulics and sediment transport, environmental flows, groundwater hydrology, water quality, and analytical aspects of water resources planning. Application areas include: flood risk management, real-time water control, water control management, hydroelectric power, navigation, erosion control, water supply, watershed studies and ecosystem restoration. Additional information about HEC and its software is available at its website, http://www.hec.usace.army.mil.

Navigation Data Center (NDC): The Navigation Data Center is the Corps designated center of expertise for the collection, management, and dissemination of infrastructure utilization and performance information for U.S. waterways and port and harbor channels. Because of the integrated nature of water resources, the NDC also directly supports a range of related Civil Works business areas, including hydropower, recreation, environmental compliance, environmental stewardship, water supply, regulatory and homeland security, as well as other Federal, state and local agencies and the private sector. The primary operational arm of NDC is the Waterborne Commerce Statistics Center, which provides one-stop capability for national navigation information systems. NDC also provides integrated business information in support of Corps decision making including financial output, performance measurement and performance-based budgeting processes. Additional information about NDC is available on its web site, www.ndc.iwr.usace.army.mil.

Conflict Resolution and Public Participation Center of Expertise (CPC): USACE created the Conflict Resolution and Public Participation Center (CPC) to help Corps staff anticipate, prevent, and manage water conflicts, ensuring that the interests of the public are addressed in Corps decision making. The CPC achieves this mission by developing and expanding the application of collaborative tools to improve water resources decision making.

The Institute has pioneered the development and advancement of one such approach known as Shared Vision Planning (SVP), and is actively involved in supporting USACE MSC's and district offices, the International Joint Commission (IJC), and a host of State and local governments in the application of Shared Vision Planning as a means to address water resources problems across the nation.

The CPC is an interdisciplinary team at IWR supplemented by designated Corps personnel in each MSC, working to enable USACE to engage in effective public participation, collaboration, and conflict resolution. The Center relies on an internal Public Participation Community of Practice

comprised of over 250 professionals, and supplements internal Corps resources through contracts with the private sector and close interaction with specialists from other federal agencies. By focusing on its five goals of capacity building, policy support, consultative services, research and information exchange, CPC supports implementation of USACE Campaign Plan Objective 2b "Deliver enduring and essential water resource solutions through collaboration with partners and stakeholders" and Objective 4b "Communicate strategically and transparently".

Collaborative process areas addressed by the CPC include: collaborative process design; conflict assessment, prevention and management techniques; and decision-making methods. Collaborative modeling support is developed through CPC's Shared Vision Planning program (http://www.SharedVisionPlanning.us) and includes applications of collaborative simulation and visualization to water planning issues, development of best practices for collaborative modeling, and the use of new technologies in environmental conflict resolution. Additional information about the CPC and its services is available on its web site, www.iwr.usace.army.mil/cpc.

International Center for Integrated Water Resources Management (ICIWaRM)

The mission of the International Center for Integrated Water Resources Management (ICIWaRM) is the advancement of the science and practice of integrated water resources management (IWRM) to address water security and other water related challenges by regional and global action, through new knowledge, innovative technologies, collaborative interdisciplinary scientific research, training, and capacity development.

The objectives of ICIWaRM are focused on its principal purpose – to develop, promote and infuse sound practices for integrated water resources management around the globe. They include:

- To contribute to the development and advocacy of IWRM principles and best management practices, focusing on issues of governance (institutional frameworks), engineering, planning, and evaluation;

- To foster research, technological development, and technology transfer, as appropriate, of models and methods that enhance IWRM, and to effectively disseminate "toolkits"; and,

- To undertake capacity building efforts in accordance with Commission/Committee guidance and IHP programmes, focusing on training for implementing IWRM at both watershed and national levels, particularly in Latin America and Africa, and to enhance collaboration among UNESCO centers towards joint problem solving.

The scope of activities to be undertaken by the Center includes:

- Focusing on practical science, applied research and technology development embodied in the UNESCO-IHP that can be readily transferred to improve IWRM through USACE Civil Works activities for developing countries;

- Partnering with, and providing or exchanging technical support for existing UNESCO-IHP programs which serve to implement IHP objectives related to attaining IWRM objectives; and,

- Collaborating on joint, applied research, capacity building and training programs through other UNESCO IHP centers (both category 1 and 2 centers) and established programs, initially with emphasis on the Western Hemisphere (Central America, South America, and the Caribbean) and Africa.

Additional information at ICIWaRM and its services is available on its website: http://www.iciwarm.org.

Risk Management Center (RMC): The Risk Management Center is a center of expertise designed to improve the technical and policy oversight of infrastructure decisions, serve as an independent advisor to USACE senior leadership, maintain and develop risk competencies, and ensure consistency in processes, application of criteria and decision making. The RMC is headquartered in Denver, Colorado, with a satellite office in Pittsburgh, Pennsylvania.

The mission of the Risk Management Center is to support the Civil Works program by providing a nationally consistent context for managing and assessing risks for dams and levee systems across the Corps, to support dam and levee safety activities throughout the Corps, and to develop policies, methods, tools, and systems to enhance those activities.

The goals of the Center are to (1) ensure that risks are managed corporately and reduced in the most efficient matter practicable; (2) lead efforts to support consistent risk-informed dam and levee decisions across the Corps; (3) ensure that consistent processes, policies, and methods are used across the Corps to evaluate risks; and (4) lead strategic planning efforts for risk management.

The RMC serves as a USACE-wide resource for risk-related tools, assessments, knowledge and methods. It offers a national perspective, while still supporting routine District and MSC dam and levee safety activities. The Center offers services to support dam safety, levee safety, and the Modeling, Mapping, and Consequence (MMC) Production Center of Expertise.

The roles of the Center include serving as a Corps-wide resource for risk-related tools, assessments, knowledge, and methods; serving as a technical center of expertise for infrastructure risk management and dam and levee engineering; providing a national perspective while working with USACE Communities of Practices, MSC's and District offices; supporting routine district and MSC dam safety activities; and supporting technical activities relating to dam and levee safety.

Information about the services provided by the Center, including the interaction between the Center and other partnering organizations, such as the U.S. Bureau of Reclamation (USBR), the Federal Energy Regulatory Commission (FERC), the Association of State Dam Safety Officials (ASDSO), the U.S. Society of Dams (USSD), and the Association of Engineering Geologists (AEG), is available at its website: http://www.iwr.usace.army.mil/rmc/.

FY 2011 SUMMARY

The Institute's FY 2011 program continued to underline IWR's status as an essential institutional asset to USACE, serving as the intellectual foundation to the future direction of the Corps' Civil Works program and the overarching USACE missions, including the response and adaptation of USACE Civil Works missions to climate change; the need for recapitalization of USACE physical assets and the need to communicate the value and contribution of USACE infrastructure assets to the economic and social well being of the Nation; and the increasing awareness of international water security, water resources management, environmental security and sustainability, and disaster preparedness issues and the role they play in shaping US government foreign policy.

The robust mix of planning, policy and engineering initiatives that IWR executed in FY 2011 was strategically targeted and aligned to address the following factors:

- A continued national emphasis on planning, designing and operating water resources assets with a perspective and awareness of adaptation to climate change;
- Planning, designing and operating water resources assets in a systems context which take into account the interconnected nature of hydrologic systems (e.g., watersheds) and the economic and ecological systems which they support;
- Planning, designing and operating water resources assets in a collaborative environment, built upon strong ties between Federal and state governments and other stakeholders;
- Planning, designing and operating water resources assets on a regional scale to address water resources issues;
- Planning, designing and operating water resources assets which incorporate risk-informed decision making and communication and reliability-based approaches which incorporate consequence analysis, with an emphasis on risk to human life, and which identify, evaluate and forestall potential failure mechanisms, and which quantify and communicate residual risk; and,
- Planning, designing and operating water resources assets in the context of crafting a strategy to address the challenge of recapitalizing the Corps' portfolio of aging Civil Works infrastructure assets in an era of limited Federal financial resources.

FY 2011 was an exceptionally productive year, with significant progress on a wide range of projects and products supporting the HQUSACE, MSC's, district offices, the Office of the Assistant Secretary of the Army (Civil Works) (OASA(CW)), the Department of the Army (DA), other federal and state agencies, Executive Office of the President (EOP) interagency committees, and international organizations and institutions.

Overall, in FY 2011 IWR executed a record program of approximately $114 million with 200 authorized in-

house employees, primarily in professional scientific and engineering disciplines, with most possessing advanced degrees. The Institute's in-house staff was supplemented by other experts detailed from USACE offices and laboratories, Intergovernmental Personnel Act (IPA) visiting scholars from universities, state and local governments, public policy research organizations, and through contract vehicles with private sector consulting firms.

A major transformative factor in the evolution of the Institute has been a corporate focus on recruitment, with over 110 new hires (over one-half of the workforce) made across IWR during the period from 2008-2011, including the hiring of over 40 professional and technical staff at the Risk Management Center, and the active use of Federal vehicles such as the Presidential Management Fellows (PMF) Program, and the National Academy of Sciences' Research Assistantship Program (NAS-RAP) to bring recent post-Doctoral graduates onto the staff of the Institute as water resources specialists.

Among the many diverse activities undertaken across the Institute during FY 2011, the following is a representative cross-section:

Development of the USACE Civil Works Strategic Plan: During FY 2011, the Institute continued its support to the HQUSACE and the OASA(CW) in the development of the USACE Civil Works Strategic Plan. The Institute made significant contributions to the newly published USACE Civil Works Strategic Plan entitled, "*Sustainable Solutions to America's Water Resources Needs: Civil Works Strategic Plan 2011-2015*" dated September 2011.

Publication of Water Resource Outlook paper on USACE Hydropower Program: In June 2011, the Institute published a Water Resources Outlook paper entitled "*Outlook for the U.S. Army Corps of Engineers Hydropower Program*", IWR report number 2011-WRO-P-02. This outlook paper examined the state of the Corps' hydropower program within the context of contemporary requirements for multiple use operations and identified opportunities to enhance hydropower as an integral part of the Nation's renewal energy portfolio.

Asset Management and Civil Works Infrastructure Recapitalization: As part an HQUSACE effort to plan for the recapitalization of the Corps' Civil Works infrastructure portfolio, the Institute was given the responsibility to develop an infrastructure recapitalization program so as to work cooperatively with the existing USACE asset management program. Among those initiatives began during FY 2011 included an examination of alternative financing mechanisms to support future planning, development, and operations and maintenance of USACE infrastructure assets; the development of an Integrated Budget Evaluation Tool (iBET) and the Water Infrastructure Systems Data Manager (WISDM) decision support software to assist with corporate budget and decision making; and a survey of Best Practices with respect to infrastructure asset portfolio management.

Revisions to the Principles and Guidelines: The Principles and Guidelines for Water and Land Related Resources Implementation Studies (P&G) are the rules that govern how Federal agencies evaluate proposed water resource development projects. During FY 2011 the staff of the Institute continued to serve on the Inter-agency Guidelines Development Team. In addition, IWR staff supported HQUSACE and OASA(CW) in analyzing various CEQ proposals to replace the Principles and Standards (P&S).

National Ocean Policy**:** During FY 2011, IWR staff continued to support the OASA(CW) and HQUSACE participation in National Ocean Policy (NOP) initiatives, which are integral to the implementation of Executive Order 13547 establishing a *National Policy for the Stewardship of the Oceans, Our Coasts and the Great Lakes*. The Executive Order adopted the final recommendations of the Interagency Ocean Policy Task Force and created a National Ocean Council (NOC) to strengthen ocean governance and coordination. During FY 2011, IWR staff represented the OASA(CW) on the Ocean Resource Management Interagency Policy Committee (ORM-IPC) and the Ocean Science and Technology Interagency Policy Committee (OST-IPC). In this capacity, IWR staff represented and coordinated diverse Civil Works interests in many NOP efforts, including participating in drafting of strategic implementation documents for coastal and marine spatial planning, coastal resiliency and adaptation to climate change effects, ecosystem protection and restoration, and ocean observation, data and mapping.

In March 2011, the Director of the Institute, Mr. Robert A. Pietrowsky participated in the inaugural meeting of the Department of Defense/Joint Services Ocean Council Executive Steering Group (DoD/JS ESG). The DoD/JS ESG was established to support the DoD portion of the National Ocean Council Deputies Group. Mr. Pietrowsky was appointed to represent USACE through HQUSACE Civil Works.

Regional Sediment Management: In FY 2011, IWR staff continued working with HQUSACE, the Engineer Research and Development Center (ERDC) staff, and District office personnel on the integration of the regional sediment management (RSM) approach through initiatives that both involve and affect Civil Works water resource projects and activities. Members of the Institute staff participated as members of the HQUSACE Regional Sediment Management Project Delivery Team, and continued to support the sediment management strategies of the Gulf of Mexico Alliance, and related efforts of the inter-governmental Gulf Coast Ecosystem Restoration Task Force, established by Executive Order 13554. Members of the Institute staff also participated in National Ocean Policy (NOP) workgroups addressing integration of RSM approaches to accomplishing NOP priority objectives.

Responses to Climate Change: During FY 2011, the Institute continued to making significant contributions to the efforts of USACE to incorporate responses to climate change within it organizational thinking, and on a broader scale, was heavily engaged in the federal government's efforts in the advancement of global climate change science and the development of policies to address adaptation to climate change. The objectives of the initiative are to understand how climate is changing, describe and characterize climate impacts to USACE missions, operations, programs, and projects, and develop consistent water resources management adaptation policies and approaches throughout USACE Civil Works and in partnership with other Federal water resources agencies. The project will provide recommendations for policy and guidance to prepare for, and respond to, climate change and variability.

On October 5, 2009, President Obama issued Executive Order 13514, which set sustainability goals for Federal agency operations and directed agencies to improve their environmental, energy and economic performance. Under this Executive Order, each Federal agency was to evaluate agency climate risks and vulnerabilities to manage both the short-term and the long-term effects of climate change on the agency's mission, programs, and operations. On March 4, 2011, the Council on Environmental Quality (CEQ) issued a set of implementing instructions for Federal Agency Adaptation Planning. During FY 2011, the Institute supported the OASA(CW) in developing the USACE Climate Change Adaptation Policy, available at http://www.corpsclimate.us/adaptationpolicy.cfm. Through this Policy, USACE establishes the USACE Climate Change Adaptation Steering Committee to oversee and coordinate agency-wide climate change adaptation planning and implementation.

A second important product of FY 2011 was the preparation and submittion of the *USACE Climate Change Adaptation Plan and Report 2011*, dated September 2011, to the CEQ and the Office of Management and Budget, available at http://www.corpsclimate.us/docs/usaceadaptnplanreport2011v02.pdf. The Report includes the Policy Statement, answers the guiding questions posed by the CEQ in its Implementing Instructions, and describes USACE progress and future priorities.

Throughout FY 2011, IWR staff continued to support the White House Interagency Climate Change Adaptation Task Force to develop federal recommendations for adapting to climate change impacts, both domestically and internationally.
The Director of the Institute served along with ASA(CW) and the PDASA(CW) on the Council of Environmental Quality (CEQ) Interagency Climate Change Adaptation Task Force. The staff of the Institute supports several task force efforts including providing representatives on working groups on Adaptation Science Inputs for Policy, Agency Adaptation Processes, and Water Resources.

A major effort by IWR staff participating on the Water Resources and Climate Change Adaptation Working Group was the development of the report "*National Action Plan (NAP): Priorities for Managing Freshwater Resources in a Changing Climate*", scheduled to be released in October 2011, which is available at (http://www.whitehouse.gov/sites/default/files/microsites/ceq/2011_national_action_plan.pdf). The Institute's Climate Change team contributed to the writing of the plan and led the team that developed the Plan's recommendations concerning integrated water resources management.

In October 2010, the Interagency Climate Change Adaptation Task Force published a report entitled, "*Progress Report on the Interagency Climate Change Adaptation Task Force: Recommended Actions in Support of a National Climate Change Adaptation Strategy*."

In October 2011, Task Force will publish its 2011 Progress Report outlining the Federal Government's progress in expanding and strengthening the Nation's capacity to better understand, prepare for, and respond to extreme events and other climate change impacts. The report will provide an update on

actions in key areas of Federal adaptation, including building resilience in local communities, safeguarding critical natural resources such as freshwater, and providing accessible climate information and tools to help decision-makers mange climate risks.

In January 2011, as part of the Climate Change and Water Working Group (CCAWWG), USACE and the Bureau of Reclamation (USBR) worked together to publish a report entitled "*Addressing Climate Change in Long-Term Water Resources Planning and Management: User Needs for Improving Tools and Information*", dated January 2011. This report identifies the needs of local, state, and federal water management agencies for climate change information and tools to support long-term planning.

The Institute's Responses to Climate Change team continued to work closely with the HQUSACE personnel from Planning, Operations and Maintenance, Hydrology and Hydraulics, and Engineering and Construction, as well as the IPET/HPDC Lessons Learned Implementation Team to develop a Civil Works Engineering Technical Letter (CWTL) on Procedures to Evaluate Sea Level Change Impacts, Responses, and Adaptation. This technical letter will describe planning measures for USACE projects in response to future sea-level change.

Collaboration and Partnering: The USACE recognizes that its Civil Works mission must be carried out in collaboration with multiple partners and stakeholders with differing authorities, capabilities and perspectives. Thus a major IWR focus has long been as the intellectual nexus for USACE expertise on collaboration, partnering and public participation. In FY 2011 the Institute collaborated with multiple federal and state agencies to address critical issues.

During FY 2011, the Institute represented USACE and the Office of the Secretary of Defense (OSD) through participation on the National Science and Technology Council's interagency Subcommittee on Water Availability and Quality (SWAQ) and its Subcommittee on Disaster Reduction.

USACE/Natural Resources Conservation Service Partnership: On May 26, 2011, the Honorable Jo-Ellen Darcy, Assistant Secretary of the Army (Civil Works) and Mr. David White, Chief of the Natural Resources Conservation Service (NRCS) within the U.S. Department of Agriculture took part in a signing ceremony to renew the NRCS/USACE National Partnership Agreement.

In April 2011, as part of the cooperation between the USACE and NRCS, a handbook entitled, "*The NRCS/USACE Partnership Handbook: A Field Guide to Working Together Toward Shared Goals*" was published for use by members of both organizations.

U.S. Geological Survey Partnership: During FY 2011, significant activities associated with the U.S. Geological Survey (USGS) Memorandum of Agreement included quarterly senior level meetings addressing national stream-gage issues; climate change and related water management issues; the sharing of water data; coastal, geotechnical and biological research; and regional and international water studies, such as on the Great Lakes.

The USACE works with the USGS on the Climate Change and Water Working Group (CCAWWG), along with other Federal agencies including the U.S. Bureau of Reclamation, the National Oceanic and Atmospheric Administration (NOAA), the Federal Emergency Management Agency (FEMA), the Environmental Protection Agency (EPA), and the National Aeronautics and Space Administration (NASA).

USACE and the USGS worked closely together on monitoring and responding to the 2011 floods on the Ohio, Mississippi, and Missouri Rivers.

On May 11, 2011, the USACE, USGS, and NOAA signed a MOU to support Collaborative Science, Services and Tools to Support Integrated and Adaptive Water Resources Management. The MOU will facilitate addressing water information needs and support the creation of a database portal to help stakeholders manage water resources.

In September 2011, the Director of the Institute, Mr. Robert A. Pietrowsky was invited to represent the Department of Defense, the Department of the Army, and USACE as co-chair with Dr. Jerad Bales, Chief Hydrologist of the USGS, for the development of the inter-agency water sector technical report for the 2013 National Climate Assessment.

USACE also partners with the USGS on international water resources, as both agencies are core members of the U.S. National Committee for UNESCO's International Hydrological Programme (IHP). The Director of the Institute is the designated USACE representative on the U.S. National IHP Committee.

U.S. Bureau of Reclamation Partnership: During FY 2011 USACE continued to work closely with the U.S. Bureau of Reclamation on the Climate Change and Water Working Group (CCAWWG), which also includes representation from the USGS, NOAA, FEMA, EPA, and NASA.

In January 2011, the USACE and the Bureau of Reclamation released a joint report entitled "*Addressing Climate Change in Long-Term Water Resources Planning and Management: User Needs for Improving Tools and Information*." The report identifies the needs of local, state, and federal water management agencies for climate change information and tools to support long-term planning. The two agencies are working on another joint report on "Short-Term Water Management Decisions: User Needs for Improved Weather and Climate Prediction Information."

Also of note, during FY 2011 several climate change and water specialists at the Institute supported the Bureau of Reclamation in the development and peer review of the Bureau's "Secure Water Act" Report to Congress. The Institute is working closely with Bureau of Reclamation specialists to leverage the Bureau's progress in the Western U.S. as a foundational element of the National Vulnerability Assessment which is underway as part of the Corps' Response to Climate Change Program.

National Flood Risk Management Program**:** In FY 2011, the National Flood Risk Management Program (NFRMP) supported the following activities:

- Continued regional coordination focused on mitigation and preparedness achieved by the Regional Flood Risk Management Team (RFRMT) in the Upper Mississippi River (UMR) basin.

- Established the Interagency Recovery Task Force in May 2011 which allows for the continued regional coordination for post-flood recovery decision-making.

- Conducted the 2011 USACE Flood Risk Management and Silver Jackets Workshop, held in Nashville, Tennessee on August 15—19, 2011. The theme of the workshop was "Sharing Experience in Driving Down Flood Risk." The workshop emphasized interagency activities in managing flood risk, including those of FEMA, the USACE Flood Risk Management and Silver Jackets programs, other Federal agencies, and state and local initiatives such as hazard mitigation plans.

- Conduct of an International Flood Risk Management Approaches: From Theory to Practice – Government Policy Oriented Discussion workshop held on November 30 and December 1, 2010 in Washington, DC. Participants at the workshop discussed the major issues, insights and challenges associated with flood risk management including risk assessment, risk communication, and approaches to addressing flood hazards.

- In September 2011, the Institute published a report entitled "*Flood Risk Management Approaches as Being Practiced in Japan, Netherlands, United Kingdom, and United States*", IWR report, IWR-2011-R-08. This report was prepared jointly by personnel from the USACE, the Japanese Ministry of Land, Infrastructure, Transport and Tourism (MLIT), the Dutch Rijkswaterstaat and the United Kingdom Environment Agency. The report examines risk-informed approaches as being practiced and developed primarily in the four countries. The findings of the report were presented at special session during the 5th International Conference on Flood Risk Management, hosted by participating agencies on September 28, 2011 in Tokyo, Japan as part of the larger conference which was convened from September 27-29, 2011.

- Improved national coordination through the Federal Interagency Floodplain Management Task Force.

- Supported efforts of the California Levees Roundtable. In FY 2011, the NFRMP participated in the work of the California Levees Roundtable, a collaborative partnership of federal, State, and local agencies formed to address vegetation issues affecting the State-federal levee system in the Central Valley.

Silver Jackets Program: Complementing the National Flood Risk Management Program, the Silver Jackets Program facilitates the delivery of the Corps' authorities for providing flood risk management services to state and local agencies through state inter-governmental partnerships that make the most of existing Federal agency programs and funding to assist states and communities in identifying and addressing flood risks by leveraging agency resources, identifying opportunities to jointly

implement complementary programs, sharing data and knowledge, and eliminating duplicative or conflicting activities or policies.

Silver Jackets teams are collaborative state-led interagency teams, continuously working together to reduce flood risk at the state level. Through the Silver Jackets program, the USACE, FEMA, additional federal, state and sometimes local and Tribal agencies provide a unified approach to addressing a state's priorities. In cooperation with FEMA, other Federal agencies, and states to develop a Silver Jackets team, 29 states are served by active inter-governmental teams and efforts to offer a team to the remaining 21 states is ongoing.

Dam Safety Program: During FY 2011, the Risk Management Center (RMC) continued to support the USACE Dam Safety program. HQUSACE published Engineer Regulation ER 1110-2-1156, "*Engineering and Design: Safety of Dams Policy and Procedures*" to transition USACE to a nationally-led and managed dam safety program. The RMC is instrumental towards implementing the guiding principles of that regulation. To support this effort the RMC initiated or completed the following activities:

- The RMC built out a programs group to manage the funding priorities and funds used by HQUSACE to manage non-routine dam safety activities. This group successfully supported the execution of $54.3 Million in dam safety studies and $16.2 Million in training and methodology development. In FY 2011, this group managed more than 85 dam safety studies undertaken by various Districts to support dam safety activities.

- The RMC led training efforts for dam safety and risk management throughout FY 2011. In FY 2011, more than 250 USACE staff attended Periodic Assessment training and Best Practices in Dam Safety Risk Analysis training which is jointly taught between USACE, the Bureau of Reclamation, and the Federal Energy Regulatory Commission (FERC).

- USACE, the Bureau of Reclamation, the Federal Energy Regulatory Commission, the Tennessee Valley Authority (TVA), and the Federal Emergency Management Agency (FEMA) continued discussions to unify the various dam safety policies, procedures, and guidelines. The Interagency Committee on Dam Safety Joint Federal Risk Management Workgroup held three meetings in 2011.

- The Risk Management Center developed, implemented, and continued various efforts to increase the quality and consistency of dam safety products. The RMC worked with various Agency Technical Review (ATR) teams to support their reviews of dam safety products. The RMC also continued efforts to augment internal reviews with national experts in dam safety specifically related to risk analysis.

- The Risk Management Center reviewed more than 40 Interim Risk Reduction Measure Plans (IRRMP) on the behalf of HQUSACE.

- The Risk Management Center supported Districts transitioning from the previous Periodic Inspection (PI) process for dams to the new Periodic Assessment (PA) process. In FY 2011, the Risk Management Center funded the Potential Failure Modes Assessment portion of PA's for more than 20 Districts and completed five pilot Periodic Assessments.

- In FY 2011, the RMC provided at least two dedicated senior technical specialists to each dam safety construction project, projects that were in Planning, Engineering, and Design (PED), and critical Dam Safety Modification Studies. This was part of HQUSACE's overall effort to provide more consistent and recurring guidance and advice for projects moving through the non-routine dam safety processes. This significant activity was instrumental in ensuring safe activities were accomplished at USACE's high risk structures and that cost effective solutions were planned or implemented. Along with the Quality, Control and Consistency (QCC) reviews, this led to more than $500 Million in cost savings versus originally-planned activities.

- The Risk Management Center funded and directed the activities of the Mapping, Modeling, and Consequence (MMC) production center. More than 50 inundation and consequence studies were completed in FY 2011. The RMC also chaired the steering committee for the MMC.

Levee Safety Program: During FY 2011, the Risk Management Center continued to support the USACE Levee Safety program in a number of ways. HQUSACE is currently leading the development of a comprehensive levee safety policy document. The RMC has been heavily involved with the

development of that policy. The RMC has also supported the following activities:

- The RMC continued to lead the development of the National Levee Database with HQUSACE and the Cold Regions Research and Engineering Laboratory (CRREL). This tool will be released in FY 2012 as the repository for spatial levee data nationwide.

- The RMC worked on a variety of vegetation issues associated with levees. This included managing all Agency Technical Reviews (ATRs) for vegetation variance requests and reviewing a number of R&D efforts related to vegetation's effects on the safety of dams and levees.

- The RMC began to develop the methods the Corps will use to assess risks posed by levees. This work is being done in conjunction with the team developing the new levee safety policy and the Planning Community of Practice. The RMC has identified five levee systems to demonstrate the procedures for Base Condition Risk Assessments. Teams have been assigned and have begun work on one system. The remaining four will be completed in FY 2012.

- The RMC continued to lead the development of the Levee Screening Tool with HQUSACE and the Cold Regions Research and Engineering Laboratory (CRREL). The tool will be used to screen levee systems across the country and help inform a national prioritization of work related to levee safety.

National Inventory of Dams: During FY 2011, the Risk Management Center administered the National Inventory of Dams (NID) program for HQUSACE. The RMC funds the Army Geospatial Center (AGC) to manage the technical aspects of the program as well as maintain the NID web site. The NID includes all high and significant hazard potential classification dams and all low hazard potential classification dams which meet specific height and reservoir storage requirements.

National Ocean Service Partnership: In FY 2011, close collaboration continued in support of the partnership agreement with the National Oceanic and Atmospheric Administration's National Ocean Service (NOS) signed on May 19, 2008. In FY 2011 collaborative efforts focused on addressing water quality challenges and development of a plan through a technical working group, including the USGS, on adopting NOAA Datum Standards, initially concentrating along the coastline. Other efforts included continued collaboration to understand climate change and variability in the Pacific Ocean to improve understanding of how our coastline is changing, and how best to apply the knowledge to coastal engineering, planning and design of coastal structures.

Interagency Committee on the Marine Transportation System: USACE participates as an integral member of the Committee on the Marine Transportation System (CMTS), a partnership of Federal departments and agencies with responsibility for the marine transportation system (MTS). The CMTS works to ensure the development and implementation of national MTS policies are consistent with national needs, and reports to the President on its views and recommendations for improving the MTS. During FY 2011, IWR staff led an interagency team to examine the National Ocean Policy and priority objectives relative to the marine transportation system, and to draft a CMTS response to the National Ocean Council.

Conflict Resolution and Public Participation Center: During FY 2011, the Center of Expertise on Conflict Resolution and Public Participation continued to focus on developing new conceptual and methodological foundations, building awareness of collaborative planning tools, and assisting Corps MSC and district offices and states in improving public participation in water resources planning and decision making.

During FY 2011, the Center published as part of the Maass White Series of books on water resources management "*Converging Waters: Integrating Collaborative Modeling with Participatory Processes to Make Water Resources Decisions*". The Center also published a report on collaboration as practiced in Corps field offices entitled "*The State of Collaboration in the Corps: A Field Perspective*", IWR Report number 2011-CPC-R-04, dated May 2011; and in association with the Environment and Water Resources Institute of the American Society of Civil Engineers published a report on the principles and best practices associated with collaborative modeling for decision support entitled "*Collaborative Modeling for Decision Support in Water Resources: Principles and Best Practices*", IWR Report number 2011-R-03, dated February 2011.

Response to Missouri River Flooding: In September 2011, the Conflict Resolution and Public Participation Center of Expertise was asked to support the Northwestern Division's Missouri River

flood recovery efforts following the Spring and Summer floods which occurred in the Missouri River basin. Faced with unprecedented damage in the Missouri River Basin due to historic flooding, communities and all levels of governments struggled to restore infrastructure, towns, and farms. In light of limited funding and many impacted entities, the Corps spearheaded a flood recovery task force to leverage authorities and funds, and coordinate and communicate flood recovery efforts.

The Northwestern Division asked the CPC to help launch the Missouri River Flood Task Force and create a forum for coordination, collaboration and cooperation among the federal officials and officers of state, local and Tribal governments within the States of Nebraska, Montana, Iowa, South Dakota, North Dakota, Wyoming, Kansas and Missouri. A member of the CPC staff relocated to Omaha to undertake this assignment. Initial efforts entailed engaging with the wide range of Corps and external stakeholders to structure an organization that would set conditions for success for all involved by leveraging funds, streamlining governmental processes, accelerating necessary assessments, coordination, and permitting requirements; and by applying critical thinking to the myriad flood recovery challenges. The staff of the CPC will continue to remain engaged in Missouri River flood recovery efforts in FY 2012.

Other activities in which the CPC was engaged during FY 2011 included providing interagency facilitation support regarding Section 404 Regulatory issues related to Colorado water supply; designing a Shared Vision Planning and Public Involvement process in support of the Rock Island District's Iowa and Cedar Rivers Basin Comprehensive Watershed Planning Process; and supporting California water planning efforts for the state of California and Corps district offices through assistance to the California Levees Roundtable as part of the efforts of the Central Valley Flood Protection Board, the California State Water Plan Update 2013, and Shared Vision Planning for the Bay Delta.

Also, the staff of the CPC assembled the 5th Annual Report on the Use of Environmental Conflict Resolution for the OASA(CW) for submission to the CEQ.

IWR Visiting Scholar Programs: In order to benefit from the infusion of new ideas and concepts in its work, the Corps has established and the Institute supports a number of visiting scholar programs by which the Institute is able to support of work of academicians who conduct research in areas which support the work of the Institute.

FY 2011 marked the ninth year of the Institute's Maass - White Visiting Scholar program. In September 2011, Dr. Denise Reed, Professor of Coastal Geomorphology within the Department of Earth and Environmental Sciences at the University of New Orleans and who also serves as the Interim Director of the Pontchartrain Institute for Environmental Sciences at the University of New Orleans, was named as the Maass-White Visiting Scholar for 2011-2012, and support the Institute during the period from September 2011 through August 2012.

FY 2011 marked the third year of the Frederick J. Clarke Visiting Scholar program, named in honor of Lieutenant General Frederick J. Clarke, Chief of Engineers from 1969-1973. The 2011-2012 Frederick J. Clarke Visiting Scholar is Dr. Todd BenDor, Assistant Professor of Environmental and Land Use Planning within the Department of City and Regional Planning at the University of North Carolina, Chapel Hill.

The Hydrologic Engineering Center has a formally established activity, referred to as the "Leo R. Beard Visiting Scholar Program". Mr. Beard was the founding Director of Hydrologic Engineering Center and he had strong ties to scholars in the profession. As part of the Visiting Scholar program, hydrologic and hydraulic professionals are invited to HEC to address critical issues or problems HEC and others within the Corps have encountered. In FY 2011, Dr. David Curtis from West Consultants was HEC's Visiting Scholar. In that role, he assisted HEC in the developing new techniques to estimate precipitation for developing countries that may not have actual precipitation records.

Planning Models Improvement Program: The USACE Planning Models Improvement Program (PMIP) was established in 2003 to assess the state of planning models in the Corps and to make recommendations to assure that high quality methods and tools are available to enable informed decisions on investments in the Nation's water resources infrastructure and natural environment. The main objective of the PMIP is to carry out "a process to review, improve and validate analytical tools and models for USACE Civil Works business programs."

During FY 2011, the HarborSym Widening model, a simulation model for the evaluation of widening of navigation channels was certified as a National model by the Deep Draft Navigation Planning Center of

Expertise (DDN-PCX) and HQUSACE. External peer review was completed for the HarborSym Deepening model and a certification package was submitted to the DDN-PCX. Other components of the HarborSym Suite of Tools are undergoing peer review.

IWR continues to actively participate in nationwide model certification efforts, providing input on policy and processes and as a member of the HQUSACE Model Certification Panel.

Guidance Update and Maintenance Program: During FY 2011 the Hydrologic Engineering Center worked on modifications to various engineering guidance documents via the Guidance Update Management Program. Among others these documents included Engineer Manual (EM) 1110-2-1413, "*Engineering and Design – Hydrologic Analysis of Interior Areas*"; EM 1110-2-1619, "*Risk-based Analysis for Flood Damage Reduction Studies*"; EM 1110-2-4000, "*Engineering and Design - Sedimentation Investigations of Rivers and Reservoirs*"; Engineer Regulation (ER) 1110-2-1400, "*Reservoir/Water Control Centers*"; ER 1110-2-240, "*Engineering and Design - Water Control Management*"; ER 1110-2-241, "*Engineering and Design - Use of Storage Allocated for Flood Control and Navigation at Non-Corps Projects*"; Engineer Technical Letter (ETL) 1110-2- 299, "*Overtopping of Flood Control Levees and Floodwalls*"; and, ETL 1110-2-537, "*Uncertainty Estimates for Graphical (Non-Analytic) Frequency Curves*", to include materials generated from research actions.

Also, four Economic Guidance Memoranda (EGM) were published in FY 2011: EGM 11-01, *Federal Interest Rates for Corps of Engineers Projects*; EGM 11-02, *Current Normalized Rates*; EGM 11-03, *Unit Day Values for Recreation*; and EGM 11-05, *Deep Draft Vessel Operating Costs*. Also, substantial progress was also made in updating Engineer Regulation 1105-2-100, the *Planning Guidance Notebook*, a draft of which is under review at Headquarters.

Savannah Harbor Expansion Project Study: During Fiscal Year 2011, IWR staff continued to work closely with the Savannah and Mobile districts and the Deep Draft Navigation Planning Center of Expertise on the economic analysis for a General Evaluation Report for expansion of Savannah Harbor. IWR developed a new economic evaluation model for containerships to be used in the evaluation of deepening Savannah Harbor from 42 feet up to a depth of 48 feet. The development and implementation of the new model also involved documentation and training of Mobile district staff in its use, as well as numerous presentations to agency technical review, external independent peer review, and headquarters policy review staffs.

Water Infrastructure Systems Data Manager (WISDM): The Water Infrastructure System Data Manager (WISDM), previously referred to as the Watershed Investment Decision Tool (WIDT) is a web-based utility being developed by the Corps to facilitate geospatial analyses and decision support nationwide and across all of the Civil Works business lines (flood risk management and coastal storm damage reduction, navigation, ecosystem restoration, hydropower, regulatory, recreation, and emergency management). The WISDM links users with information residing in databases within and outside the Corps, and provides users with techniques for visually illustrating and summarizing multiple types of data important to Corps decision-makers at multiple reporting scales (Nationwide, Division wide, District level, watershed basin).

The WISDM will facilitate and expedite efforts to deliver knowledge based decision support, ecological analyses, and assessments of asset/resource-stressor relationships at any geographic scale, under alternative future conditions and under alternative climate change scenarios. The primary goal of this effort is to provide decision makers with the means to quickly and transparently evaluate, communicate, balance, and prioritize information relevant to the Corps capacity to satisfy the needs.

In March 2011, members of the Institute staff attended the annual meeting of the Multi-Resolution Land Characteristics Consortium (MRLC). The MRLC is a consortium of federal agencies which coordinate and generate consistent and relevant land cover information on a national scale for a wide variety of environmental, land management, and modeling applications. After the meeting, the USACE was asked to join the MRLC. The USACE has subsequently joined the MRLC.

Regulatory Support: During FY 2011, IWR continued its support for the USACE Headquarters implementation of the 2008 Mitigation Rule ("Compensatory Mitigation for Losses of Aquatic Resources: Final Rule, *Federal Register*, April 10, 2008, p. 19594). IWR published a white paper on financial assurance for mitigation project success entitled "Implementing Financial Assurance for Mitigation Project Success" in June 2011. IWR staff continued to conduct the Corps Regulatory

Mitigation Workshops focusing on rule implementation. IWR also developed a draft guidebook on implementing the watershed approach for compensatory mitigation.

In April 2011, a member of the staff of the Institute served as an instructor at the National Conservation Banking Course held at the National Conservation Training Center in Shepherdstown, West Virginia. The instructor taught sessions on In-lieu fee programs, real estate protection, Joint Section 404/Endangered Species Act Banking and Regulatory In-lieu Fee and Bank Information Tracking System (RIBITS).

Also during April 2011, IWR personnel participated on the 14th National Mitigation and Ecosystem Banking Conference. Dr. Robert Brumbaugh led a half-day workshop on mitigation banking, and Dr. Brumbaugh and Mr. Steve Martin facilitated several pre-conference regulatory workshops, including a session on RIBITS.

IWR continued its major role in teaching the interagency course entitled "Mitigation Banking Interagency Review Team Training" at the National Conservation Training Center (NCTC) in Shepherdstown, WV in June 2011.

In August 2011, IWR provided instruction and technical support for a Regulatory Mitigation workshop in Manchester, New Hampshire sponsored by HQUSACE and New England District.

In June 2011, IWR provided technical support to the Buffalo and New York Districts as well as the US EPA, the US Fish and Wildlife Service, the Federal Highway Administration, and New York State agencies in establishing an In-Lieu Fee (ILF) program for 3rd party compensatory mitigation in New York State.

In September 2011, IWR provided technical support to an In-Lieu Fee (ILF) Program workshop sponsored by US EPA Region IX, the Environmental Law Institute and the Los Angeles District of USACE for current and proposed ILF program sponsors and Interagency Review Team members. More than 40 representatives of state, local, and non-profit organizations involved in ILF program operations attended the workshop.

IWR oversaw the management and maintenance of the Corps regulatory database — ORM 2.0 — the second version of the OMBIL (Operations and Maintenance Business Information Link) Regulatory Module. In addition, IWR continued to actively manage the Regulatory In-lieu Fee and Bank Information Tracking System (RIBITS), a compensatory mitigation bank data program, including providing training and district support. Important information regarding mitigation banks and in-lieu fee programs from a majority of USACE District offices is now available on-line in RIBITS. In addition, an IWR contractor began adding information on Endangered Species Conservation Banks from the U.S. Fish and Wildlife Service to the database. IWR provided training and support to the Fish and Wildlife Service according to an Interagency Agreement between the two agencies.

During FY 2011, IWR, in coordination with ERDC, provided support for technical and scientific initiatives such as the publication of regional supplements to the 1987 Corps Wetlands Delineation Manual, and a draft National Wetlands Plant List.
IWR oversaw the development of a cumulative effects analysis (CEA) prototype using GIS data for the Appalachia region associated with surface mining activities. Regional CEA tools and corresponding manuals were developed for southern West Virginia and Eastern Kentucky and are currently being used by regulators from the Huntington, Louisville, and Nashville District offices.

IWR supported the US EPA economic analysis for proposed Clean Water Act (CWA) Waters of the US jurisdiction guidance by providing information on potential costs to permit applicants associated with the proposed guidance, including compensatory mitigation costs. IWR also collaborated with US EPA on development of the cost analysis for an upcoming proposed CWA Waters of the US jurisdiction rule.

National Economic Development Manuals: The Institute is continuing to update the National Economic Development (NED) Manuals series, originally published between 1987 and 1991. The manuals are important basic reference documents for economists and others involved in the planning and analysis of Federal water resource projects. The manuals discuss the principles and concepts associated with NED benefits and provide detailed procedures to measure and calculate benefits. In FY 2011, the Deep Draft Navigation NED Procedures Manual was published online along with a draft Containership Guide. The Coastal Storm Risk Management Manual was approved for publication and will be published in FY 2012. Additionally, the NED manuals website design will be improved and

expanded in FY 2012 to include a web-based version of the Coastal Storm Risk Management Manual.

Social Vulnerability Analysis: In FY 2011, a handbook entitled "Social Vulnerability Analysis Methods for Corps Planning" (IWR Report 11-R-07) was published. The handbook presents two practical methods for identifying socially vulnerable groups. It illustrates how social vulnerability, the drivers of vulnerability, and their spatial distribution in flood hazard zones can be used in the planning process.

Regional Economic Development (RED) Procedures Handbook: This handbook provides valuable tools and insights into the use of RED analysis. It also includes discussion of RED effects for each of the Corps' business lines. Consideration of RED impacts in the planning process will result in a more comprehensive accounting of project contributions and effects. The RED Handbook was published as "Regional Economic Development (RED) Procedures Handbook", IWR Report 2011-RPT-01, dated March 2011 and is available at the IWR website.

Technical Advancements in HEC Software: The Hydrologic Engineering Center continued to enhance many software products and introduce new products. Released in FY 2011 were:

- HEC-FDA, Flood Damage Reduction Analysis, Version 1.2.5a. This version updates version 1.2.5, which was released in 2010. HEC-FDA provides the capability to perform an integrated hydrologic engineering and economic analysis during the formulation and evaluation of flood risk management plans.

- HEC-SSP, Statistical Software Package, Version 2.0. The current version of HEC-SSP, released in October 2010, can perform flood flow frequency analysis based on Bulletin 17B, "*Guidelines for Determining Flood Flow Frequency*" (1982), a generalized frequency analysis on not only flow data but other hydrologic data as well, a volume frequency analysis on high and low flows, a duration analysis, a coincident frequency analysis, and a curve combination analysis.

- HEC-GridUtil, Grid Utility Program, Version 2.0. HEC-GridUtil is designed to provide viewing, processing, and analysis capabilities for gridded data sets stored in HEC-DSS files (HEC's Data Storage System). These data sets are typically regular-interval time-series of gridded hydrologic variables, such as Stage 3 NEXRAD (Next Generation Radar) precipitation or mean daily air temperatures throughout a basin.

- HEC-GeoRAS 10 for ArcGIS 10.0. HEC-GeoRAS is an ESRI ArcGIS extension that provides the user with a set of procedures, tools, and utilities for the preparation of geographic information systems (GIS) data for import into HEC-RAS and generation of GIS data from RAS output.

- HEC-GeoHMS 10 for ArcGIS 10.0. HEC-GeoHMS is an ESRI ArcGIS extension that provides the user with a set of procedures, tools, and utilities for the preparation of geographic information systems (GIS) data for import into HEC-HMS.

- HEC-GeoEFM, Spatial Component of the Ecosystem Functions Model, Version 1.0. HEC-GeoEFM is an ArcMap extension developed to support spatial analyses commonly used during applications of the Ecosystem Functions Model (HEC-EFM).

More information about these software packages and other HEC software can be found on HEC's website.

FY 2011 also saw improvements to:

- HEC-RAS, River Analysis Systems Version 4.1. This version, released in March of 2009, continued to serve the general public while the next major release is completed.

- HEC-HMS, Hydrologic Modeling System, Version 3.5. This version, released near the end of FY 2010, continued to serve user needs while the next major release is completed. The next major release will be called Version 4.0 and will include a wide array of new simulation components and interface features.

- HEC-EFM, Ecosystem Functions Model, Version 2.0. HEC-EFM is designed to help determine ecosystem responses to changes in the flow regime of a river or connected wetlands. It allows the study team to visualize and define existing ecologic conditions, highlight promising restoration sites, and assess and rank alternatives according to predicted changes in different aspects of the ecosystem. This is also the first version of EFM that has HEC-EFM Plotter (1.0), which is an accessory for viewing, navigating,

and interpreting output generated by EFM. HEC-EFM Plotter is also available for download via the HEC website.

- HEC-WAT, Watershed Analysis Tool, Version 1.0 (not yet released) The Watershed Analysis Tool (HEC-WAT) software was created to help USACE study teams conduct watershed and water resources studies in an integrated, comprehensive and systems based approach. HEC-WAT helps a study team perform the necessary hydrologic, hydraulic, environmental, and planning analyses by integrating the software that is commonly applied by the multi-disciplinary study team.

- HEC-FIA, Flood Impact Analysis, Version 2.2 (not yet released). HEC-FIA evaluates impacts using either continuously observed or forecasted hydrographs (hydrograph-based) or depth grids (GIS-based). For a specified analysis, the program evaluates urban and agricultural flood damage, area inundated, number of structures inundated, and consequences. The consequences shall include economic and loss-of-life.

During FY 2011, HEC and the USGS, in association with IHE-Deltares, continued working together to integrate HEC-RAS and the USGS MODFLOW software. Through this effort an OpenMI compliant version of HEC-RAS was developed.

International Trade Data System (ITDS): During FY 2011, the Institute's Navigation Data Center continued its involvement in the development of the International Trade Data System (ITDS). ITDS is a multi-agency technology initiative administrated by the e-Customs Partnership, a public-private partnership led by Customs and Border Protection (CBP). Both the public and private sectors have steering committees and numerous sub-committees. The objective of this initiative is to provide a secure, single source interface for the collection, input, analysis, and proper dissemination of international trade and transportation statistics. The Corps is one of over 20 government agencies working with the trade and transportation community to implement this initiative.

In FY 2011 a new component named Automated Export Manifest (AEM) was added to the ITDS umbrella to enable collection of automated manifest information. IWR worked with CBP to incorporate Corps' requirements into the development of AEM. AEM will greatly enhance export transportation information that the Corps receives and will link manifest and shipper information at time of reporting, reducing IWR's need to spend resources to match information from multiple sources.

E-Navigation Initiatives (E-Nav): E-Nav initiatives are those promoting efficiency, safety, security, and reliability in our Nation's waterways through seamless transfer of data and information among the navigation community. During FY 2011, the Navigation Data Center continued to support several of these E-Nav initiatives.

- River Information Services (RIS): RIS will provide management, coordination and oversight for the development of the various E-Nav initiatives in which USACE participates. In FY 2011 NDC staff members and USCG representatives started a project to integrate USCG's Notice to Mariners and USACE's Notices to Navigation into one set of Federal Notices to Mariners. The project is scheduled for completion by the end of FY 2012.

- Lock Operations Management Application (LOMA): NDC staff worked with ERDC to design USCG data and services that will be used in LOMA to provide navigation information to waterway users, including lock operators, Corps management and vessel operators.

- Federal-Industry Logistics Standardization (FILS): During FY 2011 the FILS team developed a Scope of Work for development of American Standards Committee X12 approved documents for transfer of information between the leading barge companies and USACE and other participating agencies. Work on the project will begin in FY 2012, with scheduled completion to take place in FY 2013.

- Federal Initiative for Navigation Data Enhancement (FINDE): During FY 2011 the FINDE project team established and completed an Interconnection Security Agreement (ISA) between USACE and USCG, providing USACE with data and services from USCG's Enterprise Service Bus. The ISA signing was historic in that it was the first interconnectivity agreement signed between the two agencies.

- Inland Electronic Navigation Charts (IENC): IWR staff continued to work with the Army Geospatial Center (AGC) to harmonize navigation points of interest and data elements common to both AGC's IENC's and NDC's dock and facility inventory. The team leveraged

the chart information to add over 600 bridge locations to the Master Docks Plus inventory system.

- Lock Performance Management System (LPMS): The LPMS team continued their development of a tool that captures real time vessel (Automated Identification System "AIS") information at Corps locks so as to reduce the burden on the lock operators and to improve their capability to safely operate locks and results in improved safety and vessel traffic management. This effort is in partnership with LOMA and USCG. It is expected to be nationally deployed in FY 2012.

International Upper Great Lakes Study: Throughout FY 2011, IWR continued to play a major role in directing and managing the activities of the International Upper Great Lakes Study. The Study was initiated in 2007 under a Memorandum of Agreement (MOA) between IWR and the International Joint Commission (IJC) for a 5-year, $15 million US-Canadian study focusing on the *Lake Superior Regulation Plan* and the potential erosion problems associated with the St. Clair River channel. Drs. Eugene Stakhiv and Anthony Eberhardt are the U.S. co-Director and co-Manager of the Study. IWR is leading the U.S. contributions to the study, as was the case with the last IJC Great Lakes Study, the International Lake Ontario-St. Lawrence River Study, which was completed in 2006.

During FY 2011, the study team's focus was on developing an alternative to replace Plan 1977-A; the outflow regulation plan used by the International Lake Superior Board of Control since 1990. Shared vision modeling was used to guide the Study Board in their selection of the best alternative during numerous decision workshops. The recommended alternative, Lake Superior Regulation Plan 2012, provides slight improvements over Plan 1977-A particularly during extreme climatic conditions that may occur in the future. The robustness of this plan was tested under numerous hydrologic futures including those developed by the Intergovernmental Panel on Climate Change (IPCC) and stochastically generated supplies simulating 50,000 years of wet and dry scenarios.

The Study Board recommended that a long-term adaptive management strategy be pursued. Part of this strategy would be the establishment of a permanent Great Lakes Levels Advisory Board which would monitor Great Lakes hydrology, maintain the models developed during the Study and provide guidance to the IJC's existing control boards. Membership and support of the new Board could come from agencies such as the USACE, NOAA, USGS, Environment Canada and state and provincial offices with jurisdictions and interests in Great Lakes water levels and their impacts.

The Study is scheduled to be completed on 31 March 2012 with the Study's final report and documentation provided to the IJC prior to that date.

Review of Bi-national Management in International Lake of the Woods and Rainy River Watershed: In July 2010, the International Joint Commission established the International Lake of the Woods and Rainy River Watershed Task Force to help it respond to a request from the Governments of Canada and the United States for advice on how to address water quality, water quantity and related issues in the Lake of the Woods and Rainy River watershed, both now and in the future. The Task Force's main tasks were to review the ways that Canada and the United States work together to manage water quality, water quantity and related issues in the watershed, to identify gaps in the current approach, to identify key existing or emerging issues that require attention, and to recommend any new or adjusted governance mechanisms that would help address the identified future needs. Governments cited a desire to ensure the long-term ecological and economic vitality of Lake of the Woods and the Rainy River watershed, and to complement their work to foster trans-jurisdictional coordination and collaboration on science and management.

The Institute was assigned the task of directing the Task Force. The Task Force conducted extensive outreach and consultations during its one-year tenure. Priority issues identified included nutrient enrichment and harmful algal blooms; effects of climate change, land use development, invasive species, and water regulation decision-making; participation of First Nations, Métis, and U.S. Tribes in decision-making; and communication.

The Task Force issued its final report to the IJC on 15 July 2011. Report recommendations address five themes to improve bi-national governance for the priority issues in the watershed. These include a summit convened by the IJC to encourage the development of a watershed vision, common goals and objectives; combining two existing IJC Boards into a single International Watershed Board with a water quality mandate encompassing all boundary waters in the watershed (including Lake of the Woods); increased support for the existing

International Multi-Agency Arrangement's work on water quality science efforts in the watershed; increased local participation in watershed management governance; and a review of water-level regulation on Lake of the Woods.

International Center for Integrated Water Resources Management (ICIWaRM) and UNESCO Partnerships:

During FY 2011, the Institute and ICIWaRM signed two new Memoranda of Understanding to increase the total number of MOU with various UNESCO program offices and water centers to eight. The first MOU signed during FY 2011 was with the National Autonomous University of Mexico (UNAM) Water Network to support mutual cooperation and joint activities in the field of integrated water resources management, scientific research and capacity building. The MOU was signed on November 3, 2010.
In August 2011, Dr. Will Logan was invited to present a plenary talk on "Capacity Building in Water Resources Management in a Global Context" at the 3rd Annual Meeting of the National Autonomous University of Mexico (UNAM) Water Network.

Under the terms of the MOU with the National Autonomous University of Mexico (UNAM) Water Network, two members of an affiliate of the ICIWaRM, the American Society of Civil Engineers, Dr. Gerry Galloway and Mr. Kyle Schilling, conducted a Post-Flood Assessment Committee Review for the state of Tabasco, Mexico and the Water Commission of Mexico (CONAGUA). In 2007, approximately 80 percent of the Mexican state of Tabasco was inundated from record flooding, followed by near record events in succeeding years.

This second MOU was signed in June 2011 during a series of meetings of programs and national International Hydrologic Programme committees of UNESCO's Region 2 (Latin America and the Caribbean) Water Centers, to which ICIWaRM was invited as a participant and/or observer. Participation in these meetings highlighted ICIWaRM's continued engagement with the Latin America International Hydrologic Programme in 2011.

In June 2011, the Institute and ICIWaRM signed a MOU with the Center for the Sustainable Management of Water Resources in the Caribbean Islands States (CEHICA) hosted by the Instituto Nacional de Recuros Hidraulicos (INDRHI), located in Juan Dolio, Dominican Republic to cooperate in the advancement of integrated water resources management, related interdisciplinary scientific and policy research and education, training and capacity-building for developing countries, including Small Island Developing States.

Leadership in UNESCO Sponsored Activities

During FY 2011 members of the Institute continued to support various UNESCO sponsored activities through appointments to various leadership and advisory positions.

During FY 2011, the Director of the Institute, Mr. Robert A. Pietrowsky continued his service as a member of the Governing Board of UNESCO-Institute for Water Education (IHE-Delft).

Also, Mr. Pietrowsky, has been one of six permanent Federal agency members of the U.S. National Committee for the International Hydrologic Programme, and has been a member of the U.S. Government delegation to UNESCO at the IHP Intergovernmental Council (IGC) meetings in 2004, 2006, 2008 and 2010. The next meeting of the IHP Intergovernmental Council will take place in June 2012.

Dr. Eugene Stakhiv served as chairperson of the Advisory Board of the International Center for Water Hazard and Risk Management (UNESCO-ICHARM) as well as serving on the Steering Committee of the Global Water Partnership (GWP).

Dr. Eugene Stakhiv continued to co-chair a UNESCO Sponsored Steering Committee tasked with preparing IWRM Guidelines at the River Basin Level to assist water resources practitioners in finding better and more efficient solutions to water resource problems.

Projects in support of UNESCO sponsored activities

In March 2011, Dr. Guillermo Mendoza, a member of the staff of ICIWaRM and Dr. Aleix Serrat Capdevila of the University of Arizona and Mr. Stan Gibson and Mr. Chan Modini, Senior Hydraulic Engineers at the Hydrologic Engineering Center (HEC) collaborated to hold a Hydrology and Hydraulics Workshop in Asuncion, Paraguay. The workshop was sponsored by ICIWaRM in conjunction with UNESCO. The workshop was hosted by the the Centro Internacional de Hidroinformática (International Hydro-Informatics Centre, CIH), a UNESCO sponsored category 2 water center co-sponsored by Paraguay and Brazil. Technical instruction provided during the workshop included HEC-HMS (Hydrologic Modeling System), HEC-RAS (River Analysis System), and HEC-ResSim (Reservoir Simulation).

In September 2011, Dr. Will Logan led a four-person, interagency team in the Dominican Republic to provide direct support to CEHICA and its host organization, INDRHI (National Institute for Hydraulic Resources), in investigating rising lake levels at Lake Enriquillo. These lake levels threatened agriculture, trade, transportation and towns. The team provided INDRHI with guidance as to likely contributing causes of the lake-level rise. A final report is scheduled to be competed in FY 2012.

ICIWaRM continued to serve as the technical secretariat for its global network Water and Development Information for Arid Lands or G-WADI. The program aims to strengthen global capacity to manage water resources in arid and semi-arid regions by building an effective global community. It integrates contributions from networks, organizations, individuals and UNESCO Category 2 centers. The G-WADI network features knowledge bases and products such as near real-time global satellite estimates of precipitation.

In June 2011, Dr. Joseph Manous participated in the UNESCO-IHP G-WADI meeting in Muscat, Oman, during which an "Arab Global Water and Development Information (Arab G-WADI) Network" was established.

During FY 2011, ICIWaRM has been a participant in the USAID-led effort to create the President's Middle East North Africa Network of Water Centers of Excellence (MENA-NWC). This network will bring together water centers throughout the MENA region along with U.S. government agencies and universities to address some of the region's most challenging water problems.

ICIWaRM staff members continued to collaborate on implementation of the UN Secretary General's Advisory Board on Water and Sanitation/ High-Level Expert Panel on Water and Disaster (UNSGAB/HELP) action plan.

ICIWaRM co-sponsored and co-organized with ICHARM the 5th International Conference on Flood Management, held in Tokyo, Japan in September 2011. In association with that meeting, ICIWaRM participated in a meeting of the International Flood Initiative, co-sponsored panels with ICHARM on Flood Risk Management Approaches and Adaptation to Climate Change, and released a multi-lateral report on Flood Risk Management Approaches of the United States, Japan, Netherlands, and the United Kingdom.

IWR continued to provide extensive support to the World Water Assessment Program. The World Water Assessment Program (WWAP) is the flagship program of UN-Water. Housed in UNESCO, it monitors freshwater issues in order to provide recommendations, develop case studies, enhance assessment capacity at a national level and inform the decision-making process.

ICIWaRM continued to support the North American Hydrology for the Environment, Life and Policy program (HELP) basin network.

ICIWaRM continued its engagement in an advisory role with the Peru National Water Authority (ANA) to assist in capacity building and the implementation of the new water law, but at a decreased level of involvement relative to FY 2010. The World Bank, which is co-funding the project, signed an MOU with the U.S. Department of State in March 2011, and is seeking ways to fund U.S. Government collaboration on such projects. Dr. Will Logan chaired a joint World Bank – U.S. Government working group on Water Resources Management as part of this effort.

Members of the staff of ICIWaRM continued work on the development of a non-proprietary Drought Atlas software product that will be freely available to countries that may need such a product, particularly countries in transition located in arid or semi-arid areas. In partnership with fellow Category 2 center, the Water Center for Arid and Semi-Arid Zones in Latin America and the Caribbean (CAZALAC), ICIWaRM will be using the resulting product to create a complete drought atlas of Latin America.

Through a continuing collaboration between ICIWaRM academic partner University of Arizona and the International Senegal Basin Authority (Organisation pour la Mise en Valeur du Fleuve Senegal), ICIWaRM is developing a near real-time streamflow forecasting system using satellite precipitation measurements in the Senegal River Basin.

ICIWaRM Participation in World Water Day Events at World Bank

On March 22, 2011, the Director the Institute, Mr. Robert A. Pietrowsky and Mr. Will Logan represented ICIWaRM at the World Bank's World Water Day. Senior U.S. government officials recognized activities that the USACE has helped support, including the establishment of a Middle East Peace Network of Water Centers.

The event was highlighted by Secretary of State Hilary Clinton and World Bank President Robert Zoellick signing a Memorandum of Understanding providing for U.S. Government support to the World Bank on water resources and related capacity development project around the world. The MOU facilitates World Bank access to experts in 17 U.S. government agencies and departments to address a wide range of water resource issues.

At an event at the World Bank few days prior to World Water Day, Drs. Joseph Manous and Rolf Olsen gave presentations at an Expert Roundtable on Urban Flood Risk Management. The World Bank's East Asia and Pacific (EAP) Disaster Risk Management (DRM) team organized the event. In addition to representatives of the Corps of Engineers, the workshop was attended by experts from NASA, FEMA, UN-HABITAT, Columbia University, the London School of Economics, and Deltares (Netherlands). The objective of the workshop was to draw on the expertise from a wide range of water management practitioners, urban planners, hydraulic engineers, risk modelers and financial experts, and to invite comments for a World Bank Working Paper on Urban Flood Risk Management as well as the Global Handbook on Urban Flood Risk Management. The handbook will provide practical technical guidance to policy and decision-makers, and technical specialists in cities exposed to flood risk. During four thematic sessions, external and internal experts focused on structural and nonstructural solutions to urban flood risk, climate change implications for decision-making process, risk financing options, and early warning systems.

Visiting Fellow at the International Center for Integrated Water Resources Management

The International Center for Integrated Water Resources Management (ICIWaRM) hosts a visiting scholar program to further its mission of advancing the science and practice of integrated water resources management (IWRM). This Visiting Scholar Program brings recognized experts in IWRM to ICIWaRM to conduct applied research and study efforts relating to technology transfer and capacity building. In April 2011, Dr. Richard Meganck, International Program leader for Oregon State University's Institute for Water and Watersheds joined ICIWaRM as the Center's initial Visiting Scholar. Dr. Meganck's work with ICIWaRM will focus on facilitating technical and capacity development partnerships with other UNESCO water centers around the world.

International Technical Reimbursable Activities: In FY 2011, the Hydrologic Engineering Center was involved in a wide range of international activities including work in Afghanistan, Iraq, Mongolia, and Kazakhstan and support to UNESCO, the World Meteorological Organization and the International Joint Commission.

Afghanistan: During FY 2010 and FY 2011, staff from HEC participated in the Watershed Assessments for Afghanistan Project. The Watershed Assessments for Afghanistan project is a collaborative project led by the Corps' Transatlantic Division office with multiple districts participating and local experts with the objective of locating and analyzing potential dam and reservoir sites. Initially, HEC analyzed potential dam and reservoir sites in the Helmand basin but then assisted in other provinces as well. The goal of the project was to identify possible small dam sites (5- to 10-meter high) for impoundment of water for seasonal irrigation and micro-hydropower generation.

Iraq**:** In FY 2011, HEC entered into a contractual agreement with an American firm to support the second phase of the Strategy for Water and Land Resources of Iraq (SWLRI) project. The objective of the SWRLI project is to define the strategy and the related investment plan that will guide the sustainable management and development of the water and land resources of Iraq for the next two decades (from 2010 to 2030). HEC assisted in providing technical assistance on the construction and use of the reservoir simulation tool HEC-ResSim which was initially developed by HEC for the Tigris and Euphrates basin through Iraq for real-time forecasting and water management operation.

Mongolia**:** In October 2010, Mr. Jeff Harris and Mr. Cameron Ackerman participated in a training course held in Ulaanbaatar City, Mongolia. This class provided GIS training. During the training, Mr. Harris and Mr. Ackerman had the opportunity to go into the field to collect data for use in developing an HEC-HMS (Hydrologic Modeling System) rainfall-runoff model and HEC-RAS (River Analysis System) hydraulic model of the Selbe River Basin. These models developed from data collected during the October visit were then used in an HMS and RAS training class conducted by Mr. Harris and Mr. Ackerman in Ulaanbaatar City in January, 2011. Representatives from multiple Mongolian Flood control and disaster related agencies participated as well as academics. The models were used as a teaching tool and then turned over to the agencies for their future use.

Kazakhstan: Mr. Cameron Ackerman participated in a Civil Military Emergency Preparedness (CMEP) program workshop in Shymkent, Kazakhstan in September 2011. The workshop concentrated on hydrology, hydraulics, GIS and dam break analysis. Mr. Ackerman presented data on GIS and performing dam break analysis with the River Analysis System (HEC-RAS) software. This workshop provided opportunities and technology to the participants and provided hands on experience.

UNESCO: Mr. John Hickey, Senior Hydraulic Engineer, attended the UNESCO International Workshop on Challenges and Solutions for Dam Re-operation held at UNESCO Headquarters in Paris in October 2010. Mr. Hickey and Mr. Andy Warner of The Nature Conservancy presented the Sustainable Rivers Project as a case study for North American Rivers/Flood Control Reservoirs.

World Meteorological Organization (WMO): Dr. William Scharffenberg, Hydraulic Engineer, represented the United States at the Workshop on the Intercomparison of Flood Forecasting Models held in Koblenz, Germany during 14-16 September 2011. The workshop was part of the WMO Flood Forecasting Initiative. During the workshop, a team was established to produce a guidance document that will assist National Hydrological Services select a simulation tool that meets their forecasting needs. Because of his role as the lead developer of HEC-HMS and familiarity with other simulation tools, Dr. Scharffenberg was selected to chair the task team and play a prominent role in editing the output guidance document. The task team is scheduled to complete the output guidance document in time for the Commission on Hydrology XIV which will be held in Geneva, Switzerland in November 2012.

International Joint Commission: HEC provided technical support to activities led by the International Joint Commission (IJC) at the request of another Corps office. Since 2006 HEC has contributed specialized expertise to the International Upper Great Lakes Study, managed by IWR, for modeling of Upper lakes routing and Lake Superior regulation and alternate plan formulation. In addition to project work through field offices and IWR, HEC supported other IJC initiatives, including participating in a workshop as part of the IJC's International Watersheds Initiative.

Columbia River Treaty: HEC is a participating study team member for the Columbia River Treaty (CRT) 2014/2024 Study. The CRT is an agreement between the United States and Canada. The purpose of the CRT, which became effective in 1964, is to provide flood control and power benefits to U.S. and Canadian regions. HEC supports the study project development team, including the Hydrology and Hydraulics, Plan Formulation and Integration sub-teams, provides technical and policy guidance, coordination and development of the HEC-WAT and HEC-ResSim software features specific to CRT and provides overall risk assessment methods to the CRT team.

PIANC – The World Association for Waterborne Transport Infrastructure

The United States has been a national member of PIANC since 1902, and USACE provides leadership and secretariat support to PIANC. PIANC USA organizes and holds technical conferences, an Annual Meeting, and participates in the PIANC International Annual General Assembly (AGA).
The United States National Commission constitutes the governing body of the U.S. Section. In 2011 the ex-officio officers of the National Commission were: Chair, The Honorable Jo-Ellen Darcy, ASA(CW); Major General William T. Grisoli, USACE DCG-CEO; and Secretary, Ms. Anne Cann, IWR.

Smart Rivers Conference**:** PIANC USA welcomed almost 300 professionals in all aspects of inland and river transportation to New Orleans September 13-16, 2011 for the Smart Rivers 2011 Conference. Attendees came from more than 20 nations and included private sector, government, and academic participants. This international conference included nearly 100 technical presentations on a diverse array of topics such as systems/technology; environmental management; safe operations; service design and innovation; public policy and finance; and infrastructure and network management. The main objective of the conference was to analyze the latest trends in policy, technology, and innovation in the field of inland waterway transportation.

IWR's specific accomplishments during FY 2011 are described in the following sections, organized in accord with the Institute's major focus areas.

FUTURE DIRECTIONS

The Institute's Future Directions activities include the identification of emerging water challenges and opportunities and the engagement of the Office of the Assistant Secretary of the Army (Civil Works) (OASA (CW)) and USACE senior leaders to stimulate "strategic thinking". Such critical thinking is an

essential prerequisite in the formation of organizational strategic direction and the implementation of new initiatives.

IWR employs a variety of approaches to encourage strategic thinking, including the development of Water Resources Outlook papers on various innovative water resources issues, supports academic research, supports and conducts topic specific and broad strategy sessions with senior leaders from USACE and the OASA(CW).

During FY 2011, IWR continued to engage the National Institutes for Water Resources (NIWR) and the US Geological Survey (USGS) to solicit proposals on applied scholarly investigation related to critical water policy issues. A 2011 grant was awarded to the University of Maryland and titled "The Effectiveness of a Computer-Assisted Decision Support System Using Realistic Interactive Visualization as a Learning Tool in Flood Risk Management". This engagement with NIWR is engaging some of the brightest and most talented individuals working in the water resources area while establishing working relationships on emerging topics of the future.

In a similar initiative, the Future Directions staff has taken a lead role in special topic support to the HQUSACE on strategic initiatives such as publishing the USACE Civil Works Strategic Plan; interaction on behalf of the OASA(CW) with other Federal agencies in support of Administration initiatives such as climate change adaptation, energy and water sustainability, ecosystem markets development, floodplain management, and urban water renewal, and development of new concepts in critical infrastructure and infrastructure sustainability through non-governmental organizations such as the American Society of Civil Engineers (ASCE), The Infrastructure Security Partnership (TISP), and Domestic Preparedness (DomPrep).

Strategic Planning: IWR continued to support the efforts of USACE Headquarters and the OASA(CW) in the development of the USACE Civil Works Strategic Plan. The Institute made significant contributions to the recently published USACE Civil Works Strategic Plan entitled, "*Sustainable Solutions to America's Water Resources Needs: Civil Works Strategic Plan 2011-2015*" dated September 2011. The plan revised the previous Civil Works strategic goals as: 1) Assist in providing for safe and resilient communities and infrastructure; 2) Help facilitate commercial navigation in an environmentally and economically sustainable fashion; 3) Restore degraded aquatic ecosystems and prevent future environmental losses; 4) Implement effective, reliable, and adaptive life-cycle performance management of infrastructure; and 5) Build and sustain a high quality, highly dedicated workforce.

To achieve these goals, an overarching strategy of Integrated Water Resources Management (IWRM) was adopted as a means to embrace holistic and collaborative planning. This overarching strategy is supported by a series of cross-cutting strategies or methods that characterize the qualities of a technically competent and forward looking organization. The resulting six cross-cutting strategies include the application of: 1) systems approaches; 2) collaboration and partnering; 3) risk informed decision making and communication; 4) innovative financing; 5) adaptive management; and 6) state-of-the-art technology.

Outlook Paper for USACE Hydropower Program

In June 2011, the Institute published a Water Resources Outlook paper entitled "*Outlook for the U.S. Army Corps of Engineers Hydropower Program*", IWR report number 2011-WRO-P-02. This outlook paper examined the state of Federal hydropower in the U.S. within the context of contemporary requirements for multiple use operations. The outlook paper described various current trends affecting the USACE hydropower business line, including aging infrastructure, environmental considerations and constrained financial resources. The outlook paper identified opportunities to enhance hydropower as an integral part of the Nation's renewable energy portfolio.

The outlook paper advocates for a modernization strategy as a path forward that is most likely to succeed. Modernizing the USACE hydropower program would enhance Federal and non-Federal partnerships and make environmental considerations a key part of hydropower management. The outlook paper explains how modernization can lead to quality infrastructure that provides efficient energy and environmental benefits.

Operations and Maintenance Business Information Link

The Institute utilizes the USACE Operations and Maintenance Business Information Link (OMBIL) national data management systems to support formulation of the annual Civil Works budget guidance. In addition, significant progress was made in the refinement of the USACE Civil Works performance metrics in support of performance base budgeting and Value to the Nation initiatives.

IWR Staff Detailees to the Office of the Secretary of the Army (Civil Works)

During FY 2011, select members of IWR were providing staff support to the Office of the Assistant Secretary of the Army for Civil Works as rotating detailees working on a wide range of policy related initiatives.

Asset Management and Civil Works Infrastructure Recapitalization

One of the most complex and difficult tasks facing the USACE going forward is the wise management of its portfolio of aging Civil Works infrastructure assets while working hard to fulfill its various mission requirements within an era of limited Federal financial resources. The USACE is committed to maintaining a sustainable, 21st century infrastructure as a means to strengthen the Nation's economy, create jobs, reduce risks, and bolster our long term global competitiveness. The USACE has the critical responsibility of planning, constructing, operating, and maintaining a significant portion of America's water resources infrastructure. Both traditional and natural "green" infrastructure enable the transportation of goods; protect communities from flood, hurricane and drought risks; provide food for people in the US and abroad; restore significant aquatic ecosystems; and support water-based recreation. These assets provide critical value and services to the American people but are now aging rapidly (most are more than 50 years old). The current approach to and strategy for maintaining our degraded infrastructure is not sustainable and a new approach and strategy to develop and manage Civil Works water resource infrastructure systems is needed.

USACE has had an Asset Management (AM) program underway at HQUSACE for the past five years. This program has had great success working on the deployment of the Facilities Engineering Maintenance (FEM) program across the Corps' Operations community and development of the Operational Condition Analysis (OCA) tool for the Navigation program. While this progress on these tasks have been successful, HQUSACE leadership recognized that operating USACE assets and systems at even the highest levels of efficiency, squeezing out maximum levels of performance, and stretching the useful lives of our Civil Works capital stock to their practical limits cannot, alone, address the enormity of the challenges our Civil Works infrastructure will inevitably face in the 21st Century. Therefore, in close coordination with the OASA(CW), and with the full concurrence of the Assistant Secretary of the Army (Civil Works) (ASA(CW)) and the Deputy Commanding General for Civil and Emergency Operations (DCG-CEO), these leaders decided to form a related, overarching effort for planning the eventual recapitalization (ReCap) of our Civil Works infrastructure portfolio.

The Institute has been given the responsibility to develop the Infrastructure Recapitalization (ReCap) program so as to work cooperatively with the Asset Management program to ensure access to the capabilities needed for the logistical, financial and project management, and to provide technical and systems support for both efforts. The ReCap team also took the lead for integrating the Asset Management data, along with other corporate enterprise financial and performance information, results and project outcomes into an overall ReCap plan. This also included the analytical decision support, policy development, financing, and strategic communication aspects of ReCap with the Corps many partners, customers, and stakeholders. Overseeing both efforts is a Senior Oversight Group (SOG) who has the responsibility for integration of both efforts and to manage resources. The SOG also has the responsibility for providing strategic oversight of the entire program.

The initiation of the ReCap program at IWR began in August of 2011 with both acquisition of funds and specific direction by the Director of Civil Works and the SOG. Several projects were quickly initiated to provide some base information for both programs. These projects are being integrated with several existing projects that the Institute has been developing over the last few years that will provide valuable knowledge needed to assist the strategic effort. Those initiatives began in FY 2011 scheduled to be completed in FY 2012 include:

- Alternative Financing: An effort to examine options for alternative financing for USACE assets including (but not limited to) Public-Private Partnerships (PPP), infrastructure banks, and leasing options;

- iBET/WISDM: The development of an Integrated Budget Evaluation Tool (iBET) and the Water Infrastructure Systems Data Manager (WISDM) decision support software to assist with the FY 2014 budget preparation and defense;

- Survey of Best Practices with respect to Asset Portfolio Management: A survey of existing

strategies and operations of asset portfolio management; and,

- Strategic Communications: Preparing to begin a strategic communication package supporting the FY 2014 budget.

Together the Asset Management and the Infrastructure Recapitalization programs will lay the strategic foundation for long term sustainability of the Nation's USACE infrastructure assets. These two parallel, interrelated efforts will take advantage of economies of scale and leveraging of resources (where appropriate) and will need to be conducted as transparent, integrated efforts which encompass the full life-cycle of Civil Works projects, cutting across USACE business lines and functional areas towards the objective of ensuring the long term sustainability of the USACE Civil Works missions and programs.

Revisions to the Principles and Guidelines: The Principles and Guidelines for Water and Land Related Resources Implementation Studies (P&G) are the rules that govern how Federal agencies evaluate proposed water resource development projects. In the Water Resources Development Act of 2007 (Public Law 110-114), Congress instructed the Secretary of the Army to develop a new Principles and Guidelines for the U.S. Army Corps of Engineers (section 2031). In an effort to modernize the approach to water resources development, the Administration expanded the scope of the Principles and Guidelines to cover all Federal Agencies that undertake water resource projects, not just the four agencies (i.e., USACE, Bureau of Reclamation, Natural Resources Conservation Service and the Tennessee Valley Authority) which are subject to the current Principles and Guidelines.

In December 2009, the Council on Environmental Quality published a draft Principles and Standards (P&S) in the *Federal Register* requesting public comments and National Academy of Sciences peer review. Simultaneously with P&S publication, CEQ assembled an Inter-agency Team to develop the Procedures (sometimes denoted as "Guidelines"). During FY 2010 and FY2011, CEQ prepared responses to the public and the National Academy of Sciences.

During FY 2011 the staff of the Institute continued to serve on the Inter-agency Guidelines Development Team. In addition, IWR staff supported HQUSACE and OASA(CW) in analyzing various CEQ proposals to replace the Principles and Standards (P&S). As of the end of FY 2011, CEQ anticipated publishing, in final form, a P&S replacement as well as a set of draft Guidelines.

National Ocean Policy: During FY 2011, IWR staff continued to support the OASA(CW) and HQUSACE participation in National Ocean Policy (NOP) initiatives, which are integral to the implementation of Executive Order 13547 establishing a *National Policy for the Stewardship of the Oceans, Our Coasts and the Great Lakes (* July 19, 2010). The Executive Order adopted the final recommendations of the Interagency Ocean Policy Task Force and created a National Ocean Council (NOC) to strengthen ocean governance and coordination. The final recommendations prioritize actions for the NOC to pursue and call for a flexible framework for coastal and marine spatial planning to address conservation, economic activity, user conflict, and sustainable use of the ocean, our coasts and the Great Lakes.

During FY 2011, IWR staff represented the OASA (Civil Works) on the Ocean Resource Management Interagency Policy Committee (ORM-IPC) and the Ocean Science and Technology Interagency Policy Committee (OST-IPC). In this capacity, IWR staff represented and coordinated diverse Civil Works interests in many NOP efforts, including participating in drafting of strategic implementation documents for coastal and marine spatial planning, coastal resiliency and adaptation to climate change effects, ecosystem protection and restoration, and ocean observation, data and mapping. These efforts can enhance the potential to provide comprehensive, integrated approaches to planning and managing uses and activities over the long term. IWR staff engaged other USACE personnel at HQUSACE, the USACE Planning Centers of Expertise, the Engineer Research and Development Center, and in district offices. Opportunities for collaborating with the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Geological Survey (USGS) on mapping and data related issues have been identified through this participation.

In March 2011, the Director of the Institute, Mr. Robert A. Pietrowsky participated in the inaugural meeting of the Department of Defense/Joint Services Ocean Council Executive Steering Group (DoD/JS ESG). The DoD/JS ESG was established to support the DoD portion of the National Ocean Council Deputies Group. Mr. Pietrowsky was appointed to represent USACE through HQUSACE Civil Works.

IWR staff also participates on the Interagency Working Group for Ocean Social Science and have contributed to the development of training materials

on human dimensions of flooding, including vulnerability and resiliency. A member of the staff co-authored with members of the staff of ERDC and researchers from the United Kingdom an ERDC Technical Note on the use and development of Foresight Studies and their application to flood risk and coastal erosion management studies in the U.S., entitled "*Planning Regional Flood and Coastal Erosion Foresight Studies*", ERDC/CHL CHETN-II-53, dated June 2011.

IWR staff also participated in the American Society of Civil Engineers sponsored "Solutions to Coastal Disasters" conference held June 26-29, 2011 in Anchorage, Alaska, and participated in drafting a protocol for calculating annual damages prevented in coastal areas. IWR staff also chaired two sessions at the National Flood Risk Management Conference held August 15-19, 2011 in Nashville, Tennessee.

Coastal Zone 2011 Conference: IWR personnel represented USACE on the multi-agency steering committee for the Coastal Zone 2011 Conference, held July 17-21, 2011 in Chicago, IL, providing strategic input to the development of the conference program, as well as leading and assisting in a number of technical sessions during the conference. The Institute's contribution to the development of the conference program and outreach to the users of the coastal ports and harbors and members of the navigation industry contributed to an increase in the participation at the conference of the users of the maritime transportation system and other economic interests resulting in an enhanced and more robust dialog between coastal managers and the users of the attributes of the coastal features of the nation. Central to the themes of the conference were the National Ocean Policy, coastal and marine spatial planning, and collaboration and leveraging to jointly work toward common, interrelated coastal management goals across a range of sectors. Members of the Institute's staff also worked with the staff from ERDC, the Buffalo District, the Planning Center of Expertise for Coastal and Storm Damage Reduction, and other USACE offices to develop the program, encourage USACE participation and collaboratively develop panel discussions, presentations, displays and poster sessions. Among the broad range of Civil Works coastal experiences and expertise included were regional and local projects, studies and initiatives on all ocean coasts and the Great Lakes; coastal engineering science, mapping, models and other tools and technologies for assessment and decision support; ecosystem restoration; navigation structures, dredging and dredged material management; and flood risk management. The OASA(CW) and the Mississippi Valley Division commander participated in key plenary panels sessions on collaboration and strategic direction in coastal and ocean policy.

National Shoreline Management Study: The National Shoreline Management Study, authorized by the Water Resources Development Act of 1999 (Public Law 106-53, Section 215(c)), remains a collaborative, inter-agency effort that is adapting to the recent surge in coastal and ocean initiatives. The study is intended to describe the extent and causes of erosion and accretion along the shores of the U.S., the economic and environmental effects caused by erosion and accretion, and the systematic movement of sand along the shores. The study focuses on the resources committed by Federal, state and local governments to restore and nourish shores, recommend appropriate levels of Federal and non-Federal participation in shore protection, and serves to advance the use of systems approaches to sand management.

In FY 2011 the study team engaged a broad community in reviewing the North Atlantic Region Assessment and began the California Regional assessment. Each of these regional assessments will provide a detailed description of state, and local sediment processes and associated economic and environmental effects of shoreline change. The regional assessments highlight the regional diversity regarding shoreline management challenges and concerns across the states in the regions covered. The California Assessment is being done in coordination with the California Coastal Sediment Management Workgroup, and draws extensively from work done for the California Coastal Sediment Master Plan, and coastal regional sediment management plans. The staff of the Institute presented findings to date of the regional assessments through participation on a panel on management strategies at the Coastal Zone 2011 Conference.

Regional Sediment Management: The USACE has adopted the Regional Sediment Management (RSM) approach in carrying out its programs and activities involving or affecting sediment. The RSM approach uses principles of integrated water resources management, as well as a watershed perspective. Sediment management spans the USACE navigation, flood and coastal storm damage reduction (flood risk management), and ecosystem restoration missions and responsibilities. The USACE applies this perspective and approach as a major stakeholder and collaborative partner in many of the Nation's inland and coastal watersheds.

In FY 2011, IWR staff continued working with HQUSACE staff, the Engineer Research and Development Center (ERDC) staff, and District office personnel on the integration of the RSM approach through initiatives that both involve and affect Civil Works water resource projects and activities. Members of the Institute staff participated as integral members of the HQUSACE Regional Sediment Management Project Delivery Team, and continued to support the sediment management strategies of the Gulf of Mexico Alliance, and related efforts of the inter-governmental Gulf Coast Ecosystem Restoration Task Force, established by Executive Order 13554. Members of the Institute staff also participated in National Ocean Policy (NOP) workgroups addressing integration of RSM approaches to accomplishing NOP priority objectives. These efforts contributed to continuity and preventing duplication among interrelated activities, as well as engaging Corps participation on topics relevant to a range of Civil Works interests.

Experiences with RSM applications are informing the National Shoreline Management Study regarding system approaches to sediment management. These systems approaches consider sediment system dynamics, projects and activities in a region that involve or affect sediment, and the institutions associated with sediment in the region, as integrated components that vary by region.

Coastal System Portfolio Initiative (CSPI): The Institute has facilitated the initiation of a process to examine and evaluate Federal shore protection, navigation, and ecosystem restoration projects along the Nation's coastlines as a "system of systems", rather than individual projects. This initiative will help improve USACE planning, design, construction, and operation and maintenance of federal coastal risk reduction projects, as well as collaboration with other Federal, state, and local agencies and levels of government in coastal water resources management. The USACE Planning Center of Expertise for Coastal and Storm Damage Reduction located at the North Atlantic Division of the Corps is leading the technical review of coastal projects which provides a qualitative analysis of existing conditions, estimated federal future costs (over a five year period), and opportunities for action. A technical review document and web-based Geographic Information System (GIS) database present existing conditions at Federal coastal projects, including current project phase and project type, an overview of project reliability where construction is either complete or under way, and the resources at risk, including: structures, habitat, infrastructure, critical facilities, evacuation routes, and recreation.

The CSPI was extended to the South Atlantic Division in 2011. The initiative is examining the existing conditions, resources at risk, estimated future costs, and opportunities for action across the system of coastal projects, not just individual projects. The intent is to use the systems approach to better integrate and implement coastal risk reduction, navigation, and coastal ecosystem restoration. The updated 2011 CSPI Technical Review Document includes coastal projects and studies from Maine to Mississippi, and ongoing efforts are extending the review to the rest of USACE coastal districts.

Systems Approach to Geomorphic Engineering (SAGE): Begun in FY 2011, Systems Approach to Geomorphic Engineering (SAGE) is a multi-agency initiative among the USACE, the National Oceanic and Atmospheric Administration, Federal Emergency Management Agency, The Nature Conservancy, The Conservation Fund, the Virginia Institute for Marine Sciences, the University of New Orleans, and the University of Rhode Island to focus on innovative approaches to coastal landscape transformation. The Institute originated the initiative with USACE's Engineering Research and Development Center, and the other federal and non-federal partners. The purposes are to pursue and advance a comprehensive view of shoreline change, and to integrate methodologies that utilize hybrid approaches of green and gray engineering solutions in coastal communities and shorelines to slow, prevent, mitigate, and adapt to the impacts and consequences of changing weather and climate patterns. In FY 2011, the SAGE Team developed a concept paper, identified the vision, mission and goals of the initiative and held an initial meeting of representatives from the various agencies at NOAA's Coastal Services Center in Charleston, SC with the participating agencies identifying future collaborative efforts and further articulating the prospective outcomes.

IPET/HPDC (Interagency Performance Evaluation Task Force/ Hurricane Protection Decision Chronology) Lessons Learned Implementation Team (formerly Actions for Change): The IPET/HPDC Lessons Learned Implementation Team was developed to address the lessons learned from the Hurricane Katrina and Rita events. The goals of the effort are to improve public safety and the Nation's water resources infrastructure by providing expert and professional services to the Nation. The team was divided into four themes: (1)

Comprehensive Systems Approach, (2) Risk Informed Decision Making, (3) Communication of Risk to the Public, and (4) Professional and Technical Expertise.

IWR is actively participating on the core teams for the first three themes. The objective of Theme 1, Comprehensive Systems Approach, is to review the dynamic processes that potentially impact USACE projects and to develop guidelines and recommend policy and program changes to address the changes and their impacts. IWR personnel are leading the Temporal and Spatial System Changes project delivery team (PDT), the Water Infrastructure Systems Data Manager Tool PDT, and the Multi-Objective System Planning and Policy PDT. Members of the Institute's staff are also on the Sustainable Solutions PDT.

Theme 2, Risk Informed Decision Making, includes tasks that collectively aim to infuse risk and reliability concepts into decision making through the lifecycle of Corps projects and related systems. The objective is to develop improved risk assessment and management processes to inform USACE, the public, and other stakeholders of infrastructure condition and critical needs for public safety. The Corps' Chief Economist is leading the Theme 2 team and other IWR personnel are members of various Theme 2 PDTs.

Activities in FY 2011 within Theme 2 included: continued development of a new flood risk assessment software tool HEC-FRA; enhancements to the existing flood risk damage assessment software tool HEC-FDA; modernization of the IWR risk analysis overview manual; continued work on developing a USACE Civil Works risk management framework; the addition of an uncertainty module to the IWR Planning Suite; updating and expanding the USACE Risk Analysis Gateway and learning center website, and; initial development of a second generation coastal hazards model.

Theme 3, Communication of Risk to the Public, emphasizes the communication of flood risks to the public and public involvement in flood risk management decision making. Initiatives will focus on concepts of residual risk and the involvement of disadvantaged populations that are most likely to be impacted by floods. The Institute is leading the Public Involvement sub-team, and is partnering with the National Flood Risk Management team to develop a framework for public involvement in flood risk management decision making.

Responses to Climate Change: During FY 2011, the Institute continued to making significant contributions to the efforts of USACE to incorporate responses to climate change within it organizational thinking, and on a broader scale, was heavily engaged in the federal government's efforts in the advancement of global climate change science and the development of policies to address adaptation to climate change. The objectives of the initiative are to understand how climate is changing, describe and characterize climate impacts to USACE missions, operations, programs, and projects, and develop consistent water resources management adaptation policies and approaches throughout USACE Civil Works and in partnership with other Federal water resources agencies. The project will provide recommendations for policy and guidance to prepare for, and respond to, climate change and variability.

Agency Climate Change Adaptation Planning

On October 5, 2009, President Obama issued Executive Order 13514, which set sustainability goals for Federal agency operations and directed agencies to improve their environmental, energy and economic performance. Under this Executive Order, each Federal agency was to evaluate agency climate risks and vulnerabilities to manage both the short-term and the long-term effects of climate change on the agency's mission, programs, and operations.

On March 4, 2011, the Council on Environmental Quality issued a set of implementing instructions for Federal Agency Adaptation Planning. The instructions informed agencies on how to integrate climate change adaptation into their planning, operations, policies and programs, as recommended by the Interagency Climate Change Adaptation Task Force in its October 2010 Progress Report to the President.

During FY 2011, the Institute supported the OASA(CW) in developing the USACE Climate Change Adaptation Policy, available at http://www.corpsclimate.us/adaptationpolicy.cfm.

This policy calls for integrating climate change adaptation into all that the USACE does. The policy also discusses the need to take action now based on the best available and actionable science, and that the USACE should consider climate change impacts when undertaking long-term planning, setting priorities, and making decisions. The Policy Statement says that "Mainstreaming climate change adaptation means that it will be considered at every step in the project life cycle for all USACE projects,

both existing and planned… to reduce vulnerabilities and enhance the resilience of our water-resource infrastructure."

The Policy Statement establishes the Assistant Secretary of the Army for Civil Works as the Agency official responsible for ensuring implementation of all aspects of this policy. Through this Policy, USACE establishes the USACE Climate Change Adaptation Steering Committee to oversee and coordinate agency-wide climate change adaptation planning and implementation.

The second important outcome of FY 2011 was the preparation and submittal of the *USACE Climate Change Adaptation Plan and Report 2011*, dated September 2011, to the White House Council on Environmental Quality (CEQ) and the Office of Management and Budget, available at http://www.corpsclimate.us/docs/usaceadaptnplanreport2011v02.pdf. The Report includes the Policy Statement, answers the guiding questions posed by the White House Council on Environmental Quality in its Implementing Instructions, and describes USACE progress and future priorities.

Throughout FY 2011, IWR staff continued supporting the White House Interagency Climate Change Adaptation Task Force to develop federal recommendations for adapting to climate change impacts, both domestically and internationally. IWR supports several task force efforts including providing representatives on working groups on Adaptation Science Inputs for Policy, Agency Adaptation Processes, and Water Resources.

A major effort by IWR staff participating in the Water Resources and Climate Change Adaptation Working Group was the report "*National Action Plan (NAP): Priorities for Managing Freshwater Resources in a Changing Climate*", scheduled to be released in October 2011 and available at (http://www.whitehouse.gov/sites/default/files/microsites/ceq/2011_national_action_plan.pdf).

The Institute's Climate Change team contributed to the writing of the plan and led the team that developed the Plan's recommendations concerning integrated water resources management.

The National Action Plan identifies the USACE as leading the interagency team that will implement three integrated water resources management (IWRM) actions, including:

- Action 17: "Work with States and interstate bodies (e.g., River Basin Commissions) to provide assistance needed to incorporate IWRM into planning and programs, paying particular attention to climate change adaptation issues."

- Action 19: "Working with States, review flood risk management planning and drought management planning to identify "best practices" to prepare for hydrologic extremes." The USACE Silver Jackets program is specifically mentioned as a proactive effort to better coordinate flood risk management.

- Action 20: "Develop benchmarks for incorporating adaptive management into water project designs, operational procedures, and planning strategies."

USACE is also identified as co-leading other supporting actions including:

- Action 6: Provide coastal states and communities with essential information to identify areas likely to be inundated by sea level rise (co-led with the National Oceanic and Atmospheric Agency);

- Action 9: Develop a Federal Internet portal to provide current, relevant and high quality information on water resources and climate change (co-led with NOAA)

- Action 16: Enhance coordination among Federal water efficiency programs and improve program effectiveness, including creating a "toolbox" of key practices (co-lead with the Department of the Interior, the Environmental Protection Agency and the Department of Energy); and,

- Action 21: Establish a core training program related to climate change science for local, Tribal, State, and Federal water resources managers (co-led with the US Bureau of Reclamation and NOAA).

In October 2010, the Interagency Climate Change Adaptation Task Force published a report entitled, "*Progress Report on the Interagency Climate Change Adaptation Task Force: Recommended Actions in Support of a National Climate Change Adaptation Strategy*."

In October 2011, Task Force will publish its 2011 Progress Report outlining the Federal Government's progress in expanding and strengthening the Nation's capacity to better understand, prepare for, and

respond to extreme events and other climate change impacts. The report will provide an update on actions in key areas of Federal adaptation, including building resilience in local communities, safeguarding critical natural resources such as freshwater, and providing accessible climate information and tools to help decision-makers mange climate risks.

National Ocean Policy

As part of President Obama's National Policy for the Stewardship of the Ocean, Our Coasts, and the Great Lakes, IWR staff participated in the effort to draft a National Ocean Policy Implementation Plan, which will include a series of actions to address the Resilience and Adaptation to Climate Change, one of the nine priority objectives identified by the National Ocean Policy.

National Fish, Wildlife, and Plants Climate Adaptation Strategy

Federal agencies are partnering with state, tribal and local representatives to develop a National Fish, Wildlife, and Plants Climate Adaptation Strategy, to safeguard the Nation's species and natural resources. A draft strategy will be released in January 2012.

Climate Change and Water Working Group

In FY 2011, as part of the Climate Change and Water Working Group (CCAWWG) effort, USACE and the Bureau of Reclamation worked together to publish a report entitled "*Addressing Climate Change in Long-Term Water Resources Planning and Management: User Needs for Improving Tools and Information*", dated January 2011. This report (available at http://www.usbr.gov/climate/userneeds/) identifies the needs of local, state, and federal water management agencies for climate change information and tools to support long-term planning. The report found there were gaps in the information and tools needed to help water managers in how to use climate change information to make decisions, how to assess the responses of natural systems to climate change, and how to communicate the results and uncertainties of climate change assessments to decision-makers. As a result, the report seeks to focus research and technology efforts to address information and tools needed for longer term water resources planning and management.

IWR staff also worked with CCAWWG agencies in other to prepare a special collection of journal papers addressing the critical climate hydrology issue of nonstationarity. The 13 papers in the June 2011 *Journal of the American Water Resources Association* (JAWRA), see http://onlinelibrary.wiley.com/doi/10.1111/jawr.2011.47.issue-3/issuetoc) explore the implications of possible nonstationarity on hydrologic frequency analysis and water management. The papers represent issues and ideas first presented at the FY 2010 UASCE-hosted "*Workshop on Nonstationarity, Hydrologic Frequency Analysis, and Water Management*," held in Boulder Colorado from January 13-15, 2010. All of the papers have gone through the full JAWRA peer review process, with appropriate revisions and updates, and will support the development of future policy and guidance.

The Institute's Responses to Climate Change team continued to work closely with the HQUSACE personnel from Planning, Operations and Maintenance, Hydrology and Hydraulics, and Engineering and Construction, as well as the IPET/HPDC Lessons Learned Implementation Team to develop a Civil Works Engineering Technical Letter (CWTL) on Procedures to Evaluate Sea Level Change Impacts, Responses, and Adaptation. This technical letter will describe planning measures for USACE projects in response to future sea-level change. This effort is being led by district staff (with the support of IWR planners, economists, engineers and scientists), and includes members of the USGS, NOAA, FEMA, the Bureau of Reclamation, Federal Highway Administration, the Navy, the U.S. Naval Academy, and others, including experts from the United Kingdom (HR Wallingford and the University of Southampton). Personnel from the Responses to Climate Change program participated in a workshop in December 2010 and another in March 2011 to continue development of the technical guidance on sea level change impacts, responses and adaptation.

An associated work effort during FY 2011 has been the development of a new Engineer Circular, EC 1165-2-212, which addresses sea level change considerations for Civil Works Programs. This Engineer Circular provides guidance for incorporating the direct and indirect physical effects of projected future sea-level change across the project life cycle in managing, planning, engineering, designing, constructing, operating and maintaining USACE projects and systems of projects.

USACE Chief Economist: Dr. David Moser of IWR is the USACE Chief Economist and leader of the Economics Community of Practice (CoP). During FY 2011, Dr. Moser also continued his involvement in developing tolerable risk guidelines

for both dam safety and levee safety policy and procedures team.

The Chief Economist's leadership engaged to build and advance the economic analysis capability across the USACE, holding two national meetings and regular teleconferences with senior economists. A subject matter expert (SME) database of all Corps economists was reviewed and updated by senior economists to maintain a directory identifying economists by experience and expertise for each economic activity conducted by the USACE. This SME database is used by MSC economists, Planning Centers of Expertise and others to identify resources for feasibility studies, independent technical reviews, and special purpose teams. The database was transformed to be web accessible to allow individual entry and update by field economists.

As lead technical economics expert for the USACE, Dr. Moser provided review and guidance to multiple economic analyses for both field practitioners and USACE Headquarters reviewers.

As a complementary activity to building capacity, IWR focused on enhancing technical guidelines and economic manuals available to field practitioners. In FY 2011 work proceeded on the update of water resources planning National Economic Development (NED) Manuals with the publication of Deep Draft Navigation and Coastal Storm Risk Management manuals

In FY 2011, the Chief Economist also continued as the National Team Lead for Theme 2 - Risk Informed Decision Making, as part of the IPET/HPDC Lessons Learned Implementation (formerly part of Actions for Change), which transitioned to the Civil Works Campaign Plan Goal 2a. As part of that effort, the Chief Economist led development of approaches and frameworks to articulate the value of risk analysis, with emphasis on risk management, to Civil Works decision making. As part of this activity, he helped facilitate risk workshops as part of the USACE planning pilot programs. He served on the team developing and implementing tolerable risk as part of the transitioning of dam safety to a risk analysis approach. Additionally, he worked as part of a team developing tolerable risk notions to levee safety. In that role, he provided major contributions to develop and hold two public Levee Safety Engineering Circular Development workshops held 24-26 May and 28-30 June, 2011.

The Chief Economist was also was involved in issues relating to National Economic Development evaluation of navigation and other economic evaluation issues. Additionally, he was co-lead of an effort to develop improved modeling to estimate regional economic impacts of Corps spending and project operation. This web based model is currently completing its model certification review.

American Reinvestment and Recovery Funded Activities

In February 2009 the Congress passed and the President signed into law the American Recovery and Reinvestment Act, also referred to as the "Recovery Act" (Public Law 111-5, dated February 17, 2009). The Recovery Act provided appropriations for the purpose of job creation and preservation, infrastructure investment, increased energy efficiency through advancements in science and technology, investments in transportation, environmental protection, and other types of infrastructure that will yield long term economic benefits, and stabilize the fiscal condition of State and local governments.

In FY 2009 the Institute received approximately $10.0 million to carry out Recovery Act related activities.

Regional Economic System (RECONS): A portion of these funds were used to conduct a comprehensive study of the employment impacts and associated secondary economic impacts associated with Recovery Act expenditures. A regional economic impact modeling tool named Regional Economic System (RECONS), was developed to calculate accurate and defensible estimates of regional economic impacts associated with USACE Recovery Act expenditures and could be utilized to track progress and to justify continued operation, maintenance and construction activity performed by the Corps. The RECONS model automates calculations and generates estimates of employment and other economic measures such as income and sales associated with USACE's Recovery Act expenditures and regular annual Civil Works expenditures, as well as secondary indirect and induced economic impacts associated with additional economic activity associated with USACE missions including the provision of recreational opportunities at USACE facilities and the provision of improved navigation features (i.e.; increased tourism-related spending or an increase in the waterborne transportation of cargo). Estimates of increased direct and indirect employment and income impacts are generated by extracting multipliers and other economic measures from more than 1,400 regional economic models that were built specifically for

USACE's project locations. These multipliers were then imported into a database and the RECONS tool matches various spending profiles to the matching industry sectors by location to produce economic impact estimates.

In FY 2011 activities associated with the RECONS project included the following:

- Completion of the migration of the RECONS system to an online model;
- Completion of a user's manual;
- Provision of data and supporting materials to USACE senior leaders as part of briefings and other forms of communications and programmatic outreach;
- Continuation of production of estimates of employment, income and sales for various proposed new projects for planning and communication purposes, including materials associated with the preparation and release of the FY 2012 budget request;
- Continuation of technical support to MSC and district offices in use of the RECONS system;
- Development of a model certification plan for the RECONS model, including conduct of an independent review of the model;
- Execution of two new task orders to further enhance of the robustness of the model and to support the USACE Civil Works recapitalization initiative.

Accelerated Corps Water Management System Project: A Hydrologic Engineering Center Recovery Act funded initiative, the "Accelerated Corps Water Management System Project", was completed through the use of three engineering consulting firms working with the HEC. Using the three firms, eleven major watersheds in eleven District offices were modeled with hydrologic/hydraulic models within the Corps Water Management System (CWMS). These models will allow Corps water managers to better operate reservoirs and other projects in real-time. The models provide short-term hydrologic forecasts (about one week) and simulate reservoir operations for those forecasts to determine the best operations to maximize the effective use of the reservoirs. CWMS also allows for different "what-if" scenarios, so that water managers can compare different rainfall forecasts and operational scenarios to evaluate to potential impacts. The models can also be used in Corps planning studies for alternative analyses. Watersheds modeled include the Red River of the North, where there has been substantial snow melt flooding in the recent past; the Cumberland and Ohio Rivers, site of the floods in Tennessee including Nashville in the Spring of 2010; the American and Santa Ana rivers in California; the Apalachicola, Chattahoochee and Flint (ACF), as well as several others. The project was funded with $5.0 million and completed on schedule. The final report entitled "*Accelerated Corps Water Management System (CWMS) Deployment Campaign Funded by the American Recovery and Reinvestment Act of 2009 (ARRA)* (HEC Report number PR-79), April, 2011 and is available at the HEC website.

Climate Change Downscaling Projections Project: A third Recovery Act funded initiative, the "Climate Change Downscaling Projections Project" continued producing a comprehensive library of fine-resolution simulations of historical and future climate for use by decision-makers who need local to regional-scale climate information to evaluate climate impacts to water resources project performance and resilience. The project produced fine-resolution climate results spanning the period from 1950-2100 using two statistically-based methods that add spatial and temporal detail to the results of a full suite of climate models. This library of fine-resolution climate projections is distributed by the Lawrence Livermore National Laboratory through the same portal that distributes IPCC climate model results, and is freely available to other federal agencies, state and local governments, and the general public.

COLLABORATION AND PARTNERING

The USACE recognizes that the Civil Works mission must be carried out in collaboration with multiple partners and stakeholders with differing authorities, capabilities and perspectives. Thus a major IWR focus has long been as the intellectual nexus for USACE expertise on collaboration, partnering and public participation. In FY 2011 the Institute collaborated with multiple federal and state agencies to address critical issues. IWR serves as the USACE lead for multiple national collaborative partnerships and is committed to developing new training instruments, technologies, processes and policies to further USACE's overall capability in collaborative planning and partnering.

IWR represented USACE and the Office of the Secretary of Defense (OSD) through participation in

the National Science and Technology Council's interagency Subcommittee on Water Availability and Quality (SWAQ) and its Subcommittee on Disaster Reduction.

IWR's collaborative efforts extend to the academic community through the Maass-White Visiting Scholars program, the Universities Council on Water Resources (UCOWR) Fellowship Visiting Scholars program, the National Research Council (NRC) Research Associates program, the American Association for the Advancement of Science (AAAS) Science and Technology Policy Fellows program, and the Leo R. Beard Visiting Scholars program (resident at HEC).

National Partnerships: Forming strategic alliances, both through formal agreements and informal working relationships, is becoming a way of doing business in the USACE, government agencies and non-governmental organizations (NGO's). Driving this movement are the complexity and far-reaching impacts of today's water resource problems, juxtaposed with the limited financial and intellectual resources of any single organization. The USACE is increasingly committed to partnerships as a means of accomplishing common goals. In FY 2011 IWR entered into or laid the groundwork for establishing new MOU's with various federal and non-federal partners.

Natural Resources Conservation Service/USACE National Partnership

On May 26, 2011, the Honorable Jo-Ellen Darcy, Assistant Secretary of the Army (Civil Works) and Mr. David White, Chief of the Natural Resources Conservation Service (NRCS) within the U.S. Department of Agriculture took part in a signing ceremony to renew the NRCS/USACE National Partnership Agreement. The overall goal of the Partnership remains unchanged from the original agreement signed six years ago, which is to "promote a long term working relationship to improve the management of water and related natural resources under the missions and authorities of the NRCS and USACE." This renewed Partnership Agreement broadens the areas of cooperation to include coastal restoration, water quality improvements, water supply development, and coordination of programs and activities that promote the wise use of floodplains, including participation in the Federal Interagency Floodplain Management Task Force.

Building upon the national agreement between the two agencies, on April 15, 2011, representatives of the USACE Mississippi Valley Division and the NRCS met aboard the Corps' Motor Vessel (M/V) *Mississippi* to sign the first regional Memorandum of Understanding (MoU) between the two agencies.

Also, a USACE/NRCS Regulatory Interagency Work Group was established in June 2011 to address Regulatory issues. The work group is finalizing an issue paper to outline regulatory/conservation problems and potential solutions.

As part of the continued collaborative effort between the Corps and the NRCS, a handbook developed by members of both organizations for use by personnel was published in April 2011. The handbook entitled, "*The NRCS/USACE Partnership Handbook: A Field Guide to Working Together Toward Shared Goals*" is available at the IWR website, http://www.iwr.usace.army.mil/. The handbook will serve as reference guide to be used at the field level to stimulate and facilitate active cooperation and collaboration between the two agencies. The handbook contains basic information about each agency's missions, programs, capabilities, and mode of operations. Identifying and understanding each agency's mutual interests can lead to developing shared goals and leveraging resources to implement joint solutions. Case studies and examples are included to illustrate what has worked in the past and where further collaboration and problem solving is needed to reach better results in the future.

To share information about the USACE/NRCS Partnership and the Partnership Handbook, a joint USACE/NRCS conducted webinar was held on April 26, 2011, with over 200 NRCS/USACE staff participating. Two subsequent webinars were held in May 2011 to disseminate information about the partnership and handbook with personnel in field offices. Information about the Partnership and the Handbook was also presented at the 4th National Conference on Ecosystem Restoration (NCER) in Baltimore, Maryland on August 4, 2011.

An Action Plan for the USACE/NRCS partnership has been developed jointly by USACE and NRCS which identifies activities for the next 1-3 years and is intended to be dynamic and flexible. It is anticipated that new actions will be established as needs are identified by personnel within the two agencies. Issues identified will be reviewed by the Partnership Core Team, channeled through agency leadership, and when appropriate, added to the Partnership Action Plan. The Action Plan serves as a framework for agency leaders to annually review and

concur with partnership accomplishments and activities.

U.S. Institute for Environmental Conflict Resolution (USIECR)

In FY 2011 the Institute made active use of its 2008 Memorandum of Understanding (MOU) with the U.S. Institute for Environmental Conflict Resolution (USIECR). The USIECR is an independent federal program of the Udall Foundation, which impartially assists in the resolution of federal environmental, natural resources and public land conflicts and controversies through facilitated negotiation, mediation, and collaborative problem solving. The most significant use of the USIECR MOU during FY 2011 was providing a contractual vehicle to enable the Sacramento District to access USIECR facilitation support for the California Levees Round Table as part of the Central Valley Flood Protection Program. The Roundtable is a forum for high-level policy negotiation and resolution of cross-agency impediments to desirable flood management. The Roundtable agencies collaborated to draft a phased system-wide levee vegetation plan.

Other engagements with the USIECR during FY 2011 included IWR-USIECR joint leadership on both the National Coordinating Committee for the Use of Technology in ECR and the National Collaborative Modeling for Decision Support Steering Committee.

U.S. Geological Survey Partnership

During FY 2011, significant activities associated with the U.S. Geological Survey (USGS) Memorandum of Agreement included quarterly senior level meetings addressing national stream-gage issues; climate change and related water management issues; the sharing of water data; coastal, geotechnical and biological research; and regional and international water studies, such as on the Great Lakes.

The USACE works with the USGS on the Climate Change and Water Working Group (CCAWWG), along with other Federal agencies including the U.S. Bureau of Reclamation, the National Oceanic and Atmospheric Administration (NOAA), the Federal Emergency Management Agency (FEMA), the Environmental Protection Agency (EPA), and the National Aeronautics and Space Administration (NASA). The Climate Change and Water Working Group's objectives are (1) to define the most critical gaps in our capability to forecast and adapt to climate change; (2) to conduct collaborative research to address those gaps; and (3) to develop mechanisms to provide training for infusing climate change science into water planning and technical studies.

USACE and the USGS worked closely together on monitoring and responding to the 2011 floods on the Ohio, Mississippi, and Missouri Rivers.

On May 11, 2011, the USACE, USGS, and NOAA signed a MOU to support Collaborative Science, Services and Tools to Support Integrated and Adaptive Water Resources Management. The MOU will facilitate addressing water information needs and support the creation of a database portal to help stakeholders manage water resources.

In September 2011, the Director of the Institute, Mr. Robert A. Pietrowsky was invited to represent the Department of Defense, the Department of the Army, and USACE as co-chair with Dr. Jerad Bales, Chief Hydrologist of the USGS, for the development of the inter-agency water sector technical report for the 2013 National Climate Assessment.

USACE also partners with the USGS on international water resources, as both agencies are core members of the U.S. National Committee for UNESCO's International Hydrological Programme (IHP). The Director of IWR is the designated USACE representative on the U.S. National IHP Committee.

U.S. Bureau of Reclamation Partnership

During FY 2011 USACE continued to work closely with the U.S. Bureau of Reclamation on the Climate Change and Water Working Group (CCAWWG), which also includes representation from the U.S. Geological Survey, NOAA, FEMA, EPA, and NASA.

In January 2011, the USACE and the Bureau of Reclamation released a joint report entitled "*Addressing Climate Change in Long-Term Water Resources Planning and Management: User Needs for Improving Tools and Information.*" The report identifies the needs of local, state, and federal water management agencies for climate change information and tools to support long-term planning. The two agencies are working on another joint report on "Short-Term Water Management Decisions: User Needs for Improved Weather and Climate Prediction Information."

Also of note, during FY 2011 several climate change and water specialists at the Institute supported the Bureau of Reclamation in the development and peer review of the Bureau's "Secure Water Act" Report to

Congress. The Department of Interior released the Report in response to Section 9503(c) of the Secure Water Act (Public Law 111-11) that assesses climate change risks and how these risks could impact water activities in the western U.S. The report was prepared by Bureau of Reclamation staff, which relied on its interagency partnerships including the USACE via the Climate Change and Water Working Group (CCAWWG) and the Office of Science Technology and Policy Subcommittee on Water Availability and Quality (OSTP-SWAQ), in preparing and reviewing the report, with several IWR specialists contributing to the document.

The report represents the first consistent and coordinated assessment of risks to future water supplies across eight major western U.S. river basins. The Institute is working closely with Bureau of Reclamation specialists to leverage the Bureau's progress in the Western U.S. as a foundational element of the National Vulnerability Assessment which is underway as part of the Corps' Response to Climate Change Program.

National Flood Risk Management Program: In May 2006, in an IWR-led effort, the USACE established the National Flood Risk Management Program (NFRMP) for the purpose of integrating and synchronizing USACE flood risk management programs and activities both internally and with counterpart activities of FEMA and other Federal, state, regional and local agencies. Its vision is to lead collaborative, comprehensive and sustainable national flood risk management by:

- Improving capabilities to collaboratively deliver and sustain flood risk management and mitigation services to the nation,
- Improving public awareness and understanding of flood related hazards and risks, and
- Coordinating flood damage and flood risk reduction programs across Federal agencies and with local, state agencies and other non-Federal entities.

In FY 2011, the National Flood Risk Management Program supported the following activities:

- Continued regional coordination focused on mitigation and preparedness achieved by the Regional Flood Risk Management Team (RFRMT) in the Upper Mississippi River (UMR) basin. During FY 2011, the UMR-RFRMT held quarterly meetings providing the opportunity for coordination across Federal, state and local agencies to make the most of existing Federal programs to assist states and communities in managing flood risks. The focus of the UMR-RFRMT is on better integrating pre-flood mitigation with a long-term strategy to plan and implement pre- and post-flood emergency actions. Through the UMR-RFRMT quarterly meetings, member agencies were able to regularly brief the entire team on developing policy issues and suggested policy improvements, interstate or interregional issues, state mitigation plans and initiatives, updates on relevant activities from external organizations, and any other proposal or initiative that may have relevance to the Regional Team mission. Additionally, the Team Charter provides a process for vetting and acting on specific project proposals, policy reforms or other initiatives recommended by a member organization.
- Establishment of the Interagency Recovery Task Force in May 2011 which allows for the continued regional coordination for post-flood recovery decision-making. The IRTF is focused on intergovernmental coordination for purposes of post-flood recovery, but will ultimately transition to a longer term coordination entity, meeting quarterly with a focus on mitigation and preparedness, similar to the RFRMT. Members of the IRTF include the states of Louisiana, Mississippi, Arkansas, Tennessee, Kentucky, Missouri and Illinois and the following agencies: the National Weather Service, FEMA, USDA, U.S. EPA, USGS, U.S. Fish and Wildlife Service, U.S. Coast Guard, and the Maritime Administration.
- Conduct of the 2011 USACE Flood Risk Management and Silver Jackets Workshop, held in Nashville, Tennessee on August 15—19, 2011. The theme of the workshop was "Sharing Experience in Driving Down Flood Risk." The workshop emphasized interagency activities in managing flood risk, including those of FEMA, the USACE Flood Risk Management and Silver Jackets programs, other Federal agencies, and state and local initiatives such as hazard mitigation plans. USACE District and Division flood risk managers, Silver Jackets team leads and representatives of multiple Federal agencies came together for an opportunity to be briefed on the accomplishments, status and future goals of the Program, as well as to share the experiences, successes and challenges encountered as part of field level implementation of the NFRMP coordination framework and the Silver Jackets

Program. Additionally, the Workshop provided a number of technical training session providing participants access to a variety of flood risk management related information and skills.

- Conduct of an International Flood Risk Management Approaches: From Theory to Practice – Government Policy Oriented Discussion workshop held on November 30 and December 1, 2010 in Washington, DC. Participants at the workshop discussed the major issues, insights and challenges associated with flood risk management including risk assessment, risk communication, and approaches to addressing flood hazards. The workshop also featured an opportunity for participants to compare governance approaches in nine countries including the United States, Belgium, Germany, Japan, the Netherlands, the Philippines, Spain, Switzerland, and the United Kingdom. Approximately 100 people from nearly 20 countries attended this productive and thought provoking event.

- In September 2011, IWR published a report entitled "*Flood Risk Management Approaches as Being Practiced in Japan, Netherlands, United Kingdom, and United States*", published as IWR report, IWR-2011-R-08. The 124-page report was prepared jointly by personnel from the USACE, the Japanese Ministry of Land, Infrastructure, Transport and Tourism (MLIT), the Dutch Rijkswaterstaat and the United Kingdom Environment Agency. The report examines risk-informed approaches as being practiced and developed primarily in the four countries. The report is organized around a conceptual framework developed to encompass flood risk drivers, risk assessment, and the source-path-receptor concept; the flood risk management cycle; and the adaptive management cycle of maintenance, monitoring, evaluation, and adjustment over time. The findings of the report were presented at special session during the 5th International Conference on Flood Risk Management, hosted by participating agencies on September 28 in Tokyo, Japan as part of the larger conference which was convened from September 27-29, 2011.

- Improved national coordination through the Federal Interagency Floodplain Management Task Force. Beginning in November 2009, FEMA and USACE, through the NFRMP, made use of a standing authority provided by the 1968 National Flood Insurance Act to reconvene a Federal Interagency Floodplain Management Task Force (FIFM-TF), with the general intent of updating the Unified National Program for Floodplain Management; coordinating Federal agency policies for flood risk management; and identifying and recommending actions and policies by the Federal government necessary to reduce losses due to flooding and protect the safety of floodplain residents. To date, the Task Force has focused on two of the activities outlined in its 2010 work plan. It has initiated an effort to assess the impacts of federal programs on floodplain management goals, including an examination of any barriers such programs may present. Additionally, the Task Force commissioned and received a study examining the need for a new *Unified National Program for Floodplain Management* report and outlining steps for accomplishing the development and publication of such a report. The Task Force has also responded to a request from Assistant Secretary of the Army (Civil Works) and Council on Environmental Quality (CEQ) for an interagency effort to develop a definition of "unwise use" of floodplains. The Task Force Working Group has developed a draft definition, sought interagency review and is finalizing a definition to be considered by CEQ and individual agencies in the development of future policy and guidelines.

- Supported efforts of the California Levees Roundtable. In FY 2011, the NFRMP participated in the work of the California Levees Roundtable, a collaborative partnership of federal, State, and local agencies formed to address vegetation issues affecting the State-federal levee system in the Central Valley. The Round Table recognized that vegetation management is only one of many issues that threaten levees and broadened its scope to address many threats to levee integrity. The Round Table produced a document to present a short-term Framework for flood system improvements that are already underway or will be initiated before a comprehensive plan is ready in 2012. The Framework provides general guidelines for helping the State, in coordination with federal and local entities, to move forward while the comprehensive plan is being developed.

  The State's draft comprehensive plan is scheduled to be released the end of calendar year 2011 for public comment followed by approval

and submittal to the State legislature by July 2012. The Roundtable has been instrumental in identifying other levee policy issues related to feasibility studies and general reevaluation reports for discussion and resolution.

- Improved coordination between FEMA and USACE programs through quarterly meetings of an Intergovernmental Flood Risk Management Committee (IFRMC), which provides a venue for FEMA and USACE leadership to coordinate programs and policies, and thus improve program implementation for the flood risk management community.

- Completion of the second phase of a policy study examining opportunities for improving public involvement in all USACE flood risk management related programs and activities. Phase Two produced a plan for implementing the recommendations and framework put forth in Phase One.

- Conducted policy work, through a study of the "Corps Contribution to Flood Risk Management" to examine the role of USACE programs and policies in supporting risk informed, cost responsible flood risk management decision making by individuals and local governments. The study is addressing both the question of how to evaluate the performance of programs and policies in addressing flood risk and how to approach the task of evaluating flood risk at a national scale.

Silver Jackets Program: Complementing the National Flood Risk Management Program (NFRMP), the Silver Jackets Program facilitates the delivery of the Corps' authorities for providing flood risk management services to state and local agencies through state intergovernmental partnerships that make the most of existing Federal agency programs and funding to assist states and communities in identifying and addressing flood risks by leveraging agency resources, identifying opportunities to jointly implement complementary programs, sharing data and knowledge, and eliminating duplicative or conflicting activities or policies.
Silver Jackets teams are collaborative state-led interagency teams, continuously working together to reduce flood risk at the state level. Through the Silver Jackets program, the USACE, FEMA, additional federal, state and sometimes local and Tribal agencies provide a unified approach to addressing a state's priorities. Often, no single agency has the complete solution, but each may have one or more pieces to contribute. The Silver Jackets team is the forum where all relevant agencies come together with the state to collaboratively plan and implement that interagency solution.

The primary goals of the Silver Jackets program are to:

- Facilitate strategic life-cycle flood risk reduction;

- Create or supplement a continuous mechanism to collaboratively solve state-prioritized issues and implement or recommend solutions;

- Improve processes, identifying and resolving gaps and counteractive programs;

- Leverage and optimize resources;

- Improve and increase flood risk communication and present a unified interagency message, and,

- Establish close relationships to facilitate integrated post-disaster recovery solutions that increase resilience.

The Silver Jackets Program facilitates regular and sustained coordination among Federal, regional, and state, and sometimes local and Tribal partners. The intent is not to duplicate existing teams, but to supplement and strengthen current efforts, and establish relationships where they do not yet exist.

Through the Silver Jackets Program, Federal and non-Federal partners have already experienced successes cooperatively developing flood risk mitigation solutions by leveraging agency resources, identifying opportunities to jointly implement complementary programs, sharing data and knowledge, and eliminating duplicative or conflicting activities or policies.

In cooperation with FEMA, other Federal agencies, and states to develop a Silver Jackets team, 29 states are served by active intergovernmental teams and efforts to offer a team to the remaining 21 states is ongoing.

The Silver Jackets program has created the opportunity for optimized delivery of Federal services as well as significant costs savings through leveraging information and resources, increased and improved public risk communication, and combined efforts to address flood risk management challenges. Specific interagency examples include data sharing across agencies to support mapping studies,

combined and coordinated use of models, stream gage data and databases housed in different agencies to create a flood inundation model allowing for more effective flood response and mitigation, synthesis of existing studies and knowledge from different agencies to develop a comprehensive flood risk mitigation plan for a community without requiring any new study effort, and community recovery through short and long term mitigation strategies focused on nonstructural approaches and planning assistance.

Select detailed examples of FY 2010 and FY 2011 accomplishments are described below.

- Non-Structural and Natural Storage - Louisa County, Iowa, #11 Levee District: Public Law 84-99 (P.L. 84-99) provides USACE with the authority and responsibility to either repair flood-damaged levees enrolled in its levee program or to implement non-structural alternatives to those structural repairs. Following the Midwest floods of June 2008, the Iowa Flood Risk Management Team (Iowa Silver Jackets team) identified and coordinated a precedent-setting non-structural alternative to full repair of the Louisa County, Iowa, #11 Levee District's levee system. The alternative is a combination of over 300 acres of USDA's Natural Resources Conservation Service flood plain easements with significantly reduced structural repairs to protect a state highway. The alternative required the cooperation of the levee's public sponsor, the county and state mitigation agencies, the USACE and NRCS to implement. As implemented, the cost to PL 84-99 was estimated to be $187,000 less than the full structural repair while reconnecting nearly 3,200 acres of previously isolated floodplain with the Iowa River, improving environmental habitat, providing increased flood storage to those downstream, and eliminating future obligation to provide structural repair at the sites of the non-structural measures. The Iowa Silver Jackets team was encouraged by this success and is currently working to implement another non-structural alternative with the Green Island Levee and Drainage District.

- Outreach and Watershed Approach to Mitigation Planning- North Branch Elkhart River Project, Indiana: The community had sought studies and assistance from numerous agencies over many years, but none were coordinated, and little action followed, mainly because several parts of the community, and its leaders, had been pulling in differing directions regarding the possible solutions to the flooding problems. The Indiana Silver Jackets team brought together the Indiana Department of Natural Resources, the Indiana Department of Environmental Management, the Indiana Department of Homeland Security, the USGS, USDA-NRCS and USACE. Individually, the agencies had previously invested several hundred thousand dollars in studies, stream clearing, snagging efforts, and other work in the area. Together, the agencies reviewed available information and compiled a single summary document that explained the overall situation and possible approaches to resolve the effects of flooding. The modest investment in agencies' staff time resulted in a clear picture for the community, prompting it to take a watershed approach instead of narrower, neighborhood approach, develop a basin-wide strategy encompassing its neighboring communities, and focus long-term funding requests on holistic solutions rather than individual patches.

- Minnewaukan, North Dakota: The City of Minnewaukan, North Dakota has continually faced the threat of rising water inundating the city on three sides. The trust and relationships developed through the Silver Jackets Team allowed the federal and state partners to quickly come together to formulate a course of action. The city served as the local sponsor of a Planning Assistance to States study with USACE with local cost share provided by North Dakota Water Commission and the Department of Emergency Services. In developing the report, several focus meetings were held to gather information and testimony from local and state officials for recommendations on actions to assist with the flooding problems. The inter agency Devils Lake working group report is a prime example of agencies working together with local governments and organizations to step down flood risks. Numerous options were identified, including structural and non-structural solutions, which were supported by multiple federal authorities. Several homes and a church have been bought out or relocated, and an application to acquire an additional 90 homes submitted. An area of high ground has been purchased for relocation of the school and water tower. The City of Minnewaukan faces many tasks to complete their largely non-structural flood risk mitigation plan. Funding for these projects includes a combination of federal, state, and local loans and grants, resulting in a

patchwork quilt solution, with some funding sources still being identified. The ongoing efforts to relocate a large number of people, their vital institutions, and infrastructure serve as an important example of what can be accomplished when citizens and different levels of government come together to provide a shared vision and solutions to our nation's flood risk problems.

- Hawaii Silver Jackets Initiative: In August 2011, the Hawaii Silver Jackets initiative, the State of Hawaii's Coastal Zone Management Program, and the National Oceanic and Atmospheric Administration sponsored a workshop to facilitate the development of a statewide climate change policy. Sixty participants engaged in a unique futures approach to policy development. The participants represented a wide array of interests including federal, state and county agencies, academia, Native Hawaiians, environmental non-profit organizations, community organizations, business associations, and insurance companies. The workshop resulted in the development of priority guidelines for climate change adaptation being proposed by the Governor of Hawaii as an addition to the Hawaii State Planning Act in the 2012 State Legislative Session.

- Real Time Flood Inundation Model, Indiana: Indiana Silver Jackets team members struggled with differences between USACE and Indiana Department of Natural Resources data; differing boundaries used in the models produced elevation differences of up to two feet. The Silver Jackets team facilitated a resolution, and within a short time, the data were aligned. Without Silver Jackets, neither agency would have pursued a resolution. The state sees this as a valuable service; when all agencies can agree on a single set of data, the state mitigation program benefits. This success in resolving differences led to a discussion of current needs, and the team devised a real-time flood inundation model. The National Weather Service projections and hydrology from the Advanced Hydrologic Prediction Service are combined with real-time gage data from the USGS. Models create a real-time view of the location and depth of flooding. When overlaid with tax assessment data, construction data, and structural value information for residential and commercial structures, an accurate prediction of potential damage can be calculated, employing the USACE depth-damage curve and HAZUS modeling. Each database/model was written with a different digital structure. Through Indiana and Purdue University, a bridge program was written to draw the individual models and programs together under an open architecture format and allow a person to run the program automatically upon demand in real time. The program, when river levels reach a set trigger point, will run automatically and provide both current inundation information and predictive information for response and mitigation actions. The project allows emergency management personnel and the public to view current and predicted extent and depth of flooding through a Web portal. The near real-time and forecast flood inundation mapping, in addition to being viewable through a Web portal, will be downloadable in the form of GIS files that can be imported into GIS applications such as FEMA's HAZUS-MH hazard mitigation and loss estimation program. The state of Indiana is now planning to utilize recently awarded Community Development Block Grant funds to apply the tool statewide. The opportunity for major cost savings from damages avoided is tremendous. The effort provides a better predictive capacity, which will assist in zoning and planning, as well as targeting areas for mitigation such as acquisition or elevation.

- Real Time Flood Inundation Model, Mississippi: Following discussions with the Indiana Silver Jackets team, the Mississippi Silver Jackets team has begun a similar real time flood inundation model development effort. While no technical assistance funding is provided by USACE, the project was initiated due to Silver Jackets team collaboration. The Forrest County (Mississippi) Board of Supervisors entered into a joint funding agreement with the USGS to initiate a cooperative program for flood inundation mapping with the Cities of Hattiesburg and Petal and the Forrest County Emergency Management District. Through assistance of the National Weather Service, this data is provided online and can indicate which community structures are likely to be impacted by floodwaters. The first phase of a multi-year flood inundation mapping project will include the USGS evaluation of existing flood models on the Leaf River and the initial construction and instrumentation of a new flood-monitoring site on the Bouie River at Glendale Avenue. The cost of the project will be shared equally between the USGS and Forrest County, with support from the cities of Hattiesburg and Petal. Hazard mitigation grant

program funds will be applied to assist with a portion of the local share. Upon completion of the project, both the Leaf and Bouie Rivers will provide real-time river stage data via the internet during flood hazard events, and local residents and emergency managers will have valuable information for hazard mitigation.

- Orange County, Indiana and State-Wide LiDAR Mapping: In Orange County, Indiana, the Lost River flows through a Karst environment, often under the surface, and flooding occurs without warning. The Indiana Silver Jackets team has implemented an interagency approach and found a way to create a flood warning system. By linking a number of newly placed USGS stream gages with a USACE Planning Assistance to States Hydrology and Hydraulics study of the underlying Karst features below the communities, the community will receive automatic triggers when the water reaches levels corresponding to previously observed flooding. With the help of a Department of Housing and Urban Development Community Development Block Grant (CDBG), the community will provide $75,000 for their cost-share and will conduct LiDAR flyovers. The CDBG has received special supplemental funding to assist communities that were damaged during the Midwestern flood disasters of 2008. Thus the community will receive the work with minimal investment and the documentation provided will not only benefit this specific project for the community, but also will benefit for future mitigation projects and warning the community of impending floods thus saving thousands of dollars in damages. Through Silver Jackets, the state will be able to acquire LiDAR mapping for all 92 counties, leveraging interagency funds to map 12 counties and $13 million in CDBG funds to map 80 counties.

Pilot projects were initiated in 12 states to further facilitate wise flood risk management in a shared responsibility context, including support for nonstructural alternatives and Levee Safety risk communication and implementation of interim risk reduction measures. These include:

- Idaho Coeur d'Alene River Basin Shared Vision Planning - Shoshone and Kootenai Counties: This project will bring together diverse existing information in a Shared Vision Planning process to help the community understand its flood risk and take actions to reduce that risk. The area has significant investment threatened by flooding and levees no longer recognized as providing 100-year flood protection. It is also subject to extensive Superfund remediation efforts, over $80 million of which has occurred in flood-prone areas, which introduces additional flood risk-related concerns. Opportunities exist to align Superfund remediation and flood risk mitigation efforts, for example so that clean-up activities might maximize flood protection. The Shared Vision Process will bring together local governments, integrate the available information, develop a unified community vision for managing flood risk, and identify strategies the community can pursue in the near and long term.

- Tennessee – Chattanooga Regional Flood Warning and Risk Communication Plan: After middle and western Tennessee experienced record flooding during 2010, the Tennessee Valley Authority (TVA) ran models of the Tennessee River with a storm of similar magnitude centered in eastern Tennessee, upstream of Chattanooga, and the results showed that if the storm had been centered a few hundred miles to the east and south, the flooding in Chattanooga would have exceeded that of Nashville. The Tennessee Silver Jackets team initiative is to provide real time data and information to emergency management personnel in the community with sufficient time to allow them to warn local residents and the media. The project will include three main tasks which include developing models and inundation mapping for priority watersheds, bringing together multiple types of data from various agencies, and developing a multi agency, multi community team to work on flood preparedness in the Chattanooga region.

- Maine: The Silver Jackets program supports an ongoing multi-agency program to complete a hydraulic structural failure analysis for over 4,000 structures. Results will provide community officials the information needed to connect local decisions regarding development and installation of hydraulic structures with the resiliency of these structures when confronted with extreme weather events. It will supplement FEMA's Risk MAP floodplain mapping effort by mapping flood risks in sub-watersheds.

- Kansas: The Silver Jackets program supports a flood warning system and a floodplain management plan for Wildcat Creek stakeholders and the City of Manhattan, Kansas for a creek that flooded severely for the third time in five

years. The flood warning system includes flood forecast inundation mapping that will be tied to a new USGS gage and a new National Weather Service (NWS) forecast point. The NWS will host the library of inundation maps on their web page, which will be available to the public. Also, flood warning lights will be tied to the bridge where the new gage will be installed to alert motorists to turn around when bridge overtopping becomes a life threatening hazard.

- New Jersey: The Silver Jackets program supports an initiative to develop inundation maps for portions of the Passaic River will be created to provide critical information to the Passaic River Flood Advisory Committee to enable quicker flood projections and better flood preparedness.

- South Carolina: The Silver Jackets program supports an initiative to expand the inventory of historical shoreline data, digitize shoreline alterations (bulkheads, docks, revetments, other), estimate erosion rates and determine erosion "hot spots," erosion drivers, and related management implications for future armoring and implementation of "living shorelines" (or alternatives to traditional bulkheads). This will enable the development of improved coastal policies and information products for local governments.

- Indiana: The Indiana Silver Jackets team will build a comprehensive flood risk reduction program for Orange County and use it as a model for other flood prone communities. The model will include elements of mitigation planning, public outreach, and science-based response and recovery actions.

- Pennsylvania: The Silver Jackets program supports an initiative to develop a flood inundation mapping tool to inform the general public, local officials, and emergency managers of flooding risks for the City of Harrisburg and adjacent communities. The stage inundation map library will be developed based on the river gage and will be displayed on various map viewer websites.

- Iowa: The Silver Jackets program supports an initiative to digitally compile all the flood risk reduction ordinances in the Iowa-Cedar watershed to identify gaps and inconsistencies. The information will be reviewed to determine if ordinance changes are needed to better manage flood risks or community rating system opportunities should be pursued to reduce insurance rates.

- Ohio: The Ohio Silver Jackets team, the USGS, and the Muskingum Watershed Conservancy District will partner to develop a flood inundation warning system for the City of Marietta and the surrounding area. A library of flood boundary maps tied to stream gages on the Ohio and Lower Muskingum Rivers will be created to support the system that will be operated by the National Weather Service after completion.

- Kentucky: The Silver Jackets program supports an initiative to develop a flood inundation library utilizing existing dam and levee failure analyses for the Kentucky River in and near Frankfort. Additional risk scenarios will be mapped including a potential levee pumping station failure.

- Georgia: The Silver Jackets program supports an initiative to develop a flood forecast inundation map which will display a near real-time depth and extent of flooding forecast for the Chattahoochee River Basin. The map will be easily and readily accessible to all at the National Weather Service's Advanced Hydrologic Prediction Services website. The general public, planners, scientists, and first responders will benefit by more accurate, detailed, and advanced forecasts. In addition, for those that do not use this website, information can be relayed to the public through weather stations. All will benefit from the time they gain to protect themselves, their families, and their property from floods.

Dam Safety Program: The Risk Management Center (RMC) continued to support the USACE Dam Safety program in FY 2011. HQUSACE published Engineer Regulation ER 1110-2-1156, "*Engineering and Design: Safety of Dams Policy and Procedures*" to transition USACE to a nationally-led and managed dam safety program. The RMC is instrumental towards implementing the guiding principles of that regulation. To support this effort the RMC initiated or completed the following activities:

- The RMC built out a small programs group to manage the funding priorities and funds used by HQUSACE to manage non-routine dam safety activities. This group successfully supported the execution of $54.3 Million in dam safety studies and $16.2 Million in training and methodology

development. In FY 2011, this group managed more than 85 dam safety studies undertaken by various Districts to support dam safety activities.

- The RMC led training efforts for dam safety and risk management throughout FY 2011. In FY 2011, more than 250 USACE staff attended Periodic Assessment training and Best Practices in Dam Safety Risk Analysis training which is jointly taught between USACE, the Bureau of Reclamation, and the Federal Energy Regulatory Commission (FERC). The RMC began developing a variety of training courses to support the new dam safety ER. The RMC also led a new type of training course, which lasted more than 6 months and allowed virtual and interagency participation. "Seminal Papers in Geotechnical Engineering" carries into FY 2012, and includes reviews of the most important papers in geotechnical engineering related to internal erosion. Trainees increase their understanding by participating in weekly writing exercises and discussions related to each paper. This will likely be a model for other courses in the RMC.

- USACE, the Bureau of Reclamation, the Federal Energy Regulatory Commission, the Tennessee Valley Authority (TVA), and the Federal Emergency Management Agency (FEMA) continued discussions to unify the various dam safety policies, procedures, and guidelines. The Interagency Committee on Dam Safety Joint Federal Risk Management Workgroup held three meetings in 2011. The objectives of this effort are expected to include developing common procedures and methodologies, developing consistent policies, and developing similar methods to communicate risks. The Risk Management Center is leading the efforts on the behalf of HQUSACE in this workgroup.

- The Risk Management Center developed, implemented, and continued various efforts to increase the quality and consistency of dam safety products. The RMC worked with various Agency Technical Review (ATR) teams to support their reviews of dam safety products. The RMC also continued efforts to augment internal reviews with national experts in dam safety specifically related to risk analysis. Each dam safety Issue Evaluation Study (IES) and Dam Safety Modification Study (DSMS) presented their report findings to a Quality Control and Consistency (QCC) review panel. Over the course of FY 2011 more than 25 additional reviews were completed. The RMC piloted a new scalable ATR process to accelerate reviews of non-controversial low-risk projects. Several more projects are planned in 2012 to accelerate the various agency reviews. The RMC planned to hire a senior quality manager in 2011 and began robustly implementing the activities required by Engineer Circular (EC), EC 1165-2-209, "*Water Resources Policies and Authorities – Civil Works Review Policy*." More than 100 review plans were endorsed by the RMC and the RMC began supporting ATR and IEPR activities Corps-wide. The RMC also supported and participated in 4 Senior Oversight Group meetings in FY 2011.
- The Risk Management Center reviewed more than 40 Interim Risk Reduction Measure Plans (IRRMP) on the behalf of HQUSACE.

- The Risk Management Center supported Districts transitioning from the previous Periodic Inspection (PI) process for dams to the new Periodic Assessment (PA) process. In FY 2011, the Risk Management Center funded the Potential Failure Modes Assessment portion of PA's for more than 20 Districts and completed five pilot Periodic Assessments.

- In FY 2011, the RMC provided at least two dedicated senior technical specialists to each dam safety construction project, projects that were in Planning, Engineering, and Design (PED), and critical Dam Safety Modification Studies. This was part of HQUSACE's overall effort to provide more consistent and recurring guidance and advice for projects moving through the non-routine dam safety processes. This significant activity was instrumental in ensuring safe activities were accomplished at USACE's high risk structures and that cost effective solutions were planned or implemented. Along with the QCC reviews, this led to more than $500 Million in cost savings versus originally-planned activities.

- The Risk Management Center funded and directed the activities of the Mapping, Modeling, and Consequence (MMC) production center. More than 50 inundation and consequence studies were completed in FY 2011. The Risk Management Center also chaired the steering committee for the MMC, which sets their priority and manages the strategic direction of the MMC.

- The Risk Management Center led, participated in, or supported more than 35 Issue Evaluation Studies for DSAC I and II dams in FY 2011. The Risk Management Center led, participated in, or supported more than 10 Dam Safety Modification Studies for DSAC I and II dams in FY 2011.

Levee Safety Program: During FY 2011, the Risk Management Center continued to support the USACE Levee Safety program in a number of ways. HQUSACE is currently leading the development of a comprehensive levee safety policy document. The RMC has been heavily involved with the development of that policy. The RMC has also supported the following activities:

- The RMC continued to lead the development of the National Levee Database with HQUSACE and the Cold Regions Research and Engineering Laboratory (CRREL). This tool will be released in FY 2012 as the repository for spatial levee data nationwide.

- The RMC worked on a variety of vegetation issues associated with levees. This included managing all Agency Technical Reviews (ATRs) for vegetation variance requests and reviewing a number of R&D efforts related to vegetation's effects on the safety of dams and levees.

- The RMC began to develop the methods the Corps will use to assess risks posed by levees. This work is being done in conjunction with the team developing the new levee safety policy and the Planning Community of Practice. The RMC has identified five levee systems to demonstrate the procedures for Base Condition Risk Assessments. Teams have been assigned and have begun work on one system. The remaining four will be completed in FY 2012.

- The RMC continued to lead the development of the Levee Screening Tool with HQUSACE and the Cold Regions Research and Engineering Laboratory (CRREL). The tool will be used to screen levee systems across the country and help inform a national prioritization of work related to levee safety. The tool is web-based and very user friendly. Users enter basic information about the design and performance. That information is analyzed and the results are compared with the other levee systems across the country.

- The RMC led a training course for 100 USACE employees on the use of the Levee Screening Tool in 2011. This was the first training course as the tool is rolled out to the entire organization. The RMC also led more intensive training for several Districts with large levee portfolios.

- The RMC participated in a workshop at Virginia Tech in August 2011 examining the engineering and analysis strategies to evaluate high-plasticity, high liquid-limit clays. These materials can be found in many locations where the Corps has levee systems, and their properties can be difficult to evaluate properly. The workshop report is due in FY 2012.

- The RMC supported the Northwestern Division during the 2011 floods by providing staff for flood-fighting efforts.

In addition to the work performed by the Risk Management Center in support of the Levee Safety Program, in FY 2011 the Institute published the proceedings of a workshop entitled "*Exploration of Tolerable Risk Guidelines for the USACE Levee Safety Program*", convened in March 2010 in Washington, DC. The workshop provided the USACE Levee Program with the opportunity to engage the wider levee safety and flood risk management community in developing tolerable risk guidelines and methods to improve the management of risks associated with levee systems. The purpose of the workshop was to examine the concepts and principles of tolerability of risk and tolerable risk guidelines, and explore their application to and use in managing the risks associated with levee systems.

International Fellow for Risk Management

The Institute has established an International Fellow for Risk Management Visiting Scholar Program to enhance risk management tools and policies. International Fellows for Risk Management work with the Institute's Risk Management Center (RMC) to conduct research and collaborative activities. International Fellows bring perspectives from partner countries on infrastructure decisions and risk management experiences.

During FY 2011, Mr. Alex Roos, a Senior Advisor at the Dutch Rijkswaterstaat (RWS) was appointed to the Risk Management Center in Denver, Colorado as the Risk Management Center's inaugural International Fellow. While at the RMC, Mr. Roos is supporting the RMC's work in the area of levee safety.

Asset Management: In 2011, the RMC provided guidance, oversight, and technical resources for the initial development of operational condition assessment (OCA) methodology for coastal navigation and flood control projects. OCA development includes processes, tools, and data management systems to provide a means to inventory and assess condition of USACE infrastructure. The OCA tools for flood control dams were beta tested for deployment in FY 2012. The RMC is leading efforts to combine and integrate OCA with periodic inspection activities to reduce duplication of efforts and maximize data collection opportunities. The RMC advanced methodology to estimate reliability of electrical and mechanical systems using OCA data for inland navigation electrical and mechanical equipment and systems. Work was initiated to support reliability centered maintenance which is anticipated to be one pillar of the USACE asset management business activities in the future. The RMC provided technical resources and training materials for asset management workshops.

National Inventory of Dams: The Risk Management Center administers the National Inventory of Dams (NID) program for HQUSACE. The RMC funds the Army Geospatial Center (AGC) to manage the technical aspects of the program as well as maintain the NID web site. The NID includes all high and significant hazard potential classification dams and all low hazard potential classification dams which meet specific height and reservoir storage requirements. More than 80 percent of the dams contained in the NID are regulated by the 50 State Dam Safety Offices (including Puerto Rico). Beginning in FY 1999 with the first publication of the NID on the internet and continuing with biennial updates to the NID database and various improvements to the web site, the AGC has managed the collection and publication of the NID. In FY 2010 and 2011, AGC requested condition assessment information from the states and federal agencies that regulate dams. This new data field was added to the NID as specified in the National Dam Safety Act but many states and federal agencies were not able to provide any information during the last NID data call in FY 2009. The 2009 NID contained condition assessments for only 30% of all high hazard potential dams. A new NID upload web site that accepts multiple database formats and provided a data mapping template between local inventory data and the NID was used to submit this information. The current 2011 NID includes condition assessments for 78 percent of all high hazard potential dams. The NID is utilized by USACE, FEMA, DHS and national oversight organizations such as the National Dam Safety Review Board to help determine national dam safety policies.

National Ocean Service Partnership: In FY 2011, close collaboration continued in support of the partnership agreement with the National Oceanic and Atmospheric Administration's National Ocean Service (NOS) signed on May 19, 2008. IWR has been instrumental in developing and cultivating this partnership that recognizes the significance of leveraging each agency's programs and expertise through joint centers for coastal mapping, instrument testing, evaluation and training; integrating multiple coastal and ocean observing platforms and data networks; coordinating vertical datum systems and improving tidal measurement and information; and improving natural hazard risk communication that incorporates consideration of community resilience. Collaborative efforts have produced mutually beneficial advances and synergies.
In FY 2011 collaborative efforts focused on collaboration in addressing water quality challenges, development of a plan through a technical working group, including the U.S. Geological Survey on adopting NOAA Datum Standards, initially concentrating along the coastline. Other efforts included continued collaboration to understand climate change and variability in the Pacific Ocean to improve understanding of how our coastline is changing, and how best to apply the knowledge to coastal engineering, planning and design of coastal structures (including green and/or gray engineering solutions).

This Partnership continues to expand the working relationship with NOAA's National Weather Service and Office of Atmospheric Research in weather, water and climate services to leverage expertise and capacities in research and modeling that will improve decision-support and operations, which also includes focus on post-storm assessments and hurricane awareness efforts.

Interagency Committee on the Marine Transportation System: USACE participates as an integral member of the Committee on the Marine Transportation System (CMTS), a partnership of Federal departments and agencies with responsibility for the marine transportation system (MTS). The CMTS works to ensure the development and implementation of national MTS policies are consistent with national needs, and reports to the President on its views and recommendations for improving the MTS. As a member, the Corps coordinates with the Maritime Administration (MARAD), National Oceanic and Atmospheric

Administration (NOAA), the Coast Guard and other Federal departments and agencies on the CMTS. IWR provides logistics support and participates on CMTS interagency teams and working groups.

In FY 2011, IWR staff led an interagency team to examine the National Ocean Policy and priority objectives relative to the marine transportation system, and to draft a CMTS response to the National Ocean Council. The CMTS is specifically referenced in the Ocean Policy Task Force Report to coordinate with the National Ocean Council, albeit through the National Economic Council. The team produced a white paper entitled, *"The US Marine Transportation System in the National Ocean Policy: Response of the Committee on the Marine Transportation System."* The response highlights the importance of the marine transportation system (MTS) to our nation's economy as an integral and critical component to the National Ocean Policy and its implementation. It also offers the CMTS as an established forum of collective high level expertise of over 25 Federal agencies, to assist the NOC with implementation of marine transportation-related provisions in National Ocean Policy implementation plans. With concurrence from the National Economic Council, the CMTS Ocean Policy Response was transmitted to the NOC chairs in August 2011. The CMTS was approved as an ex-officio member of the Ocean Resource Management Interagency Policy Committee (IPC) to share CMTS products and activity information with IPC members, and to provide experiential information of an established inter-departmental Federal committee.

IWR staff also led the organization of an interagency panel representing various member agencies from the CMTS to discuss the importance and relevance of the Marine Transportation System (MTS) in the context of the National Ocean Policy at the Coastal Zone 2011 conference in Chicago, Illinois. The implementation of the National Ocean Policy (NOP) was a key theme at the conference, which was attended by over 1,000 participants representing diverse coastal and ocean management, policy, science and technology interests and public and private sectors.

In 2011, a Department of the Army intern on IWR staff was detailed to the CMTS Executive Secretariat on temporary assignment to assist with ocean policy, the Marine Transportation Compendium, and the Environmental Stewardship Discussion Group.

Coastal Engineering Research Board: The Coastal Engineering Research Board (CERB) provides broad policy guidance and review of plans and requirements for the conduct of research and development in support of coastal engineering and the objectives of the Chief of Engineers. In FY 2011 IWR supported the Director of Civil Works in organizing the Executive Session of the Board held October 25-26, 2010 in Atlanta, GA, whose purpose was to review a number of ongoing Board areas of interest including the Integrated Ocean Observing System (IOOS), regional sediment management, and climate change impacts and the July 2011 meeting of the Board in Niagara Falls, NY, which examined and provided recommendations regarding the navigation system assets and regional sediment management.

Environmental Advisory Board: IWR has led the USACE technical team supporting the Chief of Engineers' Environmental Advisory Board (EAB) since FY 2004. In FY 2011, the EAB continued to explore field level outreach, internal implementation of the Corps Environmental Operating Principles (EOP), and ecosystem restoration. The Board held one public meeting in FY 2011 — 29 October 2010 in Coral Gables, Florida — which provided the Board the opportunity to meet with Jacksonville District staff to discuss how the district is considering sea level change, climate change and variability, shore protection, and ecosystem restoration in South Florida.

During the year, the Board continued ongoing observation of the Corps progress associated with Vegetation and Levees; Corps climate change initiatives; and cumulative effects analysis. The Board also visited the Lower Mississippi River between the Bonnet Carre Spillway and the Old River Control Complex to examine how operational plans for the Corps flood management structures could maximize ecosystem benefits while maintaining or possibly improving current levels of flood risk management.

Inland Waterways Users Board: The Inland Waterways Users Board (IWUB) was established by Section 302 of the Water Resources Development Act of 1986 (P.L. 99-662) and pursuant to the Board's charter, approved by the Secretary of the Army on March 3, 1987. The principal responsibility of the Board is to recommend to the Congress, the Secretary of the Army, and the U.S. Army Corps of Engineers the prioritization of new and replacement navigation construction and major rehabilitation projects. The Board is a Federal advisory committee and as such

subject to the requirements of the Federal Advisory Committee Act (P.L. 92-463, as amended).

During FY 2011, IWR continued its technical and administrative support of the Board, including the analysis of and reporting on the financial status and capability of the Inland Waterway Trust Fund, evaluating potential candidates nominated for Board membership, and administration of two IWUB meetings including No. 64 on October 20, 2010 in Bettendorf, Iowa and No. 65 on April 1, 2011 in New Orleans, Louisiana.

Mass Management System (MMS): IWR staff continued facilitation and support to improve emergency management response to cyclones affecting island communities. Studies of methods to protect U.S. populations from the effects of land falling tropical cyclones have largely been confined primarily to the mainland, continental United States. These studies have emphasized evacuation of large populations from coastal areas as a primary mitigation measure against the effects of coastal storm surge and maximum cyclonic winds. The methods used to protect mainland populations from cyclone effects may not be appropriate or effective in island environments. Deepwater island effects can include terrain enhanced winds, elevated coastal water levels caused by wave-induced ponding on reefs, and mudslides caused by heavy rains. In contrast to mainland tropical cyclone hazard scenarios which have been extensively studied, island hazard scenarios have received little attention.

In 2011 a suite of products was fielded to assist local and state emergency management in the city and county of Honolulu and Hawaii State Civil Defense. ERDC programs PILOT (Pacific Island Land Ocean Typhoon Experiment), and SWIMS (Surge and Wave Island Modeling Studies) were integrated through a web-based, GIS computer dashboard (known as MMS). IWR staff led the multi-year, interagency effort to develop these tools, in partnership with ERDC-CHL, POH, SAJ, National Weather Service, FEMA Region IX, and private consultants (Adkins Engineering) to execute studies and develop products utilizing input from PILOT and SWIMS to provide a sophisticated system with easy-to-use tools and functions for the emergency management community to use in planning for and executing operational plans to protect lives and property during hurricane and tsunami events.

Conflict Resolution and Public Participation Center: The Institute has a long history of both applying collaborative modeling tools through the Shared Vision Planning (SVP) process, and in developing tools and providing technical assistance in conflict resolution and public participation. During FY 2011, IWR continued to focus on developing new conceptual and methodological foundations, building awareness of collaborative planning tools, and assisting Corps Division and district offices and states in improving public participation in water resources planning and decision making.

The Institute is the home of the Corps' Conflict Resolution and Public Participation Center. Designated as a Center of Expertise and Directory of Expertise in October 2008, the mission of the Center is to help Corps staff anticipate, prevent, and manage water conflicts, ensuring that the interests of the public are addressed in Corps decision making.

Among the notable achievements of the Center during FY 2011, the Center provided technical assistance to Division and district offices on collaborative processes, led a symposium on *Collaborative Modeling for Decision Support* at the American Water Resources Association summer conference on Integrated Water Resources Management in June 2011; published a book entitled "*Converging Waters: Integrating Collaborative Modeling with Participatory Processes to Make Water Resources Decisions*" as part of the Maass White Series of books on water resources management; published a report on collaboration as practiced in Corps field offices entitled "*The State of Collaboration in the Corps: A Field Perspective*" (IWR Report number 2011-CPC-R-04, dated May 2011); and in association with the Environment and Water Resources Institute of the American Society of Civil Engineers published a report on the principles and best practices associated with collaborative modeling for decision support entitled "*Collaborative Modeling for Decision Support in Water Resources: Principles and Best Practices*" (IWR Report number 2011-R-03, dated February 2011).

Towards the end of FY 2011, the Conflict Resolution and Public Participation Center of Expertise was asked to support the Northwestern Division's Missouri River flood recovery efforts following the Spring and Summer floods which occurred in the Missouri River basin. Faced with unprecedented damage in the Missouri River Basin due to historic flooding during the Spring and Summer of 2011, communities and all levels of governments struggled to restore infrastructure, towns, and farms. In light of limited funding and many impacted entities, the

Corps spearheaded a flood recovery task force to leverage authorities and funds, and coordinate and communicate flood recovery efforts.

The Northwestern Division asked the CPC to help launch the Missouri River Flood Task Force and create a forum for coordination, collaboration and cooperation among the federal officials and officers of state, local and Tribal governments within the States of Nebraska, Montana, Iowa, South Dakota, North Dakota, Wyoming, Kansas and Missouri. CPC staff member Maria Placht relocated to Omaha to undertake this assignment. Initial efforts entailed engaging with the wide range of Corps and external stakeholders to structure an organization that would set conditions for success for all involved by leveraging funds, streamlining governmental processes; accelerating necessary assessments, coordination, and permitting requirements; and by applying critical thinking to the myriad flood recovery challenges.

CPC staff will continue to remain engaged in Missouri River flood recovery efforts in FY 2012.

Other significant achievements accomplished by the Center during FY 2011 include the following:

Capacity Building within the Corps

- The Center established a Collaboration and Public Participation Community of Practice (CPP CoP) with Mr. Steven Stockton, Director of Civil Works, as Champion; the CoP offered webinars covering topics including public engagement, risk communication and conflict management, including: "Risk Map for Silver Jackets and FEMA"; "The Use of Technology in Public Participation for the Mississippi Coastal Improvement Plan"; and "Working with Native American Tribes."

- The Center developed a Facilitator Network and Training Program. CPC is building a USACE facilitators network to better serve Division and district offices with facilitation needs. The Center is also working with other agencies to develop a database of federal facilitators. Facilitation training is also being finalized for USACE Division and district offices.

- The staff of the Center led courses on "Public Involvement and Teaming in Planning" for the Southwestern Division, the Jacksonville District, as well as a general PROSPECT course open to all Corps staff. As new course owner for the "Public Involvement and Teaming in Planning" course, the staff of the Center updated the course, trained new instructors and conducted sessions. The Center is also the proponent for a new "Risk Communication/Public Participation" PROSPECT course.

- Other opportunities for teaching public involvement, risk communication and shared vision planning included leading seminars on risk communication at the USACE Project Management conference and at the Floodplain Management Association conference; providing on line training classes on Shared Vision Planning; making a presentation on Collaborative Leadership before the USACE Asset Management team; and suggesting revisions to the Project and Program Managers career development guidelines.

Consultation Services across the Corps

- The staff of the Center provided interagency facilitation support regarding Section 404 Regulatory issues related to Colorado water supply.

- The staff of the Center designed a Shared Vision Planning and Public Involvement process in support of the Rock Island District's Iowa and Cedar Rivers Basin Comprehensive Watershed Planning Process.

- The staff of the Center supported California water planning efforts for the state of California and Corps district offices through assistance to the California Levees Roundtable as part of the efforts of the Central Valley Flood Protection Board, the California State Water Plan Update 2013, and Shared Vision Planning for the Bay Delta.

Information Exchange

- The Center created a Lessons Learned database of case studies on USACE collaboration efforts.

- The staff of the Center provided Shared Vision Planning training to Silver Jackets team members, and at the Flood Management Association conference.

- The staff of the Center prepared a flowchart for USACE field personnel on when the Federal Advisory Committee Act applies.

Policy Support

- The staff of the Center assembled the 5th Annual Report on the Use of Environmental Conflict Resolution for the Office of the Assistant Secretary of the Army (Civil Works) for submission to the Council on Environmental Quality.

- The staff of the Center finalized and conducted external stakeholder review for the *"Framework and Implementation Plan for Improving Public Involvement in Flood Risk Management"* report.

- Provided national leadership in interagency Environmental Conflict Resolution and Technology and Collaborative Modeling working groups.

- Provided USACE support for Environmental Justice guidance including drafting of a case study on environmental justice in practice in New Orleans during post-Katrina recovery.

- Provided Shared Vision Planning support to UNESCO's International Center for Integrated Water Resource Management (ICIWaRM) projects and proposals for the Government of Peru and the Mekong River Initiative.

Research

- The staff of the Center developed methods to address public participation, collaboration and communication challenges for a USACE document on Risk-based Decision Making for Climate Change.

- Drafted articles on Indigenous Knowledge in Water Resources, USACE Collaborative Capacity Assessment, and the Intersection of Collaborative Modeling and integrated water resources management.

- Drafted "Use of Collaborative Modeling for IWRM" for UNESCO's Integrated Water Resources Management Guidelines series.

The Nature Conservancy Sustainable Rivers Project: Begun in July 2002, the Sustainable Rivers Project is a nationwide partnership between the USACE and The Nature Conservancy (TNC) to restore the health and life of rivers across the United States. This nationwide effort to modify operations of Corps dams to improve ecosystems, while maintaining or enhancing project benefits, currently involves work on eight rivers systems: the Willamette in Oregon, the Bill Williams in Arizona, the Green in Kentucky, the Savannah in Georgia and South Carolina, the Roanoke in North Carolina and Virginia, the White, Black, and Little Red in Arkansas and Missouri, the Connecticut in New Hampshire, Vermont, Massachusetts and Connecticut, and Big Cypress Creek in Texas and Louisiana.

The Sustainable Rivers project is working towards its goals through a combination of partnered activities, including demonstration projects, training, software development, and staff exchanges via the Intergovernmental Personnel Act. Successes already achieved are attracting interest from other river management interests both within the United States and internationally, where methods used in Sustainable Rivers are now being applied in Asia, Africa, and South America.

In 2008, the USACE received The Nature Conservancy's Outstanding Partner Award in recognition of the broad and successful partnership between the two organizations.

The fifth USACE-TNC Partnership Conference was held in the Fall of 2011 and celebrated more than a decade of collaboration between the two organizations. The conference highlighted a renewal of the national memorandum of understanding between the two organizations, which was originally signed in December 2000.

A senior engineer from the Institute's Hydrologic Engineering Center serves as the Corps' Technical Liaison with TNC for Sustainable Rivers. In that capacity, he continues to foster the program by working with representatives from the Corps and TNC on technical and modeling issues.

Academic and Professional Practice Partnerships

Academic Institutions

In FY 2011 the Institute continued to utilize the technical expertise and resources made available through its long established network of partnerships with academic institutions and professional practice organizations.

Since 2007, the Institute has entered into a number of Memoranda of Understanding with various educational institutions, each of which has unique program features that compliment the strengths and talent of the Institute.

Each academic institution is described briefing as follows:

Colorado State University, Civil and Environmental Engineering Department/International School for Water Resources (MoU signed January 7, 2008). This partnership with Colorado State University will facilitate cooperation in research in a number of areas including integrated water resources management, scientific research in the adaptation to global climate change and its impacts on water resources, and methods for understanding and managing extreme hydrological events and related natural hazards and disaster preparedness.

The University of Arizona (MoU signed September 7, 2007) is home to the National Science Foundation's Science and Technology Center for Sustainability of Semi-Arid Hydrology and Riparian Areas (SAHARA), thus allowing the Institute and the University to focus on sustainable development and sound water management policies, particularly in arid and semi-arid climates.

The University of New Hampshire (MoU signed September 14, 2007) Institute for the Study of Earth, Oceans, and Space, Water Systems Analysis Group, focuses on the understanding of water resources issues on a global scale and the application of technological improvements in water resources management, allowing for cooperation in the field of global water science, integrated water resources management, and interdisciplinary scientific research and capacity building, particularly in developing and emerging countries and post-disaster nations and regions.

The Oregon State University (MoU signed September 20, 2007) Institute for Water and Watersheds, focuses on integrated water resource management, sustainable development, ecological design, ecosystem restoration, and environmental conflict resolution, allowing for cooperation in numerous areas including infrastructure development, adaptive management and adaptation to global climate change, flood risk management, hydrologic analysis, risk analysis and systems modeling, environmental restoration, ecological design, consensus building, conflict resolution, alternative dispute resolution, and shared vision planning.

Florida International University (FIU) (MoU signed January 12, 2010) is the lead institution of the Global Water for Sustainability (GLOWS) program, a consortium of U.S. and international organizations with extensive experience and expertise in integrated water resources management, financed by the United States Agency for International Development (USAID). FIU is also the home of the NASA sponsored WaterSCAPES University Research Center. WaterSCAPES (Science of Coupled Aquatic Processes in Ecosystems from Space) focuses on an integrated set of research and education activities centered on the interaction between the hydrologic cycle and vegetation dynamics at the scale of ecosystems, analyzing the spatial and temporal changes on this interaction and determining the influence of these changes on water cycling, vegetation structure, biomass dynamics and biodiversity. Collaboration between the Institute and FIU will focus on pursuing opportunities in the field of integrated water resources management, scientific research and capacity building for developing countries and countries in transition.

The National Institutes for Water Resources (NIWR) (MoU signed October 17, 2009) is a 501(c)4 organization that represents the 54 state and territorial Water Resources Research Institutes and Centers in their collective activities to (1) advance competent research that addresses water problems or expands the understanding of water and water-related phenomena; (2) aids the entry of new research scientists into the water resources field; (3) helps train future water scientists and engineers; (4) infuses the results of sponsored research to water managers and the public; and (5) focuses on applied research, including practical applications to improve water supply reliability and helps resolve water issues, working under the general guidance of the Secretary of the Interior, through the U.S. Geological Survey (USGS). The NIWR networks these various Institutes into a coordinated unit, and facilitates, as appropriate, the response of the Water Resources Research Institutes and its membership to other mutual concerns and interests in water. The Institute and the NIWR will use their best efforts to establish long-term cooperation and partnership in the development and practice of integrated water resources management through scientific research and joint activities or programs that support National, regional, and local water resources needs.

The Institute is also an affiliate member of the Universities Council on Water Resources (UCOWR), an organization comprised of over 90 member universities and organizations. UCOWR's main objectives are to facilitate water related education at all levels; promote meaningful research and technology transfer on contemporary and emerging water resources issues; compile and disseminate

information on water problems and solutions; and inform the public about water issues with the objective of promoting informed decisions at all levels of society. To achieve these objectives, member institutions engage in education, research, public service, international activities, and information support for policy development related to water resources. UCOWR holds an annual conference that provides a forum to explore key and timely topics of interest to water resources researchers and educators. UCOWR also publishes the "Journal of Contemporary Water Research and Education", presenting both scholarly work and current water resources news.

At the 2011 joint UCOWR-NIWR Annual Conference held in July 2011 in Boulder, Colorado, the Institute for Water Resources was formally recognized as a "Friend of UCOWR", a designation awarded to an organization or individual that has a demonstrated record of substantive contributions to the field of water resources. Receiving the award on behalf of the Institute was its Director, Mr. Robert A. Pietrowsky.

Professional Practice Organizations

In FY 2011 the Institute continued to explore cooperative opportunities with its various Professional Practice Organizations with whom it has entered into Memoranda of Understanding, including the Environmental and Water Resources Institute (EWRI) of the American Society of Civil Engineers (ASCE) (MoU signed August 4, 2007), the American Water Resources Association (AWRA) (MoU signed December 20, 2007), and the Global Water Partnership (GWP) (MoU signed October 9, 2007).

The Institute and these organizations have a common interest in integrated water resources management, environmentally sustainable development, engineering and scientific excellence, water resources education, technology transfer and capacity building. Partnering with these organizations will further the Institute's and their efforts towards developing procedures and methods for integrated water resources management in support of sustainable development, adaptation to global climate change and its impact on water resources; collaborative modeling and decision support in water resources planning, energy and water sustainability, ecosystem markets development, development of new concepts and practices in the area of critical infrastructure sustainability and recapitalization, and establishing a long term basis for cooperative efforts in areas including flood risk management, hydrologic analysis, risk analysis and systems modeling, environmental restoration, ecological design, eco-hydrologic analysis and water quality, and capacity building, training, and technology transfer.

IWR Visiting Scholar Programs: In order to benefit from the infusion of new ideas and concepts in its work, the Corps has established and the Institute supports a number of visiting scholar programs by which the Institute is able to support of work of academicians who conduct research in areas which support the work of the Institute. These visiting scholar programs seek to bring the foremost water resources experts from academia, private industry and other agencies and laboratories to residence at the Institute or at the Hydrologic Engineering Center for periods of six months to one year. Visiting scholars are expected to bring new energy, perspectives and ideas to the Institute's research agenda, while the practical work environment at the Institute and at HEC provides a stimulating context for mutual exploration of potential advances in water resources planning and hydrologic engineering and analysis.

Maass-White Visiting Scholar Program

FY 2011 marked the ninth year of the Institute's Maass - White Visiting Scholar program. Established in 2001, the Maass-White Visiting Scholar program recognizes the contributions of, and the Institute's intellectual alignment with, Professor Arthur Maass of Harvard University and Professional Gilbert White of the University of Colorado, two of the founders of modern water resources planning's theoretical underpinnings.

In September 2011, Dr. Denise Reed, Professor of Coastal Geomorphology within the Department of Earth and Environmental Sciences at the University of New Orleans and who also serves as the Interim Director of the Pontchartrain Institute for Environmental Sciences at the University of New Orleans, was named as the Maass-White Visiting Scholar for 2011-2012, and support the Institute during the period from September 2011 through August 2012.

Frederick J. Clarke Visiting Scholar Program

FY 2011 marked the third year of the Frederick J. Clarke Visiting Scholar program, named in honor of Lieutenant General Frederick J. Clarke, Chief of Engineers from 1969-1973. Lieutenant General Clarke was instrumental in securing expert, independent advice on environmental issues facing the Corps by founding the Environmental Advisory Board. The Frederick J. Clarke Visiting Scholar program

provides scholars the opportunity to advise the Corps on important policy issues related to the Corps environmental mission.

The 2011-2012 Frederick J. Clarke Visiting Scholar is Dr. Todd BenDor, Assistant Professor of Environmental and Land Use Planning within the Department of City and Regional Planning at the University of North Carolina, Chapel Hill. Dr. BenDor's research utilizes computer and spatial modeling, including system dynamics modeling and spatial analysis, to better understand the impacts that human activities and development can have on sensitive ecological and environmental systems. While at IWR, Dr. BenDor will focus his research on the effects of Corps of Engineers land purchases for environmental restoration purposes, including a review of the Mississippi Coastal Improvement Program and post-Hurricane Katrina recovery plans.

The 2010-2011 Frederick J. Clarke Visiting Scholar was Dr. G. Mathias (Matt) Kondolf, Professor of Landscape Architecture and Geography at the University of California, Berkeley. While at IWR, Dr. Kondolf focused his research on the technical and policy advancements of regional sediment management and its application to restoration of riverine environments.

HEC "Leo R. Beard" Visiting Scholar Program

The Hydrologic Engineering Center has a formally established activity, referred to as the "Leo R. Beard Visiting Scholar Program". Mr. Beard was the founding Director of Hydrologic Engineering Center and he had strong ties to scholars in the profession. As part of the Visiting Scholar program, hydrologic and hydraulic professionals are invited to HEC to address critical issues or problems HEC and others within the Corps have encountered. Faculty from a number of universities, engineers from other agencies and members of the private sector have participated in the program. The experience and the exchange of ideas between HEC and the Visiting Scholars have proven to be intellectually satisfying and productive for both HEC and the visitors themselves.

In FY 2011, Dr. David Curtis from West Consultants was HEC's Visiting Scholar. In that role, he assisted HEC in the developing new techniques to estimate precipitation for developing countries that may not have actual precipitation records.

HEC asked for Dr. Curtis' assistance because HEC has become increasingly involved in international modeling activities. Many times the work involves training in hydrologic and hydraulic engineering principles and rainfall-runoff model building. Unfortunately, most of the time there is a lack of rainfall data necessary to build hydrologic models of historic events which are used to calibrate a model. Dr Curtis is a national expert in rainfall data. The purpose of his effort was to provide information on available domestic and international satellite and radar estimates of rainfall, the viability of using these data for rainfall-runoff modeling, comparing and contrasting satellite to radar precipitation, and the process to acquire the data and format it for use by HEC-HMS. The result of Dr. Curtis' work was a detailed report of available satellite rainfall data around the world including comparison at one location of rainfall data sources. A Visiting Scholar has not been identified for FY 2012.

Other Visiting Scholars Programs

FY 2011 was the eighth year of the Universities Council on Water Resources fellowship, a program established in partnership with the Universities Council on Water Resources (UCOWR).

FY 2011 marked the fourth year of the Institute's utilization of two new post-doctoral Fellows programs: the National Research Council (NRC) Research Associateship and the American Association for the Advancement of Science (AAAS) Science and Technology Policy Fellows program. IWR and HEC underwent a rigorous certification process by independent reviewers in order to qualify for these visiting scholars and post-doctoral fellows programs.

Dr. Aleix Serrat-Capdevila, Research Assistant Professor at the Department of Hydrology and Water Resources, University of Arizona, joined the Institute as a NRC Research Associate for the period 2010-2011. Dr. Serrat-Capdevila's research and work will support the International Center for Integrated Water Resource Management (ICIWaRM) and the Center of Expertise on Conflict Resolution and Public Participation.

Dr. Charles J. Vörösmarty served as the 2010 – 2011 Faculty Fellow of the National Research Council Associateship Program at IWR. Dr. Vörösmarty is a professor of Civil Engineering and Director of The City University of New York's Environmental Crossroads Initiative at The City College of New York. He is also a Distinguished Scientist with the NOAA-Cooperative Remote Sensing Science and Technology Center. Dr. Vörösmarty's research will focus on the development of computer models and geospatial data sets used in studies of the interaction

between the water cycle, biogeochemistry, and anthropogenic activities.

Previous IWR visiting scholars have included:

- Maass-White Visiting Scholars: Dr. Daniel (Pete) Loucks, Cornell University (2002-2003); Dr. Peter Rogers, Harvard University (2003-2004); Dr. Leonard Shabman, Resources for the Future, (2004-2006); Dr. Gerald Galloway, University of Maryland (2006-2007); Dr. Yacov Haimes, University of Virginia (2007-2008); Dr. Kenneth Strzepek, University of Colorado (2009-2010).

- Frederick J. Clarke Visiting Scholar: Dr. Martin Doyle, University of North Carolina (2009-2010); Dr. G. Mathias Kondolf, University of California (Berkeley), (2010-2011).

- Leo R. Beard Visiting Scholar: Mr. William A. Thomas, founder and president of Mobile Boundary Hydraulics (2004-2005); Dr. Jery Stedinger, Cornell University (2005-2006); Dr. David W. Watkins, Jr., Michigan Technological University (2008); Dr. Eric Larson, University of California at Davis (2009-2010).

- UCOWR Fellow: Dr. Bruce Hooper, Southern Illinois University (2004-2005); Dr. Paul Kirshen, Tufts University (2007–2009).

- IWR NRC Research Associate: Dr. Peter Rogers, Colorado State University (2006-2007); Dr. Jason Giovannettone, Duke University (2006-2007, at HEC); Dr. Stacy Langsdale, University of British Columbia (2007-2009); Dr. Michael Deegan, University of Albany (2008-2009); Dr. Guillermo Mendoza, Cornell University (2009-2010); Dr. Aleix Serrat-Capdevila, University of Arizona (2010-2011).

- AAAS Fellow: Dr. Alexey Voinov, University of Vermont, (2006-2007).

In September 2010, Dr. Peter Rogers, former Maass-White Visiting Scholar at the Institute and current Gordon McKay Professor of Environmental Engineering and Professor of City and Regional Planning at Harvard University co-authored with Ms. Susan Leal a book entitled "*Running Out Of Water: The Looming Crisis and Solutions to Conserve Out Most Precious Resource.*" The book describes the scope of water supply issues facing the water as well as strategies for averting a water shortage crisis.

WATER RESOURCES METHODS AND MODELS

Two major IWR focus areas are (1) the evaluation of engineering, economic, social, institutional and environmental needs and, to address those needs, (2) the development, transfer and application of improved water resources analytical techniques, models and information systems. The goal is to produce state-of-the-art multi-purpose planning and hydrologic engineering methods and models to support investment decisions. This is accomplished by means of programs in research, planning analysis, training and technical assistance.

Planning Models Improvement Program: The Corps of Engineers Planning Models Improvement Program (PMIP) was established in 2003 to assess the state of planning models in the Corps and to make recommendations to assure that high quality methods and tools are available to enable informed decisions on investments in the Nation's water resources infrastructure and natural environment. The main objective of the PMIP is to carry out "a process to review, improve and validate analytical tools and models for USACE Civil Works business programs. In compliance with Engineer Circular (EC) 1105-2-412, "Assuring Quality of Planning Models" and its predecessor Engineer Circular (EC 1105-2-407, "Planning Models Improvement Program: Model Certification), IWR has established a model certification program and is actively pursuing the certification of existing and new models.

During FY 2011, the HarborSym Widening model, a simulation model for the evaluation of widening of navigation channels was certified as a National model by the Deep Draft Navigation Planning Center of Expertise (DDNPCX) and Headquarters. External peer review was completed for the HarborSym Deepening model and a certification package was submitted to the DDNPCX. Other components of the HarborSym Suite of Tools are undergoing peer review.

IWR continues to actively participate in nationwide model certification efforts, providing input on policy and processes and as a member of the HQUSACE Model Certification Panel.

Guidance Update and Maintenance Program (GUMP): During FY 2011 the Hydrologic Engineering Center worked on modifications to various engineering guidance documents via the Guidance Update Management Program (GUMP). Among others these documents included Engineer

Manual (EM) 1110-2-1413, "*Engineering and Design – Hydrologic Analysis of Interior Areas*"; EM 1110-2-1619, "*Risk-based Analysis for Flood Damage Reduction Studies*"; EM 1110-2-4000, "*Engineering and Design - Sedimentation Investigations of Rivers and Reservoirs*"; Engineer Regulation (ER) 1110-2-1400, "*Reservoir/Water Control Centers*"; ER 1110-2-240, "*Engineering and Design - Water Control Management*"; ER 1110-2-241, "*Engineering and Design - Use of Storage Allocated for Flood Control and Navigation at Non-Corps Projects*"; Engineer Technical Letter (ETL) 1110-2- 299, "*Overtopping of Flood Control Levees and Floodwalls*"; and, ETL 1110-2-537, "*Uncertainty Estimates for Graphical (Non-Analytic) Frequency Curves*", to include materials generated from research actions.

Also, four Economic Guidance Memoranda (EGM) were published in FY 2011: EGM 11-01, Federal Interest Rates for Corps of Engineers Projects; EGM 11-02, Current Normalized Rates; EGM 11-03, Unit Day Values for Recreation; and EGM 11-05, Deep Draft Vessel Operating Costs. Also, substantial progress was also made in updating Engineer Regulation 1105-2-100, the Planning Guidance Notebook, a draft of which is under review at Headquarters.

Savannah Harbor Expansion Project Study: During Fiscal Year 2011, IWR staff continued to work closely with the Savannah and Mobile districts and the Deep Draft Navigation Planning Center of Expertise on the economic analysis for a General Evaluation Report for expansion of Savannah Harbor. IWR developed a new economic evaluation model for containerships to be used in the evaluation of deepening Savannah Harbor from 42 feet up to a depth of 48 feet. The development and implementation of the new model also involved documentation and training of Mobile district staff in its use, as well as numerous presentations to agency technical review, external independent peer review, and headquarters policy review staffs.

Navigation Systems Research Program: For more than a century, the USACE has played a key role in maintaining a robust national economy by ensuring that farmers, manufacturers and businesses can easily transport goods up and down our Nation's rivers and out to sea via coastal ports. The Navigation Systems Research Program supports the navigation mission of the Corps by developing state-of-the-art, credible, independently verified economic models, tools and techniques used by Corps planners in informing investment decision making at all levels of the agency. The knowledge and tools developed by the research program are based on reviews of economic transportation and market theory, current best practices both within and outside of the Corps, data needs and availability, and peer recommendations.

In FY 2011, the main products of the Navigation System Research Program were the completion of the HarborSym Modeling Suite, including the external peer review of the models and the preparation of the certification package. HarborSym is a discrete event Monte Carlo simulation model designed to be a general-purpose tool for use by Corps planners. HarborSym is part of a suite of similar IWR developed models, all with a similar architecture and approach of "data-driven" modeling, in which the factors that tailor a general-purpose model to a specific situation and study are stored in a database and populated by the user. The model measures the economic effects of modifications to deep draft harbors as overall reductions in transit times and associated changes in total vessel operating costs. HarborSym was initially developed as a tool for analyzing channel widening projects, herein referred to as HarborSymWidening, which were oriented toward determining time savings of vessels transiting a harbor but did not, in general, involve assessing changes in vessel loading or shipping patterns. The latest HarborSym release, herein referred to as HarborSym Deepening, is designed to assist analysts in evaluating channel deepening projects in addition to the original model capabilities. The additional deepening features incorporate calculations for both within harbor and ocean voyage costs through a route group concept.

HarborSym Deepening is oriented toward general cargo, bulk, container, and other commodity and vessel movements with simplified loading and transit behaviors. The simulation results can be used in a comparative analysis of alternative harbor improvements and to support a benefit-cost analysis of proposed navigation improvements.

All components of HarborSym Widening were certified in June 2011 by the Deep Draft Navigation Planning Center of Expertise (DDNPCX) and Headquarters (HQ). A certification package focused on the deepening features of the HarborSym model will be submitted to the DDNPCX in December 2011.

Other analytical tools developed under the Navigation System Research Program to assist Corps planners in conducting navigation improvement studies include IWR Tide Tool, W-DAPP (Waterborne Data Analyzer and Pre-Processor), AIS-

DAPP (Automated Information System – Data Analyzer and Pre-Processor), and Container Loading Tools.

Environmental Sustainability: The Environmental Sustainability Project, managed by Dr. Richard Cole, includes activities that pertain to the implementation of the Environmental Operating Principles. Activities in FY 2011 concentrated on refinement of the Biodiversity Security Index (BSI) and reviewed drafts of ERDC publications. This included progress on directions for implementing the BSI with particular attention to calibrating the risk term of the metric and to demonstrating BSI use in incremental cost analysis. A final draft of a technical report on nonmonetary measurement of environmental benefits was submitted for publication by ERDC early in the year. An ERDC technical note on the BSI had been peer reviewed and submitted for final publication editing. A third ERDC technical report comparing the new metric with other metrics and a journal article continue to be in peer review. A presentation of those results were also made at the National Ecosystem Restoration Conference in Baltimore A draft ERDC technical report was submitted for peer review. Two USACE reports on sustainability concepts and principles (to be published in a series on Campaign Plan accomplishments) have been completed and have been in final review. An IWR report presenting a framework for achieving environmental sustainability had undergone all peer review and was undergoing final editing before publication at the end of the year.

IWR Planning Suite: This Planning Suite is a water resources investment decision support tool that performs computations associated with cost-effectiveness and incremental cost analyses used during the formulation and evaluation of planning alternatives that involve monetary and non-monetary costs and benefits. Originally designed to assist with the development and comparison of alternative plans for ecosystem restoration and watershed planning studies, the program is a standard piece of software applied during integrated water resources planning activities to assist with identification of cost-efficient plans and sound financial investments. In addition to automating computations, the software facilitates synthesis of standard charts and tables required for study-related reports. During FY 2011, Version 2.0.6.0 remained the certified version of the IWR Planning Suite.

In FY 2011, an EC 1105-2-412 review of the Planning Suite's Multi Criteria Decision Analysis module was initiated. The Multi-Criteria Decision Analysis module is intended to increase the transparency of any exploratory analyses pursued by study teams authorized to pursue formulation of multi-purpose alternatives. Review of the module is scheduled to be completed by March 2012.

A contract to advance the alpha/beta test version of the Uncertainty and Risk module was initiated. The Uncertainty and Risk module is intended to provide users with opportunities to assign probability distributions to monetary and non-monetary costs and benefits, or individual variables comprising either, and implement Monte Carlo analysis to yield risk-informed cost-effectiveness and incremental cost analyses. The module is expected to allow for users to characterize variability or uncertainty in potential project costs and effects and to identify which alternatives are most likely to be cost effective over the widest range of anticipated conditions and/or identified variability or uncertainties in costs and benefits. Delivery of a reviewable beta is expected by June 2012.

During FY 2011, the Planning Suite was demonstrated and used in class exercises associated with the Ecosystem Restoration and Economic Analysis PROSPECT courses and the Planning Associates module on ecosystem restoration. Additionally, the IWR Planning Suite development team provided technical assistance to field planners during application of the Planning Suite to three ongoing watershed-scale investigations; assisted with delivery of regional training on the Planning Suite; and provided ad-hoc technical support to field planners during application of the Planning Suite.

Water Infrastructure Systems Data Manager (WISDM): The Water Infrastructure System Data Manager (WISDM), previously referred to as the Watershed Investment Decision Tool (WIDT) is a web-based utility being developed by the Corps to facilitate geospatial analyses and decision support nationwide and across all the Corps Civil Works business lines (ecosystem restoration, flood risk management and coastal storm damage reduction, hydropower, navigation, regulatory, recreation management, and emergency management). The WISDM links users with information residing in databases within and outside the Corps, and provides users with techniques for visually illustrating and summarizing multiple types of data important to Corps decision-makers at multiple reporting scales (Nationwide, Division wide, District level, watershed basin).

The Corps is partnering with the U.S. Forest Service and the University of Redlands (California) to integrate the strengths of Ecosystem Management Decision Support (EMDS) software to enable landscape scale evaluations of potential actions based on management priorities. IWR is also working to improve the WISDM by incorporating a Web based program that supports multi-factor analysis of large geospatial data sets at very fast processing speeds to improve performance.

The WISDM will facilitate and expedite efforts to deliver knowledge based decision support, ecological analyses, and assessments of asset/resource-stressor relationships at any geographic scale, under alternative future conditions and under alternative climate change scenarios.

The primary goal of this effort is to provide decision makers with the means to quickly and transparently evaluate, communicate, balance, and prioritize information relevant to the Corps capacity to satisfy the needs. It is important to note that this application provides additional information to decision makers, but does not provide an all-inclusive one size fits all answer to the most complex questions faced by government officials today.

In March 2011, two members of the Institute staff, Dr. Paul Wagner and Mr. Joel Schlagel were invited to attend the annual meeting of the Multi-Resolution Land Characteristics Consortium (MRLC). The MRLC is a consortium of federal agencies which coordinate and generate consistent and relevant land cover information on a national scale for a wide variety of environmental, land management, and modeling applications. Dr. Wagner and Mr. Schlagel gave a presentation on USACE geospatial data. After the meeting, the USACE was asked to join the MRLC. The USACE has subsequently joined the MRLC.

Regulatory Support: IWR supports the Regulatory Sub-CoP through policy analysis and training. In FY 2011, IWR continued its support for the USACE Headquarters implementation of the 2008 Mitigation Rule ("Compensatory Mitigation for Losses of Aquatic Resources: Final Rule, *Federal Register*, April 10, 2008, p. 19594). IWR published a white paper on financial assurance for mitigation project success entitled "Implementing Financial Assurance for Mitigation Project Success" in June 2011. IWR staff continued to conduct the Corps Regulatory Mitigation Workshops focusing on rule implementation. IWR also developed a draft guidebook on implementing the watershed approach for compensatory mitigation.

In April 2011, Mr. Steve Martin of the Institute was an instructor at the National Conservation Banking Course held at the National Conservation Training Center in Shepherdstown, West Virginia. Conservation Banking entails preservation, restoration, or enhancement of habitat for listed or at risk species as offsets for impacts permitted under the Endangered Species Act, the Migratory Bird Treaty Act, or the Bald or Golden Eagle Protection Acts. Mr. Steven Martin taught sessions on In-lieu fee programs, real estate protection, Joint Section 404/Endangered Species Act Banking and Regulatory In-lieu Fee and Bank Information Tracking System (RIBITS).

Also during April 2011, IWR personnel participated on the 14th National Mitigation and Ecosystem Banking Conference. Dr. Robert Brumbaugh led a half-day workshop on mitigation banking, and Dr. Brumbaugh and Mr. Martin facilitated several pre-conference regulatory workshops, including session on RIBITS.

IWR continued its major role in teaching the interagency course entitled "Mitigation Banking Interagency Review Team Training" at the National Conservation Training Center (NCTC) in Shepherdstown, WV in June 2011.

In August 2011, IWR provided instruction and technical support for a Regulatory Mitigation workshop in Manchester, New Hampshire sponsored by USACE Headquarters and New England District. Mr. Steve Martin was engaged in organizing the workshop and presented sessions on Mitigation Rule Overview, Ecological Performance Standards, Financial Assurances, and Long Term Management. Mr. Jae Chung presented sessions on Watershed Approaches to Mitigation Site Selection. Ms. Cindy Wood presented a session on Real Estate Protection of Mitigation Sites. A total of 44 Corps regulatory staff from 12 District offices attended the workshop.

In June 2011, IWR provided technical support to the Buffalo and New York Districts as well as the US EPA, the US Fish and Wildlife Service, the Federal Highway Administration, and New York State agencies in establishing an In-Lieu Fee (ILF) program for 3rd party compensatory mitigation in New York State. Mr. Steve Martin presented the required elements of ILF programs under the joint Corps-EPA mitigation rule, the process of developing

ILF programs, and the national status of ILF programs.

In September 2011, IWR provided technical support to an In-Lieu Fee (ILF) Program workshop sponsored by US EPA Region IX, the Environmental Law Institute and the Los Angeles District of USACE for current and proposed ILF program sponsors and Interagency Review Team members. More than 40 representatives of state, local, and non-profit organizations involved in ILF program operations attended the workshop. Mr. Steve Martin taught sessions on Determining Advance Credits, and Financial Assurances for ILF programs.

IWR oversaw the management and maintenance of the Corps regulatory database — ORM 2.0 — the second version of the OMBIL (Operations and Maintenance Business Information Link) Regulatory Module. In addition, IWR continued to actively manage the Regulatory In-lieu Fee and Bank Information Tracking System (RIBITS), a compensatory mitigation bank data program, including providing training and district support. Important information regarding mitigation banks and in-lieu fee programs from a majority of USACE District offices is now available on-line in RIBITS. In addition, an IWR contractor began adding information on Endangered Species Conservation Banks from the U.S. Fish and Wildlife Service to the database. IWR provided training and support to the Fish and Wildlife Service according to an Interagency Agreement between the two agencies.

During FY 2011, IWR, in coordination with ERDC, provided support for technical and scientific initiatives such as the publication of regional supplements to the 1987 Corps Wetlands Delineation Manual, and a draft National Wetlands Plant List.

IWR oversaw the development of a cumulative effects analysis (CEA) prototype using GIS data for the Appalachia region associated with surface mining activities. Regional CEA tools and corresponding manuals were developed for southern West Virginia and Eastern Kentucky and are currently being used by regulators from the Huntington, Louisville, and Nashville District offices.

IWR supported the US EPA economic analysis for proposed Clean Water Act (CWA) Waters of the US jurisdiction guidance by providing information on potential costs to permit applicants associated with the proposed guidance, including compensatory mitigation costs. IWR also collaborated with US EPA on development of the cost analysis for an upcoming proposed CWA Waters of the US jurisdiction rule.

Transportation Systems: The Transportation Systems Program supports HQUSACE and USACE district offices in accomplishing waterborne navigation project planning and evaluation responsibilities through the provision of (1) uniform and consistent maritime transportation data concerning costs of operation and replacement of foreign flag and domestic commercial vessels and (2) comprehensive statistics on the composition and physical parameters of the world deep draft fleet and the domestic shallow draft inland fleet. Macro-level world trade and cargo flow forecasts are also provided. Work completed in FY 2011 included new contracts for updating of vessel operating costs for both the deep and shallow draft fleets with an increase in statistical samples and the number of ship types covered compared to previous years; updated world trade and commodity flow forecasts through 2028; distribution of updated materials and statistics from various maritime industry data subscriptions; renewal of new multi-year contracts for transportation, trade and economic forecasts from Informa Economics, Inc. and IHS Global Insight, and continued work on the development of cruise ship, Great Lakes and oceangoing barge vessel operating costs, and a containership trade model. Work was also initiated to develop a containership model and to conduct a peer review of the methodology for developing deep draft vessel operating costs. Additionally, funding was secured to proceed with customization of Global Insight's "Trade Navigator" software to provide disaggregation of trade forecasts by commodity and vessel type down to the individual port level, which will be accomplished in FY 2012.

Flood Damage Data Collection Program: The Flood Damage Data Collection Program is intended to produce generic relationships for computing expected annual flood losses and tools for the collection and management of floodplain inventory data. In FY 2011, IWR completed an expert elicitation process to define the mechanisms and parameters that are the primary causes of flood damage to roads, completed a critical analysis of the expert analysis process used in the road damage analysis process, and initiated work on a model to estimate the impacts of flood induced transportation delay and rerouting. A draft report on the use of expert elicitation in flood risk management studies was completed and favorably reviewed through the Flood Risk Management Center of Expertise. Work continued on a newly redirected work plan to create a structure valuation web service for a redesign of

IWR-GeoFIT (Geospatial Floodplain Inventory Tool).

System-Wide Water Resources Research (SWWRP): The System-Wide Water Resources Research program (SWWRP) is a joint effort between IWR, led by HEC, and ERDC, focusing on expanding research activities to encompass a "System Wide" perspective, reflecting a concerted effort by USACE to follow concepts of sustainable development in a watershed context. Funding from SWWRP supports the development of multiple software packages that are widely used throughout the USACE and the professional engineering community, including: HEC-HMS (Hydrologic Modeling System), HEC-RAS (River Analysis System), and HEC-WAT (Watershed Analysis Tool).

FY 2011 marked the end of the SWWRP Program. Over its seven-year run, SWWRP provided HEC with funds to support development of multiple software packages. These included:

- HEC-RAS – The Corps' primary one-dimensional hydraulic modeling software. Funds supported development of the hydraulic modeling engine, sediment and nutrient computations. In addition to providing funds for RAS development, SWWRP also provided funds for flume experiments. The results of these experiments provided results which will be incorporated into HEC-RAS.

- HEC-HMS – The USACE main hydrologic rainfall-runoff software. Funds supported development of the hydrologic modeling engine, sediment and nutrient computations.

- HEC-WAT – A software environment allowing multiple pieces of software to interact and provide comparative results on flood risk reduction project measures and alternatives.

- HEC-ResPRM (Prescriptive Reservoir Model) – Application providing a means to compare impacts of reservoir operations on a variety of areas including recreation and environment.

- HEC-EFM (Ecosystems Function Model) – Software that provides the results of impacts of flow regime changes on a variety of species.

- HEC-ResSim – Reservoir operation software used for determination of reservoir outflows resulting from a variety of operational decisions.

There were other small pieces of software which received funding from SWWRP but the above list covers the majority of software. If funding and time allow, HEC will continue to collaborate with ERDC on the continued development of the Nutrient Sub-Model, NSM. The capabilities of this sub-module have been incorporated into HEC-RAS and HEC-HMS. Some of the activities supported by SWWRP were moved to other R&D programs. Unfortunately, some were dropped and did not receive continued funds.

Details on these products are available on the HEC website, http://www.hec.usace.army.mil.

Flood and Coastal Storm Damage Reduction Research (FCSDR): The Flood and Coastal Storm Damage Reduction Research (FCSDR) program is a collaborative effort between ERDC and IWR. HEC is the lead office within IWR with regards to the FCSDR program. The FCSDR program supports the development of methods and tools to improve the analysis and modeling of flood damage and flood damage reduction techniques, including risk and uncertainty. Funds from FCSDR support the development of HEC-WAT (Watershed Analysis Tool), including the FRA (Flood Risk Analysis compute option within HEC-WAT), HEC-FDA (Flood Damage Analysis), and HEC-FIA (Flood Impact Analysis). Details on HEC-WAT with the FRA compute option are described in the section of the report entitled "Technical Advancements in HEC Software", while details on all other products are available on the HEC website, http://www.hec.usace.army.mil.

- **IWR-HEC H&H and Risk and Uncertainty:** Funds from the FCSDR program supports the development of the FRA (Flood Risk Analysis) compute option within the HEC-WAT software. HEC-WAT with FRA is the next generation of the Hydrologic Engineering Center's Flood Damage Analysis (HEC-FDA) model. It is being constructed to include a systems approach, event-based sampling, the ability to do scenario analysis, and structure-by-structure, cost, non-structural, and agricultural damage analyses. Loss-of-life estimates have become a priority since Hurricane Katrina. Loss-of-life computations are being incorporated into the FRA computations. The tool will accommodate many, if not all, of the recommendations that the Corps concurred with from the National Research Council report "*Risk Analysis and Uncertainty in Flood Damage Reduction Studies*" (published by the National Academy of

Sciences in 2000) on the Corps' implementation of risk analysis for flood damage reduction and it will also aid in implementing the Chief of Engineers' Actions for Change initiative. The initial application of the FRA compute option has been on the Columbia River System as part of the Columbia River Treaty (CRT) study.

Ecosystem Management and Restoration Research Program (EMRRP): The Ecosystem Management and Restoration Research Program (EMRRP) is the Corps' tactical research and development response to the demand for new and expanding technologies to address the need for ecosystem assessment, restoration, and management activities at the project level. Technologies developed under the EMRRP build upon a sound understanding of ecosystem functions, which lead to sustainable stewardship of Corps resources. The EMRRP provides funds for the development of the HEC-EFM (Ecosystems Function Model) software and its spatial accessory HEC-GeoEFM. EFM and GeoEFM are designed to help study teams determine ecosystem responses to changes in the flow regime of a river or connected wetlands. Using these technologies, study teams are able to visualize and define existing ecologic conditions, highlight promising restoration sites, and assess and rank alternatives according to predicted changes in different aspects of the ecosystem. The initial public release of GeoEFM occurred in June 2011. More information is available on the HEC website, http://www.hec.usace.army.mil.

Planning Methodologies:

National Economic Development Manuals: IWR is continuing to update the National Economic Development (NED) Manuals series, originally published between 1987 and 1991. The manuals are important basic reference documents for economists and others involved in the planning and analysis of Federal water resource projects. The manuals discuss the principles and concepts associated with NED benefits and provide detailed procedures to measure and calculate benefits. The updated manuals will be exclusively web-based to increase accessibility for field personnel, facilitate the maintenance and update of the manuals, improve the efficiency and effectiveness of providing up-to-date information to the field, and be responsive to a diverse audience. In FY 2009 the Economics Primer and the Overview NED Manual were completed. In FY 2011, the Deep Draft Navigation NED Procedures Manual was published online along with a draft Containership Guide. The Coastal Storm Risk Management Manual was approved for publication and will be published in FY 2012. Additionally, the NED manuals website design will be improved and expanded in FY 2012 to include a web-based version of the Coastal Storm Risk Management Manual.

Social Vulnerability Analysis: In FY 2011, a handbook entitled "Social Vulnerability Analysis Methods for Corps Planning" (IWR Report 11-R-07) was published. The handbook presents two practical methods for identifying socially vulnerable groups. It illustrates how social vulnerability, the drivers of vulnerability, and their spatial distribution in flood hazard zones can be used in the planning process. Such information assists in identifying problems and opportunities, developing planning objectives, creating and evaluating management measures, and evaluating project alternatives. This handbook provides field analysts with the framework and tools they need to perform a social vulnerability analysis. An Other Social Effects (OSE) training module has been completed and is being beta tested in selected PROSPECT training courses. A class exercise to accompany the training module is in development. An OSE questionnaire for OMB approval and an Other Social Effects Primer are also in development.

Regional Economic Development (RED) Procedures Handbook: The need to account for Regional Economic Development (RED) effects has grown in recent years as codified in EC 1105-2-409, "Planning in a Collaborative Environment" which encourages planners to consider all four P & G accounts (National Economic Development (NED), Environmental Quality (EQ), Regional Economic Development (RED), and Other Social Effects (OSE)).

This handbook provides valuable tools and insights into the use of RED analysis. It also includes discussion of RED effects for each of the Corps' business lines. Consideration of RED impacts in the planning process will result in a more comprehensive accounting of project contributions and effects. The RED Handbook was published as "Regional Economic Development (RED) Procedures Handbook", IWR Report 2011-RPT-01, dated March 2011 and is available at the IWR website.

Multi-Objective Planning Manual: In response to ER 1105-2-100 ("Planning Guidance Notebook"), EC 1105-2-404 ("Planning Civil Works Projects under the Environmental Operating Principles") and EC 1105-2-409 ("Planning in a Collaborative Environment"), the Corps has been increasingly encouraged to formulate projects having multiple

objectives. Since few Districts have performed true multi-objective planning, IWR is developing this manual to educate planners on how to perform this more complex type of water resources decision making. HQUSACE and IWR have made the decision to integrate this manual with a Plan Formulation Manual, which is expected to be completed during FY 2012.

Technical Advancements in HEC Software: HEC continued to enhance many software products and introduce new products. Released in FY 2011 were:

- **HEC-FDA, Flood Damage Reduction Analysis, Version 1.2.5a**. This bug-fix version updates version 1.2.5, which was released in 2010. HEC-FDA provides the capability to perform an integrated hydrologic engineering and economic analysis during the formulation and evaluation of flood risk management plans. HEC-FDA is designed to assist study team members in using risk analysis procedures for formulating and evaluating flood risk management measures and analyzing the economics of flood risk management projects. It computes stage-aggregated damage, expected annual damage (EAD) and equivalent annual damage and provides the annual exceedance probability (AEP) and conditional non-exceedance probability as required for levee certification.

- **HEC-SSP, Statistical Software Package, Version 2.0**. The current version of HEC-SSP, released in October 2010, can perform flood flow frequency analysis based on Bulletin 17B, "*Guidelines for Determining Flood Flow Frequency*" (1982), a generalized frequency analysis on not only flow data but other hydrologic data as well, a volume frequency analysis on high and low flows, a duration analysis, a coincident frequency analysis, and a curve combination analysis. The duration, coincident frequency, and curve combination analyses were new to Version 2.0. The duration analysis can be used to show the percent of time that a hydrologic variable is likely to equal or exceed some specific value of interest. The Coincident Frequency Analysis is designed following guidelines in EM 1110-2-1415, "*Hydrologic Frequency Analysis*". This analysis tool can be used to compute the exceedance frequency relationship for a variable that is a function of two other variables, e.g., interior pond elevation as a function of inflow into the pond and the exterior river stage. The curve combination analysis provides a tool for combining frequency curves from multiple sources into one frequency curve, such as observed historic measurements of annual maximum stage, results from a hydrology model, and an estimate of the maximum stage from the probable maximum flood. The curve combination tool can be used to develop one frequency curve that combines all these sources of information.

- **HEC-GridUtil, Grid Utility Program, Version 2.0**. HEC-GridUtil is designed to provide viewing, processing, and analysis capabilities for gridded data sets stored in HEC-DSS files (HEC's Data Storage System). These data sets are typically regular-interval time-series of gridded hydrologic variables, such as Stage 3 NEXRAD (Next Generation Radar) precipitation or mean daily air temperatures throughout a basin. The structure of gridded data in HEC-DSS provides efficient storage and retrieval of constant-interval data sets that contain a single parameter covering a consistent set of grid cells. Storage in HEC-DSS facilitates use of the data by the HEC-HMS and CWMS (Corps Water Management System), as well as providing advantages in storage speed, size, and portability for other purposes. Gridded time series can be visualized with one of several color scales and animated. A summary time-series plot and animation controls help the user navigate through the data. Vector, point, and raster data may be loaded as separate layers to assist with data analysis and to create publication-quality GIS-style maps. These features can be enhanced by adjusting their color, line style, transparency, data labels, and other features. HEC-GridUtil can perform a number of statistical time series functions on gridded data sets over various time intervals. Other capabilities include computing the mean areal value, extracting sub-grids, and creating mosaics of multiple grids. Version 2.0 is the first official release.

- **HEC-GeoRAS 10 for ArcGIS 10.0.** HEC-GeoRAS is an ESRI ArcGIS extension that provides the user with a set of procedures, tools, and utilities for the preparation of geographic information systems (GIS) data for import into HEC-RAS and generation of GIS data from RAS output. While the GeoRAS extension is designed for users with limited GIS experience, knowledge of GIS is advantageous. GeoRAS provides the user the capability to build the HEC-RAS model from a digital terrain model (DTM) and visualize results of a RAS simulation

projected on the terrain. It is compatible with ArcGIS versions 10 and 9.3.

- **HEC-GeoHMS 10 for ArcGIS 10.0.** HEC-GeoHMS is an ESRI ArcGIS extension that provides the user with a set of procedures, tools, and utilities for the preparation of geographic information systems (GIS) data for import into HEC-HMS. While the GeoHMS extension is designed for users with limited GIS experience, knowledge of GIS is advantageous. GeoHMS provides the user the capability to build the HEC-HMS model from a digital terrain model (DTM). It is compatible with ArcGIS versions 10 and 9.3.

- **HEC-GeoEFM, Spatial Component of the Ecosystem Functions Model, Version 1.0.** HEC-GeoEFM is an ArcMap extension developed to support spatial analyses commonly used during applications of the Ecosystem Functions Model (HEC-EFM). GeoEFM provides three primary capabilities for users planning ecosystem restoration projects or water management scenarios: 1) management of spatial data sets, 2) computation and comparisons of habitat areas, and 3) assessment of habitat connectivity. GeoEFM was developed through a partnership between HEC and the Environmental Systems Research Institute, Inc. (ESRI), in recognition of both the power of GIS and the importance of ecological considerations in water systems. The initial public release of GeoEFM occurred in June 2011 and is compatible with ArcGIS versions 9.3 and 9.3.1.

More information about these software packages and other HEC software can be found on HEC's website.

FY 2011 also saw improvements to:

- **HEC-RAS, River Analysis Systems Version 4.1.** This version, released in March of 2009, continued to serve the general public while the next major release is completed. Version 4.2 of HEC-RAS will include several new features:

  - Automated Manning's n value calibration;

  - New Hydraulic Outlet Features for an HEC-RAS Inline Structure (i.e., culverts, rating curves, time series outlet);

  - Linkages between HEC-RAS and the two-dimensional ADaptive Hydraulics Modeling software from ERDC (Engineer Research and Development Center);

  - Improved sediment transport capabilities and additional functionality;

  - Advanced rules capability for pump stations;

  - RASMapper Capabilities – RASMapper provides the modeler with detailed mapping tools to visualize the results of a simulation without leaving RAS and going to ArcGIS. As time progresses, RASMapper will eventually replace the capabilities of HEC-GeoRAS.

  Other minor enhancements were also added. The development team has also continued careful and systematic testing of the program since the last release. The results of that testing in combination with reports from users has allowed the identification and repair of various problems. Some minor problems that did not affect results but caused problems in the program interface have been repaired without being specifically documented.

  In addition to the above items, two-dimensional capabilities are being added to HEC-RAS. This capability most likely will not be completed in time to include in Version 4.2 but will be ready for Beta use later in FY 2012. The capability will allow the user to model 2D spreading in storage areas and in channel reaches.

- **HEC-HMS, Hydrologic Modeling System, Version 3.5**. This version, released near the end of FY 2010, continued to serve user needs while the next major release is completed. The next major release will be called Version 4.0 and will include a wide array of new simulation components and interface features. Two different surface erosion methods will be added to the subbasin. The reach will gain erosion, deposition, and sediment transport methods. The reservoir will add several sediment settling methods. Nutrient water quality components will be added to the reach and reservoir elements. The meteorologic model will gain an energy balance snowmelt method with supporting methods for shortwave and long wave radiation. Finally, a major new simulation tool to support real-time forecasting operations will be added. Zone configuration and computation points will facilitate calibration and parameter

adjustment in large models. The map interface is also updated with new features.

- **HEC-EFM, Ecosystem Functions Model, Version 2.0**. HEC-EFM is designed to help determine ecosystem responses to changes in the flow regime of a river or connected wetlands. It allows the study team to visualize and define existing ecologic conditions, highlight promising restoration sites, and assess and rank alternatives according to predicted changes in different aspects of the ecosystem. Version 2.0 offers several new features and improved software behaviors, including expanded statistical capabilities, metric units, user controlled output options, and enhanced user guidance. This is also the first version of EFM that has HEC-EFM Plotter (1.0), which is an accessory for viewing, navigating, and interpreting output generated by EFM. HEC-EFM Plotter is also available for download via HEC's website.

  Continuing work includes the creation of HEC-EFMSim which is a new software tool that uses spatial and temporal data sets to predict changes in ecological communities. It allows modelers to test the effects of land management practices, water management decisions, water quality concerns, and any other spatial and temporal variable of interest. This work is intended to simulate ecosystems for large spatial areas and long periods of record and is significantly expanding the computational abilities of HEC ecological software.

- **HEC-WAT, Watershed Analysis Tool, Version 1.0** (not yet released) The Watershed Analysis Tool (HEC-WAT) software was created to help USACE study teams conduct watershed and water resources studies in an integrated, comprehensive and systems based approach. HEC-WAT helps a study team perform the necessary hydrologic, hydraulic, environmental, and planning analyses by integrating the software that is commonly applied by the multi-disciplinary study team. The HEC-WAT framework uses software commonly applied by a study team when conducting a water resources study. Software such as HEC-HMS, HEC-SSP, HEC-RAS, HEC-ResSim, HEC-DSSVue, HEC-FIA, HEC-EFM, GSSHA (Gridded Surface Subsurface Hydrologic Analysis; ERDC), ADH, HEC-GeoRAS, and HEC-GeoHMS are currently implemented within HEC-WAT thus allowing a study team to perform many of the necessary hydrologic, hydraulic, and planning analyses all orchestrated from a single interface. A beta version of HEC-WAT was released in FY 2008 and is available for use and testing. Official release of this software is expected in early 2012.

  On the heels of the initial HEC-WAT release is an enhanced capability in the WAT that will address the Corps need for performing water resources studies in a systems context while using risk analysis.

  For over two decades, USACE has required all Corps planning studies follow these processes. However, within the Corps there is very little guidance and few tools to support this requirement. Because of these limitations, CEIWR-HEC began researching and creating a tool that would perform risk analysis in a systems approach.

  HEC-WAT fit the part for creating comprehensive watershed studies, and already had the available software that was needed, so the decision was made to add a flood risk compute option to HEC-WAT. This new option, FRA (Flood Risk Analysis), is a computation option from the HEC-WAT software that allows a user to perform plan formulation or system performance analyses while incorporating risk analysis.

  The FRA compute option includes sampling and solution techniques, uncertainty definitions, and system-wide component fragility and performance interactions/relationships for these complex riverine systems. The HEC-WAT with the FRA compute option performs system-wide benefit analyses while assessing risks in complex interdependent systems.

  The FRA option performs Monte Carlo analyses, during which sampling of uncertainties about hydrologic, hydraulic, geo-technical and economic parameters occur. The FRA process will also incorporate social and environmental consequences in the risk analysis.
  With the FRA compute option, HEC-WAT can provide effective risk communication and be used as a tool for levee assessment and certification.

  New computational methodologies for HEC-WAT have been created. Since the FRA compute will be quite intensive, distributed computing and use of multiple processors will be required.

Work has been proceeding on the FRA compute option since FY 2008 and is expected to be released in Version 2.0 of HEC-WAT.

- **HEC-FIA, Flood Impact Analysis, Version 2.2** (not yet released). HEC-FIA evaluates impacts using either continuously observed or forecasted hydrographs (hydrograph-based) or depth grids (GIS-based). For a specified analysis, the program evaluates urban and agricultural flood damage, area inundated, number of structures inundated, and consequences. The consequences shall include economic and loss-of-life. HEC-FIA has a graphical user interface (GUI) that allows the user to enter and edit data necessary for impact analysis. Also, HEC-FIA is being used to develop the consequence models that are being used in the risk assessments that are being conducted under the dam safety program. Official release of this software is pending the certification process underway in the first quarter 2012.

Finally, HEC made progress on a few other software development activities. First, a plug-in to HEC-ResSim was developed to couple the CE-QUAL-W2 water quality model with ResSim. The coupled analysis system provides a tool to incorporate water quality considerations into operational reservoir decision-making. The plug-in includes model integration, control, and visualization features that allow the user to evaluate multiple operational objectives within a watershed and identify the most beneficial project operations to meet system-wide water quality goals. Workshops were given in Portland, OR and Nashville, TN demonstrating the capabilities of this software to staff from the Corps and other agencies.

Second, HEC and the USGS, in association with IHE-Deltares, are also working together to integrate HEC-RAS and the USGS MODFLOW software. Through this effort an OpenMI compliant version of HEC-RAS was developed.

INTEGRATED CIVIL WORKS SYSTEMS

Performance based budgeting, performance measurement and program assessments are increasingly important. In response, IWR created a corporate data warehouse of financial and navigation infrastructure inventory data, lock characteristics, navigation project profiles, OMBIL outputs, waterborne commerce, lock performance, hydropower, recreation, water supply, National Recreation Reservation System and environmental stewardship data. Data from these sources is linked, integrated and combined to generate performance measures, which are then used in the budget process.

OMBIL: The Operations and Maintenance Business Information Link (OMBIL) Plus, a centralized performance management information system, encompasses the Civil Works business lines of navigation, hydropower, recreation, environmental compliance, environmental stewardship, water supply and regulatory. The OMBIL decision support system distributes data to support a variety of Corps management initiatives, performance-based budgeting and Federal and public data requirements.

In support of the Civil Works business performance measurements, the Navigation Data Center (NDC) extracts expenditure data from the USACE Financial Management System (CEFMS) and combines it with business output data to generate efficiency and effectiveness measurements, including submissions to the Office of Management and Budget. NDC data supports and is a source of information and data used in the Corps *"Value to the Nation"* publications and the Federal government's recreation access site: http://www.recreation.gov. Navigation data is also integrated with CorpsMap, providing an intranet web-based GIS interface. All of NDC's publicly available navigation and water transportation data is available at www.ndc.iwr.usace.army.mil.

ORM 2.0: IWR has completed development and deployment of OMBIL Regulatory Module Version 2 (ORM 2.0). ORM 2.0 is a web-based geospatial database application for tracking and managing all aspects of the Corps regulatory process. ORM 2.0 was developed using a unique combination of Corps in-house expertise and contract support. ORM 2.0 supports a consistent national business process for the regulatory program resulting in consistent tracking and reporting of program performance. ORM 2.0 integrates with USACE district enterprise geographic information systems and other federal and state agencies. ORM 2.0 provides the foundation for watershed based decision making in the Corps regulatory program. By the end of FY 2008, the database was deployed and historical data loaded for all districts with continual improvements being implemented.

Corps Water Management System (CWMS): The Corps Water Management System (CWMS) is a comprehensive data acquisition and hydrologic modeling system developed by the Hydrologic Engineering Center (HEC) for short-term decision

support of water control operations in real time. CWMS supports field-level decision making within the Corps water management mission. It embodies data acquisition, validation, transformation and management; forecasting, simulation and decision support analysis; and information dissemination.

The first version of CWMS was released by HEC in 2002. CWMS has been updated at roughly annual intervals at the thirty plus Corps offices with water control management responsibilities. HEC improvements to the system continue via a field-prioritized betterments program. A major milestone was the development of CWMS version 2.0.

CWMS Version 2.0 allows the field to make major revisions to the basic database structures, allows water control users more direct access to their data and enables them to make more effective use of the features inherent in the commercial Oracle database at the center of CWMS. Version 2.0 was released in FY 2010, and is the current production system.

Improvements that have been incorporated into CWMS Version 2.1 include "CCP", the CWMS Computational Processor. CCP provides users math functions within the Oracle database and will replace the existing system for validation/transformation.

Current work on CWMS includes report generation and access to native model features. Other work under the aegis of CWMS includes national database and COOP design.

In addition to software development, HEC continues to be actively engaged with ACE-IT and the CWMS management team in standard hardware platform design and service requirements for CWMS and other water control programs. This platform is known as the Water Management Enterprise Architecture (WMeA) and includes data servers, storage devices, switches, and data ports. This effort has produced a more uniform and easily supported implementation of water control data and modeling systems throughout the Corps and support the uniform access to water control data nationwide through access to roll-up databases at the Corps enterprise processing centers. The next major effort is to secure funding for a WMeA implementation project. Several field offices have already purchased equipment based on the WMeA design. The intent of the implementation project is to provide the field a standard template for setting up and configuring this equipment which would allow for efficiencies gains. Information about CWMS and other HEC software is available on the HEC website, http://www.hec.usace.army.mil.

WATER RESOURCES TRAINING AND EDUCATION

The Institute for Water Resources, including the Hydrologic Engineering Center, has always been a leader in innovation within the Corps of Engineers family. IWR has been responsible for developing techniques and approaches for economic analysis, risk analysis, planning methodologies, public involvement, conflict dispute resolution, water conservation and other topic areas. HEC, through the development of hydraulic, hydrologic and planning analysis methods and models, has built a reputation recognized throughout the world in the fields of hydraulics and hydrology. Over the course of their existence, both IWR and HEC have made considerable effort to build appropriate training vehicles for the instruction in the use of the various tools they have developed. As a result, each office routinely offers eight to twelve courses per year through the Proponent-Sponsored Engineer Corps Training (PROSPECT) program and/or through other training venues, such as workshops and seminars.

PROSPECT Program and Specialty Workshops: IWR is committed to technology transfer and the dissemination of its tools, processes and procedures. The organization and staff are committed to provide assistance in using our tools, through workshops, telephone consultation or whatever may be necessary.

During FY 2011 IWR continued to support technology transfer and capacity building throughout the Corps through its engagement with the USACE **Pro**ponent **Sp**onsored **E**ngineer **C**orps **T**raining (PROSPECT) program. The National Capital Region office and the Hydrologic Engineering Center presented twenty two week-long courses (ten led by the IWR-NCR and twelve by HEC). The PROSPECT courses covered a wide range of Civil Works water resources topics including plan formulation; collaborative planning; ecosystem restoration; flood risk management; hydrologic and hydraulic engineering; public involvement and team planning; public involvement and communications; environmental considerations in water resources planning; and regulatory issues. Specialty workshops often use pieces of the PROSPECT training courses but generally, workshops are built specifically for the requesting office and often included topics outside of the normal PROSPECT training course curriculum.

Since FY 2007 the NCR office of IWR assumed responsibility for several of the Planners Core

Curriculum (PCC) courses including Plan Formulation; Environmental Considerations in Planning, Economic Analysis; and Public Involvement and Team Building.

Other IWR-NCR supported courses include Risk Analysis - Water Resources Planning and Management; Conflict Management and Dispute Resolution; Public Involvement - Communications, (taught primarily by consultants outside of the government); and Planning for Ecosystem Restoration. In addition to the IWR-sponsored courses, IWR staff members are instructors for a number of other PROSPECT courses, teaching specialized topics such as Cost Effectiveness and Incremental Cost Analysis, Economics, Forecasting, Risk Analysis, and Environmental Benefits Evaluation.

IWR-NCR is also responsible for managing the Corps Planning Associates (PA) program, a ten month training program designed to provide comprehensive training to future leaders in the Planning Community of Practice. The PA program is a series of interrupted one, two and three week sessions interspersed with trips back to the home district to keep up with the workload. Students are committed to keeping their work at home moving while participating in the program.

Under the auspices of the PROSPECT program, HEC conducted the ecosystem-oriented training course "Water and the Watershed" and a full menu of hydrologic and hydraulic (H&H) engineering and planning analysis topics, including courses on H&H for Dam Safety Studies; Risk Analysis for Flood Risk Management Projects (two sessions); Hydrologic Engineering Applications for GIS; Advanced Steady Flow Analysis with HEC-RAS; Unsteady Flow Analysis with HEC-RAS; Hydrologic Modeling with HEC-HMS; Reservoir System Analysis with HEC-ResSim; CWMS Modeling for Real-Time Water Management; Hydrologic Analysis for Ecosystem Restoration; and Statistical Methods in Hydrology. A list of HEC offered PROSPECT training courses is available at the HEC website (http://www.hec.usace.army.mil/training/course_list.html).

In addition to the PROSPECT training program, HEC conducts specialized training classes for a variety of clients. HEC support to the Civil Military Emergency Preparedness (CMEP) program continued in FY 2011 with a week-long training activity for water managers and emergency management officials in Mongolia and Kazakhstan. The workshop in Mongolia provided training in surface water hydrology, river hydraulics, and floodplain mapping. The workshop in Kazakhstan provided training on water management activities for flood prediction and levee management.

HEC conducted training courses for District offices on HEC-DSSVue in Tulsa; Sediment Modeling with HEC-RAS in Detroit; HEC-FDA in Seattle; and a special Working Session at HEC for CWMS 2.0. HEC also lead workshop for the Sonoma County Water Agency regarding Groundwater Modeling with MODFLOW, in Santa Rosa, CA.

The IWR International Center for Integrated Water Resources Management (ICIWaRM) sponsored two HEC and two IWR staff members to provide a Hydrology and Hydraulics Workshop on Hydro-Informatics hosted jointly by Paraguay and Brazil in Asuncion, Paraguay. Over 25 participants from Paraguay, Uruguay, Bolivia, and Chile participated in the training. This effort included training sessions on HEC-HMS (Hydrologic Modeling System), HEC-RAS (River Analysis System), and HEC-ResSim (Reservoir Simulation), in addition to several days of model building and simulation of the participants' reservoir management capabilities.

Planning Excellence Program: Throughout FY 2011 IWR provided managerial and technical support to the Planning Community of Practice (CoP) in the execution of the Planning Excellence Program. This included the management of the Planning Associates (PA) program and conduct of the three-week "Washington DC Experience" module for the FY 2011 class. The goal of the PA program is to develop planning leaders who can manage complex planning studies that lead to quality decision documents and who will provide water resources technical and professional leadership in the future.

IWR, in coordination with HQUSACE, is responsible for the implementation of the program, including setting up the criteria for selection of candidates, development and delivery of training sessions, and financial management and logistical support of the program.

IWR also provided support to the local delivery of four of the seven Planning Core Curriculum courses by the Corps Major Subordinate Commands (MSCs). These four courses provide the basic, full-performance training needed by entry level planners across the USACE as the means to accelerate their progress to the journeyman stage of their career development. These courses include: Environmental

Considerations; Economic Analysis; Plan Formulation; and Public Involvement and Team Planning. IWR also supports to the local delivery of the Risk Analysis - Water Resources Planning and Management course.

Water Resources Training and Education Program

The Water Resources Training and Education Program, previously known as the Advanced Degree Program, was completely restructured in FY 2011 to offer prospective students access to information on a much broader range of training opportunities. The previous program was much more narrowly focused on five separate universities that had developed Masters degree programs specifically tailored for the Corps' planning community. That approach proved to be unsustainable, so a revamp was undertaken in 2011 in favor of a much more inclusive strategy. Students interested in advancing their water resources training will now have access to information based on thematic, geographic, and distance learning availability. Options ranging from short courses through to post-doctoral training opportunities will be available through the new website (http://www.waterresourceseducation.us/). The initial program was developed in partnership with the Universities Council on Water Resources, and they gave their full approval for this redirection prior to the new website's launch.

REIMBURSABLE TECHNICAL ASSISTANCE

During FY 2011 the Institute performed a wide array of reimbursable project work for USACE field offices as well as HQUSACE Civil Works Planning, Engineering, Operations, Regulatory, Office of Homeland Security; and Office of Interagency and International Activities; the Engineering Research and Development Center (ERDC), Coastal and Hydraulics and Environmental Laboratories; combatant commands of the U.S. Army; the Federal Emergency Management Agency; the International Joint Commission (IJC); the U.S. Agency for International Development (USAID); the National Weather Service; the U.S. Geological Survey; the Natural Resources Conservation Service; the US Environmental Protection Agency; and other Federal agencies; and approved Thomas Amendment Agreement (Section 211 of the Water Resources Development Act of 2000, Public Law 106-541) technical support to the Lower Colorado River Authority, Texas and the Tampa Bay Water Authority, Florida.

Other projects for USACE clients included navigation systems economic evaluation, technical advice and guidance on plan formulation, incremental cost and cost effectiveness analysis, risk analysis, watershed and reservoir system modeling, water quality, river hydraulics, wetlands hydrology, water control management, regional statistical analysis, flood damage analysis, flood warning response systems, GIS applications in hydrology and hydraulics, groundwater modeling and water supply in support of interagency investigations.

IWR worked on a variety of projects including American Recovery and Reinvestment Act (Stimulus) activities; post-Hurricane Katrina Interagency Performance and Evaluation Taskforce (IPET) activities, hydraulic modeling, and risk analysis; providing additional features in HEC-RAS software for the Tampa Bay Water Authority; helping the Lower Colorado River Authority implement CWMS for their water management needs; contributing to the revision of Bulletin 17B; writing levee certification guidance; working with the Corps Screening Portfolio Risk Assessment teams evaluating the safety of the Nation's dams; assisting the Sacramento District and the South Pacific Division perform a risk analysis of the Sacramento River from a systems context; working with the Sacramento District on the Sacramento River Bank Protection Project; working with the Mobile District to update the Alabama-Coosa-Tallapoosa (ACT) and Apalachicola-Chattahoochee-Flint (ACF) water control manuals; providing technical support to the New England District in support of the Connecticut River Restoration Project; providing technical support to the Mississippi Valley Division as part of the Value Engineering Review Team for the Louisiana Coastal Authority Mississippi River Diversion project; providing HEC-ResSim, HEC-HMS, and HEC-RAS training to the water management staff of the Omaha District; providing technical support to the South Florida Water Management District and the Jacksonville District on linking HEC-RAS with ModFlow software; providing technical support to the Sonoma County (CA) Water Agency on linking HEC-RAS with ModFlow so that the interaction of groundwater and surface water could be modeled by SCWA; providing technical support to the San Francisco District, the USGS, the Weather Service and the Sonoma County Water Agency on developing a revised Hydrologic Indexing methodology for the operation of reservoirs in the Russian River basin; providing HEC-FIA training to the staff of the Nashville and Sacramento Districts in order to perform post flood simulations to

analyze the 2010 flood in Nashville, Tennessee; providing technical support to the Great Lakes and Ohio River Division, the Mississippi Valley Division, and the St. Louis District on real time analysis of flood along the Ohio and Mississippi Rivers in Spring 2011; providing technical support to the USGS on technical studies of the Bill Williams River in Arizona; provided technical support to the USEPA, the State of Colorado, the Colorado Water Conservation Board and the Omaha District on water supply permitting issues in the Denver Metropolitan region; provided technical support with the Cold Regions Research Laboratory to the Alaska District on the snowmelt capabilities in HEC-HMS, due to the increasing importance to modeling of systems such as the Red River of the North; provided technical support in the evaluation of the performance of the Mississippi River and Tributaries system during the Spring floods of 2011; provided technical support to the Nashville District and the National Weather Service on HEC-RTS modeling of the Cumberland River above Cheatham Dam and below J. Percy Priest dam; provided technical support to the St. Paul District on the application of HR Wallingford risk tools to the St. Paul, Minnesota levee safety; provided technical support to the Fort Worth District and the Southwestern Division on the assumptions used in the development of the Trinity River project in Dallas, Texas; provided HEC-FDA training to staff at Seattle District, HEC-RAS sediment training to staff at Detroit District, and HEC-DSSVue training to staff at Tulsa District; collaborated with the Detroit District to experiment with an unsteady flow HEC-RAS model for routing flows from Lake Superior to Lake St. Clair; collaborated with the Northwestern Division, Seattle District and Portland Districts and Bonneville Power Administration on the Columbia River Treaty (CRT) 2014/2024 Study;; and numerous miscellaneous consultations.

HEC entered into an agreement with the Sonoma County Water Agency and initiated another agreement with the South Florida Water Management District. Both of these agreements will allow HEC to add specific enhancements to the HEC software that provides capabilities for these agencies.

CIVIL WORKS PROGRAM AND PROJECT INFORMATION

IWR maintains, develops and provides a full range of international, national and USACE project and program data and information for decision support for the Corps, other federal government agencies, the private sector, and the public on key Civil Works activities. National water resources database concept development, design, implementation, operation and maintenance activities are provided through a combination of in-house and private sector systems analysts, statisticians, engineers and scientists who work in close coordination with USACE users. Also IWR acquires external data from other federal agencies and private sector sources, to be used by the Corps for integrated analysis and benchmarking. These data are used within the Corps for program management, budget development and justification, OMB Program Assessment Rating Tool, numerical models and real time management at the project. Major initiatives within the past year have been the development and creation of performance measures for the Corps business lines to reflect the efficiency and effectiveness of the programs and analysis.

Navigation Data Center: The Navigation Data Center (NDC), located at the National Capital Region headquarters of IWR at Ft. Belvoir, VA., is the central manager of navigation, hydropower, recreation, environmental stewardship, water supply and regulatory program data for the Nation. Information provided by NDC directly supports the USACE annual Civil Works performance-based budgeting program. NDC is responsible for national level executive oversight and management responsibilities, including the development of Federal and USACE Engineer Regulations (ER's) and Code of Federal Regulations pertaining to Corps navigation data reporting requirements by industry and the associated enforcement of those regulations. OMB, acting on legislative mandates, recognizes USACE, acting through NDC, as the Federal collection agent for waterborne commerce, vessel activities and waterway infrastructure data and statistics.

NDC accomplishes its objectives of supplying timely and accurate data through the following activities: assessing user requirements; developing, designing, operating and maintaining systems to collect, process and store data and information; developing and disseminating data, information and statistical products; training providers and users of project and program information and data; and maintaining knowledge of the latest developments in the area of technical and content interoperability.
As a national statistical center, NDC coordinates extensively with other Federal statistical agencies and data users, representing the U.S. government before other nations in the development of data and information standards and protocols and in the negotiation of data exchanges. NDC actively participates in corporate information integration and

coordination within the USACE and plays a lead role in developing, coordinating and disseminating water resources information for performance measurement and management purposes. It leads the development of strategic communication with both internal communities of practice and external water resources interests, stakeholders and communities.

Waterborne Commerce and Vessel Statistics: Under the authority of the River and Harbors Act of 1922, as amended and codified in 33 U.S.C. 555, the USACE is to collect, process, distribute and archive U.S. waterborne commercial vessel trip and cargo data. These data and statistics are used to analyze the feasibility of new water transportation projects and activities; to set priorities for new investment and rehabilitation; and for management of the operation and maintenance of existing projects.

Under Federal law, vessel operating companies must report domestic waterborne commercial vessel movements directly to the USACE. The types of vessels include, but are not exclusively limited to: dry cargo ships and tankers, barges (loaded and empty), towboats (with or without barges in tow), tugboats, crew boats and supply boats to and from offshore locations, newly constructed vessels from shipyards to the point of delivery, ferries and other passenger vessels, and vessels remaining idle during the monthly reporting period. Harbor Maintenance Tax information, providing the name of the shipper of the commodity and the shipper's Internal Revenue Service number or Social Security number, is also reported for the cargo movements into or out of ports that are subject to the provisions of section 1402 of the Water Resources Development Act of 1986 (Pub. L. 99-662). U.S. foreign waterborne import, export and in-transit cargo and vessel movement data is provided to the Corps by the U.S. Customs and Border Protection, the U.S. Bureau of the Census, and the Port Import Export Reporting Service.

Movement data acquired by the NDC Waterborne Commerce Statistics Center is primarily for the use of the USACE and other governmental agencies. Since 2004, data have been incorporated into the USACE budget preparation process, providing the navigation project outputs and performance measures used to rank and justify operation and maintenance funding requests. Summary statistics, which do not disclose movements of individual companies, are also released to private companies and to the general public.

Harbor Maintenance Fee Data Collection: During the 103rd Congress legislation was enacted which allows the U.S. Customs and Border Protection Service, the Corps, and the U.S. Department of Commerce to share a maximum total of $5 million per year for expenses incurred in the administration of the Harbor Maintenance Tax. In FY 2011, $809,632 was made available to the Corps to collect domestic shipper information required for auditing Harbor Maintenance Tax collections, tracking USACE navigation related operation and maintenance expenditures, to prepare the annual Harbor Maintenance Trust Fund report to Congress, to coordinate with the Customs and Border Protection on data collection and enforcement issues, and for addressing and evaluating possible alternatives to the Harbor Maintenance Tax.

Validation of Domestic Data In light of the past variations in the level of domestic collections and concerns expressed by the World Trade Organization that the U.S. has not fully collected fees due from domestic shippers, the Corps' Waterborne Commerce Statistic Center has made it a priority to ensure full compliance on the domestic side. In FY 2011, the Corps worked with the Customs and Border Protection Service to improve the collection and analysis of domestic Harbor Maintenance Tax receipts and to develop a system to collect and validate shipper information required by the Customs and Border Protection Service for auditing domestic Harbor Maintenance Tax collections. The goal of this effort is to increase the accuracy and completeness of domestic shipping information in order to improve the Federal government's ability to verify the level of compliance. Additionally WCSC worked with the IRS to develop a methodology to detect unreported movements of cargo subject to the Harbor Maintenance Tax.

Improved Delineation of Foreign Vessel and Cargo Movements: The Corps has improved the accuracy of the delineation of ports where moves are subject to the Harbor Maintenance Tax and the facilities contained in these ports. With the transfer of the U.S. Foreign Waterborne Transportation Statistics Program from the U.S. Census to the Corps on October 1, 1998, the Corps' Waterborne Commerce Statistic Center is now involved in the identification of foreign cargo movements subject to the tax. The Corps, in partnership with the CBP, has improved the geographic accuracy of data for foreign vessel and cargo movements in U.S. ports, and has improved the process that matches the cargo to the vessel moves. In 2011 CPB and the Corps completed a collaborative effort to accurately identify reported facilities at the time of international cargo load and unload. As a result, the percentage of vessels

attributed to the correct facility for cargo load and offload rose from 87% to 99%, rendering the foreign data more suitable for verifying compliance.

International Trade Data System (ITDS): During FY 2011, the Institute's Navigation Data Center continued its involvement in the development of the *International Trade Data System* (ITDS). ITDS is a multi-agency technology initiative administrated by the e-Customs Partnership, a public-private partnership led by Customs and Border Protection (CBP). Both the public and private sectors have steering committees and numerous sub-committees.

The objective of this initiative is to provide a secure, single source interface for the collection, input, analysis, and proper dissemination of international trade and transportation statistics. The Corps is one of over 20 government agencies working with the trade and transportation community to implement this initiative.

In FY 2011 a new component named Automated Export Manifest (AEM) was added to the ITDS umbrella to enable collection of automated manifest information. IWR worked with CBP to incorporate Corps' requirements into the development of AEM. AEM will greatly enhance export transportation information that the Corps receives and will link manifest and shipper information at time of reporting, reducing IWR's need to spend resources to match information from multiple sources. Additionally, as part of the Corps requirements, the export information will be tied to a Corps facility and thus a Corps project.

E-Navigation Initiatives (E-Nav): E-Nav initiatives are those promoting efficiency, safety, security, and reliability in our Nation's waterways through seamless transfer of data and information among the navigation community. IWR supports several of these E-Nav initiatives.

- **River Information Services (RIS):** RIS will provide management, coordination and oversight for the development of the various E-Nav initiatives in which USACE participates. In FY 2011 NDC members of USACE, and USCG representatives started a project to integrate USCG's Notice to Mariners and USACE's Notices to Navigation into one set of Federal Notices to Mariners. The project is scheduled for completion by the end of FY 2012.

- **Lock Operations Management Application (LOMA):** IWR technical experts worked with ERDC to design USCG data and services that will be used in LOMA to provide navigation information to waterway users, including lock operators, Corps management and vessel operators.

- **Federal-Industry Logistics Standardization (FILS):** In FY 2011 the FILS team developed a Scope of Work for development of American Standards Committee X12 approved documents for transfer of information between the barge leading barge companies and USACE and other participating agencies. Work on the project will begin in FY 2012, with scheduled completion to take place in FY 2013.

- **Federal Initiative for Navigation Data Enhancement (FINDE):** In FY 2011 the FINDE project team established and completed an Interconnection Security Agreement (ISA) between USACE and USCG, providing USACE with data and services from USCG's Enterprise Service Bus. The ISA signing was historic in that it was the first interconnectivity agreement signed between the two agencies.

- **Inland Electronic Navigation Charts (IENC):** IWR technical experts continued to work with the Army Geospatial Center (AGC) to harmonize navigation points of interest and data elements common to both AGC's IENC's and NDC's dock and facility inventory. The team leveraged the chart information to add over 600 bridge locations to the Master Docks Plus inventory system.

- **Lock Performance Management System (LPMS):** The LPMS team continued their development of a tool that captures real time vessel (Automated Identification System "AIS") information at Corps locks so as to reduce the burden on the lock operators and to improve their capability to safely operate locks and results in improved safety and vessel traffic management. This effort is in partnership with LOMA and USCG. It is expected to be nationally deployed in FY 2012.

Navigation Infrastructure Inventory: Navigation Infrastructure Inventory information supports the USACE Federal Central Collection Agency responsibility for documenting the Nation's commercial port infrastructure served by Federal channels. Data for approximately 31,000 individual navigation points of interest (NPIs) are published on the Internet. Dock data are updated as each port

facility is contacted and characteristics are verified. New update and survey procedures are being developed to increase the frequency of update and to allow individual facility operators and port authorities to update their own facility information in the database. Due to the dynamic and continuous update of the NPIs, the hard-copy Port Series books are no longer being published. Instead, an NPI search tool has been designed which will facilitate retrieval of information for specific NPIs.
Navigation Infrastructure Inventory information is used to identify industries served by the Federal channels and is part of the budgetary process of prioritizing projects. The U.S. Coast Guard (USCG) is another primary user of the information in the execution of its homeland security mission. A new initiative, begun in FY 2008, was the formation of the Federal - Industry Logistics Standardization group, which is a working group comprised of the Corps, IRS, USCG, CBP and the barge and towing industry. The highest priority task is to produce a definitive list of NPIs with unique identification codes and accurate geo-location that both the public and private sector can use when communicating with each other. A list of NPIs is located on the Corps' NDC website: http://www.ndc.iwr.usace.army.mil/ports/data/published_nav_units.xls. A search tool is also available at http://www.ndc.iwr.usace.army.mil/NavUnitSearch/NavUnitSearch.aspx.

Lock Performance and Characteristics: The lock performance database provides the USACE access to individual lock near-real-time information as well as summary and performance statistics. The data are entered into the database by the lock operator as the vessel is locking through the chamber. A national data warehouse provides all USACE users direct access to current and historical data and summaries. The data is used by the USACE for budget formulation, tactical and strategic operation and maintenance of the navigation lock system, and OMB navigation system performance measures. The data are also important to other agencies, such as the U.S. Coast Guard and the Tennessee Valley Authority (TVA), in the execution of their missions. All locks in the New Orleans District now use the Coast Guard required vessel Automated Information System (AIS) signal to not only visualize on a map, the location and identification information of all vessels in the vicinity of the lock, but also to automatically record selected timing events directly into the lock database as the vessel moves through the locking process. These features reduce data entry demands, improve data accuracy, and allow the operator to better plan local maintenance and his locking sequences.

Lock characteristics data and the physical descriptions of all the USACE owned and operated locks are updated as information changes. Lock characteristics and performance information are available on the public web site, http://www.ndc.iwr.usace.army.mil. The lock performance and characteristics databases are feeder systems to the OMBIL decision support system. The lock data are used to supply the OMB required performance data of lock unavailability due to mechanical problems.

Dredging Statistics: This web-based ORACLE database is successful in supplying information on all USACE performed and contracted dredging to the USACE, industry and private users. Data entry and report generation is accomplished via the USACE intranet and enables all USACE members to access the central system information. The database contains information on dredging location, equipment used, quantity removed, government estimate and winning bid and bidder. National briefings with Corps and industry representatives employ the data from this central system and the database is used to generate specific reports such as the Small Business Report for dredging contracts. Biweekly reports are posted on the public web site to inform the industry and public of Corps and contracted dredging activities. These reports are available in downloadable spreadsheet format providing more functionality for report users. Standard reports and summaries plus customized queries and reports are quickly generated to meet Corps and user needs. Use of the information has resulted in improved bidding competition and more efficient utilization of dredging equipment. The dredging database is a feeder system to the OMBIL decision support system.

Recreation: Recreation data associated with the Corps' 4250 recreation areas are collected and maintained within the OMBIL database. An inventory of recreational physical features and structures including recreation areas, visitor centers, facilities, and amenities; outputs including a count of the number of visitors and visitor hours; and activities including citations and interpretive contacts, are combined with revenues and expenditures to produce performance measures that assist the Corps in making management decisions regarding the Recreation program. This data is furnished to public websites such as Value to the Nation, www.vtn.iwr.usace.army.mil, CorpsLakes, http://corpslakes.usace.army.mil/visitors and the federal interagency recreation website www.recreation.gov. In FY 2011, OMBIL has continued to focus on improving the accuracy of the

visitation data and the inventory of recreation projects, and has also initiated a nationwide effort to better define the project site area (recreation area) list. OMBIL also supported the budget process by continuing to supply data to the *RECreation Budget Evaluation SysTem* (Rec-BEST), Recreation Self Assessment Tool, and RecStatus, project information and benchmarking report, developed by IWR/ERDC.

A new regional economic development model was developed in FY 2010 named RECONS (Regional Economic System). This modeling tool automates calculations and generates estimates of the employment impact and other economic measures such as income generated and sales associated with USACE's Civil Work program spending, as well as economic impacts of recreation visitor spending at Corps lakes. The latest economic impact information for all recreation projects has been estimated using RECONS and posted on the Value to the Nation website.

IWR, in collaboration with ERDC, has provided additional technical support to Corps Recreation Business line activities. The activities that were accomplished in FY 2011 include a new nationwide visitation estimation survey, and continued support of the Performance Based Budget Development for Recreation Business line; Regional Economic Impact Analysis of Recreation; GIS mapping applications using the Google Map platform to inventory all Corps managed recreation areas and facilities, updating of the Google Earth application for all Corps Recreation projects; and other miscellaneous technical support to Corps Natural Resources management activities. Lastly, in FY 2011 IWR continued to provide technical support for individual public survey submissions on recreation planning and recreation management.

Hydropower: Hydropower data from the 75 Corps power plants is collected and maintained within the OMBIL database. For those power plants in the Northwestern Division that have automated control systems (Generic Data Acquisition and Control System or "GDACS"), electronic upload of generation data is in place. Data such as power generation statistics, unit availability and revenue generated, enable the Corps hydropower program to determine its performance, make budgeting decisions and furnish OMB with program performance information. In FY 2011, hydropower performance measures for the FY 2013 budget process were supplied by OMBIL hydropower data. Also included in OMBIL Plus is a module related to capturing the ongoing water supply reallocation studies. The OMBIL Operations and Maintenance team is preparing updates and revisions data entry forms in order to capture the amplification code records for unplanned (forced) outages of type U1 for all units. These data are required to be reported on a national level to the North American Electric Reliability Corporation, NERC.

Water Supply: IWR serves as the HQUSACE national program manager for the Water Supply business program. In this capacity, the annual budget and the five-year development plan associated with USACE Water Supply budget is developed in coordination with the MSCs and the strategic plan as presented in the Program Assessment Rating Tool. It is necessary to develop and provide annual budget guidance to the MSCs, collect their data, prioritize it in conjunction with the seven other business lines and eight program areas, and present the data to the senior leaders of Civil Works, the Assistant Secretary of the Army (Civil Works) and a panel of water supply examiners from the Office of Management and Budget. The annual program must then be modified and adjusted as necessary based on OMB comments and directives.

Part of the Corps of Engineers yearly budget is a line item in the Operations and Maintenance Remaining Items for a program titled: "National Portfolio Assessment for Reallocations." The responsibility to develop and monitor this program falls under the water supply business line program. This item, initially funded in the FY 2008 budget at $300,000 per year, was just to develop a portfolio of projects suitable for reallocations and to explore new methods of paying for reallocation studies. The report on this initiative was forwarded to headquarters in June 2010. As a result of all the data collected to develop this portfolio and the addition of a "Sustainable Rivers" element, the study was modified in FY 2010 to an "Assessment of Data" program. Under this program, IWR has reviewed, collected data and/or provided reports on water management, water quality, climate change, sedimentation issues, the Sustainable Rivers Program as well as keeping the water supply needs or reallocations updated. Funding for this "Assessment Program" is approximately $570,000 per year.

The IWR Water Supply business line manager is also responsible for the development and maintenance of the USACE database of Municipal and Industrial (M&I) water supply projects. The first IWR developed database was in 1996 based on an update of an old headquarters 1989 database. IWR updated this database in 2004 and again in 2005. These

databases were developed by paper drills to the districts. In fiscal year 2006 an effort was initiated in IWR to develop a Water Supply module in the Operations and Maintenance Business Information Link (OMBIL) system. Once developed and loaded with all the contractual data this system will enable a continual update of water supply data, similar to some of the other business lines. The fiscal year 2010 database is a combination of the new OMBIL data, where loaded and the old 2005 data from those districts which have not completed the loading process. The 2010 database (developed in Fiscal Year 2011) shows there are 135 Corps multipurpose projects which contain storage space for M&I water supply. Of these agreements, seven are just for water conduits. There also are 58 separate activate future actions where the districts have converted future use to present use. These projects are located in 26 states and in 22 of the 38 Corps districts. In these projects the Corps has 326 repayment agreements representing some 9.7 million acre-feet of storage space and an investment cost of $1.43 billion of which about $800 million has been repaid with interest to the U.S. Treasury. The storage space is capable of providing about 6.6 billion gallons of water per day for use by municipalities and industrial firms which have signed repayment agreements. This yield is capable of providing the indoor household needs of approximately 98 million people and represents about three percent of the Nation's off stream municipal and industrial water supply needs. The 2010 M&I Water Supply Database Report was published as IWR Report 2011-R-06 and can be found at: http://www.iwr.usace.army.mil/docs/iwrreports/2011-R-06.pdf

In FY 2011, in addition to the normal activities of the Water Supply business line two major actions were under taken:

- The second biennial water supply workshop was held in Savannah, GA on 31 May – 2 June 2011. It was attended by 52 individuals representing headquarters, 3-divisions, 12-districts, the Institute for Water Resources and the non-Federal sector. The workshop covered a broad range of water supply topics of current interest. Additional information on this workshop can be found at: http://corpsresults.us/watersupply/wsWaterSupplyWorkshop11.html

- To assist in the development of the water supply module of OMBIL, a training session was held in Tulsa, OK on 20-21 September 2011. The session was attended by 14 individuals representing 1-division, 7-districts, the Institute for Water Resources and a private consultant.

Optimization Tools for Navigation (OTN): The Optimization Tools for Navigation program supports multiple initiatives concerning methods and analyses to minimize costs or enhance efficiencies for asset evaluation and management of the Corps' navigation operation and maintenance (O&M) program. Related initiatives include support for enhanced development and field testing of the Channel Analysis Design Evaluation Tool (CADET) in partnership with the Engineer Research and Development Center as technical scope and review lead and the Naval Surface Warfare Center (NAVSEA-Carderock Division) as prime technical developer. Also supported is the development of a centralized system for benefit evaluation of the O&M program for deep draft harbors (the National Navigation Operation and Maintenance Performance Evaluation and Assessment System, also referred to as "NNOMPEAS") and investigations and research conducted in concert with the U.S. Naval Academy to better quantify critical inputs for navigation analysis. Work completed in FY 2011 included completion of the CADET initiative, completion of a geographic information system (GIS) interface for NNOMPEAS, data expansion of NNOMPEAS to include nearly 50 high volume ports with multiple years of data, and modifications to the RIS data collection system to capture detailed dredging information by location and cost for inclusion in NNOMPEAS. Work scheduled for FY 2012 includes continued schematic mapping of coastal deep draft waterway projects, adding data for more than 100 additional harbors, and deploying RIS dredging data collection at the Corps district level.

INTERNATIONAL WATER RESOURCES

The Institute formed the International Water Resources program in 2006 as a means to better coordinate the various international initiatives that are under its purview. These initiatives fall into three categories: global water resources strategies, international partnerships, and technical and advisory support. These initiatives and the major projects that fall under them include:

International Upper Great Lakes Study: Throughout FY 2011, IWR continued to play a major role in directing and managing the activities of the International Upper Great Lakes Study. The Study was initiated in 2007 under a Memorandum of Agreement (MOA) between IWR and the

International Joint Commission (IJC) for a 5-year, $15 million US-Canadian study focusing on the *Lake Superior Regulation Plan* and the potential erosion problems associated with the St. Clair River channel. Drs. Eugene Stakhiv and Anthony Eberhardt are the U.S. co-Director and co-Manager of the Study. IWR is leading the U.S. contributions to the study, as was the case with the last IJC Great Lakes Study, the International Lake Ontario-St. Lawrence River Study, which was completed in 2006.

During FY 2011, the study team's focus was on developing an alternative to replace Plan 1977-A; the outflow regulation plan used by the International Lake Superior Board of Control since 1990. The team of plan formulators included scientists from the Hydrologic Engineering Center and the USACE Detroit District office, Michigan State University, the Great Lakes Office of Environment Canada and the University of Waterloo-Ontario. Shared vision modeling was used to guide the Study Board in their selection of the best alternative during numerous decision workshops. The recommended alternative, Lake Superior Regulation Plan 2012, provides slight improvements over Plan 1977-A particularly during extreme climatic conditions that may occur in the future. The robustness of this plan was tested under numerous hydrologic futures including those developed by the Intergovernmental Panel on Climate Change (IPCC) and stochastically generated supplies simulating 50,000 years of wet and dry scenarios.

Realizing the limitations of any regulation plan for Lake Superior, the uppermost lake in the Great Lakes system, the Board also investigated multi-lake regulation. Investigations considered the placement of control structures on the St. Clair and Niagara Rivers, as well as structures and channel modifications in the St. Lawrence River. It was found that extreme hydrologic conditions could be ameliorated with these additional structural changes. However, the costs were estimated to be in the billions and it would take decades to pursue and complete the necessary full economic and environmental studies required prior to construction. The timing for implementation triggered by a shift in the climate regime is unknown and, as such, further consideration of multi-lake regulation was not recommended by the Study Board at this time. Instead, the Board recommended that a long-term adaptive management strategy be pursued. Part of this strategy would be the establishment of a permanent Great Lakes Levels Advisory Board which would monitor Great Lakes hydrology, maintain the models developed during the Study and provide guidance to the IJC's existing control boards. Membership and support of the new Board could come from agencies such as the Corps, NOAA, USGS, Environment Canada and state and provincial offices with jurisdictions and interests in Great Lakes water levels and their impacts. Extensive public meetings were held in July and August 2011 at locations around the Great Lakes to receive input on the tentatively proposed plan, as well as, on the adaptive management strategy. Thousands of individuals attended these public meetings.

The Study is scheduled to be completed on 31 March 2012 with the Study's final report and documentation provided to the IJC prior to that date. The American Society of Civil Engineers – Environmental and Water Resources Institute (ASCE-EWRI) and the Canadian Water Resources Association have been involved in an independent peer review of the products incorporated in these final documents. An information management strategy has been developed to ensure that the Study's extensive data and models remain available after the completion of the study.

Review of Bi-national Management in International Lake of the Woods and Rainy River Watershed

The International Joint Commission established the International Lake of the Woods and Rainy River Watershed Task Force in July 2010 to help it respond to a request from the Governments of Canada and the United States for advice on how to address water quality, water quantity and related issues in the Lake of the Woods and Rainy River watershed, both now and in the future. Ms. Elizabeth Bourget of IWR was invited to serve on the Task Force. The Task Force's main tasks were to review the ways that Canada and the United States work together to manage water quality, water quantity and related issues in the watershed, to identify gaps in the current approach, to identify key existing or emerging issues that require attention, and to recommend any new or adjusted governance mechanisms that would help address the identified future needs. Governments cited a desire to ensure the long-term ecological and economic vitality of Lake of the Woods and the Rainy River watershed, and to complement their work to foster trans-jurisdictional coordination and collaboration on science and management.

The Task Force conducted extensive outreach and consultations during its one-year tenure, including through a 44-member Citizen Advisory Group, 11 public meetings, discussions with 6 bi-national entities and 26 government agencies, a joint

conference with Grand Council Treaty 3 focused on the specific concerns of dozens of Tribes and First Nations, and a meeting with the Métis Nation of Ontario. Priority issues identified included nutrient enrichment and harmful algal blooms; effects of climate change, land use development, invasive species, and water regulation decision-making; participation of First Nations, Métis, and U.S. Tribes in decision-making; and communication.

The Task Force issued its final report to the IJC on 15 July 2011. Report recommendations address five themes to improve bi-national governance for the priority issues in the watershed. These include a summit convened by the IJC to encourage the development of a watershed vision, common goals and objectives; combining two existing IJC Boards into a single International Watershed Board with a water quality mandate encompassing all boundary waters in the watershed (including Lake of the Woods); increased support for the existing International Multi-Agency Arrangement's work on water quality science efforts in the watershed; increased local participation in watershed management governance; and a review of water-level regulation on Lake of the Woods. Following public input on the Task Force report and Commission hearings, the IJC will issue its final report with recommendations to the U.S. and Canadian Governments on 30 January 2012. The IJC included the comprehensive Task Force report within its own report and encouraged the governments to review it.

World Water Council: The World Water Council (WWC) is an international association of over 400 public and private organizations involved in water-related activities. Established in 1996, the WWC includes the principal United Nations water agencies and international banks as its founding organizations. The main activity of the WWC is hosting the World Water Forum, which is held once every three years. As the main international event on water, it seeks to enable multi-stakeholder participation and dialogue to influence water policy making on a global scale, thus assuring better living standards for people all over the world and a more responsible social behavior towards water issues in line with the pursuit of sustainable development. IWR's ongoing engagement with the WWC include participating in organizational and thematic meetings associated with the 6th World Water Forum, scheduled to take place in March 2012 in Marseilles, France.

Mr. Steven L. Stockton, HQUSACE Director of Civil Works, was elected to the WWC Board of Governors in 2006 and continued to serve on the board through 2010 and 2011. Dr. Jerry Delli Priscoli (IWR) serves as the alternate and is a representative on the WWC Executive Bureau. He is also the Editor in Chief of the peer reviewed *Water Policy*, the official journal of the World Water Council. Ongoing WWC activities involve close liaison with the U.S. State Department, in particular, the Bureau of Near Eastern Affairs and the Bureau of Oceans and International Environmental and Scientific Affairs, on the dialogues and content of the WWF, so as to assist U.S. interests.

The *6th World Water Forum* will be held in March 2012 in Marseilles, France. Dr. Delli Priscoli has been appointed to serve on the international steering committee for this forum.

Pacific Environmental Security Conference

In March 2011, Dr. Jerry Delli Priscoli provided technical and institutional support to the Pacific Ocean Division and the US Pacific Command (USPACOM) with respect to the Pacific Environmental Security Conference (PESC). The PESC convened just four days following Japan's devastating earthquake and tsunami, which set the tone for the importance of the conference and exemplified the value of international, civil-military cooperation in all phases of disaster management. The conference focused on the topics of Environmental Security and Sustainability, Water Resources Management, Adaptation to Climate Change, and Disaster Preparedness. The Primary aim of the conference was to review the major environmental security issues facing the region and engage in a policy-oriented dialogue that examines joint civil-military environmental security efforts. Eighteen countries participated in the conference. Ms. Jo-Ellen Darcy, Assistant Secretary of the Army (Civil Works) was a keynote speaker at the conference and Dr. Delli Priscoli spoke on a panel addressing water and security and the civil-military role in water resource management and disaster preparedness.

Fourth Yangtze Forum

In April 2011, Dr. Jerry Delli Priscoli supported USACE Headquarters and the Pacific Ocean Division by accompanying MG Jeffrey J. Dorko, Deputy Commanding General for Military and Internation Operations at the Fourth Yangtze Forum in Nanjing, China. MG Dorko delivered a keynote address on multi-purpose water resource development in North America and the role the USACE Civil Works mission has in United States. The purpose of the forum was to convene various stakeholders within the Yangtze River basin to discuss future frameworks of action on the river.

United Nations High Level Expert Panel on Water and Disasters

In April 2011, Dr. Jerry Delli Priscoli supported USACE Headquarters, the Pacific Ocean Division, and the Japan District by accompanying MG William T. Grisoli, Deputy Commanding General for Civil and Emergency Operations to a meeting of the United National level Expert panel on Water and Disaster. The meeting took place in Tokyo, Japan. In addition to meetings with the UN High Level Expert Panel on Water and Disasters, the USACE delegation met with Ministry of Water and visited the city of Rikuze-Takata, a city of 24,000 people, which was completely destroyed by the March 2011 earthquake and tsunami.

International Center for Integrated Water Resources Management (ICIWaRM) and UNESCO Partnerships:

As part of a whole-of-government approach, the Institute for Water Resources supports the U.S. Department of State, Bureau of International Organization Affairs and U. S. Mission to UNESCO in several broad areas.

Much of the activity of both governmental and non-governmental entities is organized by the U.S. National Commission for UNESCO (USNC-UNESCO), a Federal Advisory Committee to the Department of State, and the U.S. National Committee for the International Hydrological Program (USNC-IHP), located within the USNC-UNESCO. The International Hydrologic Program is UNESCO's international scientific cooperative program in water research, water resources management, education, and capacity-building. The USNC-UNESCO established the USNC-IHP in 2006 to support UNESCO's IHP activities.

The Institute has hosted the *International Center for Integrated Water Resources Management* (ICIWaRM), an institution run by IWR and "under the auspices of UNESCO", since its creation in October 2009. It was the first UNESCO affiliated center in the United States and is still the only one in the area of natural sciences or engineering. Its mission is the advancement of the science and practice of IWRM to address water challenges through new knowledge, innovative technologies, collaborative interdisciplinary scientific research, networking, training and capacity development, within the framework of UNESCO's International Hydrological Programme (IHP).

Partnerships with Other UNESCO Centers

In support of these activities, USACE has eight Memoranda of Understanding (MOU) with UNESCO and its various program offices and selected water centers. These include an umbrella agreement with UNESCO signed in 2002; an MOU with UNESCO-IHE, Institute for Water Education, located in Delft, The Netherlands, also signed in 2002; an MOU with the Water Center for Arid and Semi-Arid Zones in Latin America and the Caribbean (CAZALAC), located in La Serena, Chile, signed in 2006; an MOU with the International Center for Water Hazard and Risk Management (ICHARM), located in Tsukuba, Japan, signed in 2006; an MOU with the Water Center for the Humid Tropics of Latin American and the Caribbean (CATHALAC), located in Ciudad de Panama, signed in 2007; and, an MOU with UNESCO-International Hydrologic Programme (IHP), signed in 2009 (this is the MOU that established the International Center for Integrated Water Resources Management at IWR).

During FY 2011, the Institute and ICIWaRM signed a MOU with the National Autonomous University of Mexico (UNAM) Water Network to support mutual cooperation and joint activities in the field of integrated water resources management, scientific research and capacity building. The MOU was signed on November 3, 2010.

In August 2011, Dr. Will Logan was invited to present a plenary talk on "Capacity Building in Water Resources Management in a Global Context" at the 3rd Annual Meeting of the National Autonomous University of Mexico (UNAM) Water Network.

Under the terms of the MOU with the National Autonomous University of Mexico (UNAM) Water Network, two members of an affiliate of the ICIWaRM, the American Society of Civil Engineers, Dr. Gerry Galloway and Mr. Kyle Schilling, conducted a Post-Flood Assessment Committee Review for the state of Tabasco, Mexico and the Water Commission of Mexico (CONAGUA). In 2007, approximately 80 percent of the Mexican state of Tabasco was inundated from record flooding, followed by near record events in succeeding years.

This most recent MOU was signed in June 2011 during a series of meetings of programs and national International Hydrologic Programme committees of UNESCO's Region 2 (Latin America and the Caribbean) Water Centers, to which ICIWaRM was invited as a participant and/or observer. Participation

in these meetings highlighted ICIWaRM's continued, and increasing, engagement with the Latin America International Hydrologic Programme in 2011.

In June 2011, the Institute and ICIWaRM signed a MOU with the Center for the Sustainable Management of Water Resources in the Caribbean Islands States (CEHICA) hosted by the Instituto Nacional de Recuros Hidraulicos (INDRHI), located in Juan Dolio, Dominican Republic to cooperate in the advancement of integrated water resources management, related interdisciplinary scientific and policy research and education, training and capacity-building for developing countries, including Small Island Developing States. The MOU was signed on June 3, 2011.

Another organization with which the Institute has a signed MOU is the Global Water Partnership Organization, an organization founded in 1996 by the World Bank, the United Nations Development Programme, and the Swedish International Development Cooperation Agency (MOU signed October 2007). The mission of the Global Water Partnership is to support the sustainable development and management of water resources. The Global Water Partnership has over 2,000 partner organizations in 153 countries, including government agencies, public institutions, private companies, professional organizations, multilateral development agencies and others concerned with water issues.

Leadership in UNESCO Sponsored Activities

During FY 2011 members of the Institute continued to support various UNESCO sponsored activities through appointments to various leadership and advisory positions.

During FY 2011, the Director of the Institute, Mr. Robert A. Pietrowsky continued his service as a member of the Governing Board of UNESCO-IHE.

Also, Mr. Pietrowsky, has been one of six permanent Federal agency members of the U.S. National Committee for the International Hydrologic Programme, and has been a member of the U.S. Government delegation to UNESCO at the IHP Intergovernmental Council (IGC) meetings in 2004, 2006, 2008 and 2010. The next meeting of the IHP Intergovernmental Council will take place in June 2012.

Dr. Eugene Stakhiv served as chairperson of the Advisory Board of ICHARM as well as serving on the Steering Committee of the Global Water Partnership (GWP).

Dr. Eugene Stakhiv continued to co-chair a UNESCO Sponsored Steering Committee tasked with preparing IWRM Guidelines at the River Basin Level to assist water resources practitioners in finding better and more efficient solutions to water resource problems.

Projects in support of UNESCO sponsored activities

In March 2011, Dr. Guillermo Mendoza, a member of the staff of ICIWaRM and Dr. Aleix Serrat-Capdevila of the University of Arizona and Mr. Stan Gibson and Mr. Chan Modini, Senior Hydraulic Engineers at the Hydrologic Engineering Center (HEC) collaborated to hold a Hydrology and Hydraulics Workshop in Asuncion, Paraguay. The workshop was sponsored by ICIWaRM in conjunction with UNESCO. The workshop was hosted by the the Centro Internacional de Hidroinformática (International Hydro-Informatics Centre, CIH), a UNESCO sponsored category 2 water center co-sponsored by Paraguay and Brazil. Technical instruction provided during the workshop included HEC-HMS (Hydrologic Modeling System), HEC-RAS (River Analysis System), and HEC-ResSim (Reservoir Simulation). The workshop also included several days of model building and simulation of the participants' reservoir management capabilities. CIH provided Spanish translations of much of the teaching materials for the course. UNESCO's Regional Center for Science and Technology for Latin America and the Caribbean funded regional participation in the workshop. UNESCO's International Hydrological Program office in Montevideo, Uruguay sponsored many of the participants from neighboring countries. Over 25 persons from Paraguay, Uruguay, Bolivia, and Chile participated in the workshop.

In September 2011, Dr. Will Logan led a four-person, interagency team in the Dominican Republic to provide direct support to CEHICA and its host organization, INDRHI (National Institute for Hydraulic Resources), in investigating rising lake levels at Lake Enriquillo. These lake levels threatened agriculture, trade, transportation and towns. The team provided INDRHI with guidance as to likely contributing causes of the lake-level rise. A final report is scheduled to be competed in FY 2012.

ICIWaRM continued to serve as the technical secretariat for its global network Water and Development Information for Arid Lands or G-WADI. The program aims to strengthen global capacity to manage water resources in arid and semi-arid regions by building an effective global community. It integrates contributions from

networks, organizations, individuals and UNESCO Category 2 centers. The G-WADI network features knowledge bases and products such as near real-time global satellite estimates of precipitation.

In June 2011, Dr. Joseph Manous participated in the UNESCO-IHP G-WADI meeting in Muscat, Oman, during which an "Arab Global Water and Development Information (Arab G-WADI) Network" was established.
During the fiscal year, ICIWaRM has been a participant in the USAID-led effort to create the President's Middle East North Africa Network of Water Centers of Excellence (MENA-NWC). This network will bring together water centers throughout the MENA region along with U.S. government agencies and universities to address some of the region's most challenging water problems.

ICIWaRM staff members continued to collaborate on implementation of the UN Secretary General's Advisory Board on Water and Sanitation/ High-Level Expert Panel on Water and Disaster (UNSGAB/HELP) action plan.

ICIWaRM co-sponsored and co-organized with ICHARM the 5th International Conference on Flood Management, held in Tokyo, Japan in September 2011. In association with that meeting, ICIWaRM participated in a meeting of the International Flood Initiative, co-sponsored panels with ICHARM on Flood Risk Management Approaches and Adaptation to Climate Change, and released a multi-lateral report on Flood Risk Management Approaches of the United States, Japan, Netherlands, and the United Kingdom.

IWR continued to provide extensive support to the World Water Assessment Program. The World Water Assessment Program (WWAP) is the flagship program of UN-Water. Housed in UNESCO, it monitors freshwater issues in order to provide recommendations, develop case studies, enhance assessment capacity at a national level and inform the decision-making process. ICIWaRM's support was primarily for its work in the areas of indicators, water policy, waterway transport and climate change adaptation. IWR facilitated the work of Dr. Gerald Galloway of the University of Maryland, who served as co-chair of the WWAP Expert Group on Policy Relevance, and Dr. Charles Vorosmarty, of the City College of New York, whose work focused on developing consistent sets of indicators for actual renewable water resources.

ICIWaRM continued to support the North American Hydrology for the Environment, Life and Policy program (HELP) basin network, through the support of Mr. George Kalli of the USACE Anchorage District office in developing a HELP monograph, to be published in FY 2012. Also, ICIWaRM worked closely with the USACE Rock Island District as a partner in the Iowa-Cedar River HELP basin.

ICIWaRM continued its engagement in an advisory role with the Peru National Water Authority (ANA) to assist in capacity building and the implementation of the new water law, but at a decreased level of involvement relative to FY 2010. The World Bank, which is co-funding the project, signed an MOU with the U.S. Department of State in March 2011, and is seeking ways to fund U.S. Government collaboration on such projects. Dr. Will Logan chaired a joint World Bank – U.S. Government working group on Water Resources Management as part of this effort.

Through a continuing collaboration between ICIWaRM academic partner University of Arizona and the International Senegal Basin Authority (Organisation pour la Mise en Valeur du Fleuve Senegal), ICIWaRM is developing a near real-time streamflow forecasting system using satellite precipitation measurements in the Senegal River Basin. Currently, there are no operational near real-time streamflow forecasts using satellite precipitation products in any large and poorly-gauged river basin. By using real time spatially explicit precipitation measurements as input to rainfall-runoff hydrological models, the objective is to provide a daily operational forecast for the management of the Senegal Basin and its reservoirs.

ICIWaRM staff members Dr. Guillermo Mendoza and Dr. Aleix Serrat-Capdevila led an effort to translate into Spanish a UNESCO sponsored Steering committee's publication series IWRM Guidelines at the River Basin Level. UNESCO's Montevideo, Uraguay office and the Inter-American Development Bank are partners in this effort and completion is anticipated in early FY 2012.

Dr. Eugene Stakhiv continued ICIWaRM's work in collaboration with the National Academy of Sciences of Ukraine, in co-organizing a meeting on "Global and Regional Climate Changes" in Kyiv, Ukraine in November 2010. This meeting was a follow on to the first U.S.-Ukrainian meeting on scientific approaches to adaptation to climate change in the water sector, including flood protection activities in the Carpathian region, co-organized by ICIWaRM earlier in 2010. With funding from CRDF Global, the initiative will continue into FY 2012.

Dr. Jason Giovannettone and Mr. Michael Wright continued work on the development of a non-proprietary Drought Atlas software product that will be freely available to countries that need such a product, particularly countries in transition located in arid or semi-arid areas. In partnership with a fellow Category 2 center CAZALAC, ICIWaRM is using the resulting product to create a complete drought atlas of Latin America, including conducting several regional workshops on regional frequency analysis and training in the software. This project was inspired by the IWR's National Drought Atlas of the U.S. — a unique source of information about the frequency, severity and duration of drought as reflected by precipitation depths and streamflows. The software is scheduled to be released for user testing and peer review in FY 2012.

During FY 2011, IWR staff member, Mr. Aaron Willis completed a five month rotation at the U.S. Agency for International Development (USAID), working with the USAID Water Team in the Washington office on a number of projects. The bulk of his time was spent in collaboration with an interagency team from USAID and the U.S. Department of Agriculture, completing an assessment of USAID/Mali water management programs to enhance the efficacy of the Feed the Future initiative in Mali.

In support of water related activities in Mexico ICIWaRM staff continued to support a project to assist Mexico to develop their National Wetlands Inventory.

ICIWaRM also sponsored a special session at the June 2011 Summer Specialty Conference of the American Water Resources Association focused on the ongoing activities underway at the Center.

ICIWaRM Participation in World Water Day Events at World Bank

On March 22, 2011, the Director the Institute, Mr. Robert A. Pietrowsky and Mr. Will Logan represented ICIWaRM at the World Bank's World Water Day. Senior U.S. government officials recognized activities that the USACE has helped support, including the establishment of a Middle East Peace Network of Water Centers.

The event was highlighted by Secretary of State Hilary Clinton and World Bank President Robert Zoellick signing a Memorandum of Understanding providing for U.S. Government support to the World Bank on water resources and related capacity development project around the world. The MOU facilitates World Bank access to experts in 17 U.S. government agencies and departments to address a wide range of water resource issues.

At an event at the World Bank few days prior to World Water Day, Drs. Joseph Manous and Rolf Olsen gave presentations at an Expert Roundtable on Urban Flood Risk Management. The World Bank's East Asia and Pacific (EAP) Disaster Risk Management (DRM) team organized the event. In addition to representatives of the Corps of Engineers, the workshop was attended by experts from NASA, FEMA, UN-HABITAT, Columbia University, the London School of Economics, and Deltares (Netherlands). The objective of the workshop was to draw on the expertise from a wide range of water management practitioners, urban planners, hydraulic engineers, risk modelers and financial experts, and to invite comments for a World Bank Working Paper on Urban Flood Risk Management as well as the Global Handbook on Urban Flood Risk Management. The handbook will provide practical technical guidance to policy and decision-makers, and technical specialists in cities exposed to flood risk. During four thematic sessions, external and internal experts focused on structural and nonstructural solutions to urban flood risk, climate change implications for decision-making process, risk financing options, and early warning systems.

Visiting Fellow at the International Center for Integrated Water Resources Management

The International Center for Integrated Water Resources Management (ICIWaRM) hosts a visiting scholar program to further its mission of advancing the science and practice of integrated water resources management (IWRM). This Visiting Scholar Program brings recognized experts in IWRM to ICIWaRM to conduct applied research and study efforts relating to technology transfer and capacity building. ICIWaRM's program addresses the science- and research-driven programmatic goals of UNESCO's International Hydrological Programme-VII. Visiting scholars at ICIWaRM therefore focus their efforts on practical science, applied research, and technology development to improve IWRM practices in developing countries. Collaboration with partners is central to ICIWaRM's mission. Visiting scholars provide support to existing UNESCO IHP programs and fellow UNESCO Water Centers. Visiting scholars also collaborate with ICIWaRM's many academic, international and non-governmental partners, as well as U.S. Government partner agencies.

In April 2011, Dr. Richard Meganck, International Program leader for Oregon State University's Institute for Water and Watersheds joined ICIWaRM as the Center's initial Visiting Scholar. Dr. Meganck's work with ICIWaRM will focus on facilitating technical and capacity development partnerships with other UNESCO water centers around the world.

Dr. Meganck is the former Director of the UNESCO Institute for Water Education (IHE) in Delft, Netherlands. Prior to that appointment Dr. Meganck was Director of the UN International Environment Technology Center and Director of the Regional Seas Program for the Caribbean with the UN Environment Program. Dr. Meganck has also served as the Director of Sustainable Development and Environment with the Organization of American States. Dr. Meganck began his professional career as a Peace Corps volunteer in Latin America.

ICIWaRM Hosts Pakistan Water Delegation

In March 2011, in support of the Office of International and Interagency Affairs at USACE Headquarters and the U.S. Department of State, members of the ICIWaRM hosted a delegation of Pakistani water resources professionals. The visit to ICIWaRM focused on water resources management in Pakistan, and resulted in an exchange of ideas for collaboration with respect to their National Flood Management Analysis Report. Much interest was expressed by all parties and data was shared to continue to work together on integrated flood management analysis of the Indus River basin.

Dutch Rijkswaterstaat Exchange: The USACE and the Dutch Rijkswaterstaat (RWS) have a long standing Memorandum of Agreement, originally signed in May 2004. This partnership aims to promote and facilitate collaborative efforts that benefit the integrated water resources management policies of both countries. The USACE and RWS will cooperate in research, development, testing, evaluation and information exchange.

During FY 2011, the relationship between the Corps and the continued to be extremely productive and further strengthened.

The USACE and RWS participated in a technical staff exchange related to levee and dam safety, evidenced by the appointment of a Mr. Alex Roos, Senior Advisor at the RWS to the Risk Management Center in Denver, Colorado as the Risk Management Center's inaugural International Fellow. The investigation of levee and dam safety was subject area of investigation of several joint meetings through the year in both the U.S. and the Netherlands.

In March 2011, members of the staff of the Institute participated in a series of meetings with senior officials from the Dutch Rijkswaterstaat (RWS) in Washington, DC. Mr. Nate Snorteland, Director of the Risk Management Center and Mr. Alex Roos, RWS Senior Advisor on appointment to the RMC, met with senior Dutch officials including Mr. Jan Hendrik Dronkers, Director General of RWS, Dr. Luitzen Bijlsma, Managing Director of the RWS's Water Management Center, and Harry Baaijen, Managing Director of Deltares. Among the topics discussed during these meetings was the status of the two Nations bilateral partnership on levee safety, the current status of technical staff exchange and the technical and policy differences on levee safety between the U.S. and the Netherlands.
IWR staff also participated in a meeting of the USACE-RWS Memorandum of Agreement Executive Steering Committee. The status of ongoing partnership activities was discussed, along with identification of other future opportunities for partnering. Priorities for FY 2012 were addressed, including the staff exchange of a Risk Management Center subject matter expert Needham to be appointed to the RWS. Further, the Executive Steering Committee also explored the willingness of both parties to provide joint technical assistance in support of an ex-post analysis of the Japanese earthquake and tsunami disaster which occurred in March 2011. The Dutch delegation continued their U.S. visit by travelling to California where they meet with Federal and state officials working in the San Francisco Bay-Delta.

In September 2011, a delegation from the Dutch Delta Commission visited the Corps of Engineers to discuss the use of bypasses and floodways during the 2011 Mississippi River floods, the organization and experiences of flood-fighting efforts, communication efforts during the event, the possibility of cooperation between the Dutch Delta Program and the U.S. National Committee on Levee Safety and governance issues in the Netherlands and the U.S.

The USACE and the RWS, in partnership with the Japanese Ministry of Land, Infrastructure, Transport and Tourism and the United Kingdom Department of the Environment published a report addressing international flood policies. The report entitled *"Flood Risk Management Approaches as Being*

Practiced in Japan the Netherlands, the United Kingdom, and the United States" (IWR Report 2011-R-08, dated September 2011) was presented at the 5th International Conference on Flood Management in Tokyo, Japan in September 2011. The report focused on how flood risk is addressed in Japan, the United Kingdom, the Netherlands and the US.

The manuscript for Bridging the Pond (Key Decisions in Water Management: A Dutch-US Retrospective) was completed in FY 2011, with an anticipated publication date in 2012. The book explores how water management evolved within the two countries over the course of the last two hundred years.

A renewed interest in navigation was established through PIANC channels this year resulting in a new USACE/RWS exchange team being formed.

USACE also agreed to join the Storm Surge Barrier group this year. This is an international exchange that was spearheaded by the Dutch a few years ago for managers to share lessons learned on matters related to large-scale storm protection structures.

Japanese Ministry of Land, Infrastructure, Transport, and Tourism: USACE participates in an ongoing technical exchange program with the Water and Disaster Management Bureau (formerly the River Bureau) of the Japanese Ministry of Land, Infrastructure, Transport and Tourism (MLIT). The program is governed by an Implementing Arrangement (IA) under the *"Agreement between the Government of the United States of America and the Government of Japan on Cooperation in Research and Development in Science and Technology"*, signed in Toronto, Canada on June 20, 1988, as amended and extended. The IA was signed by the USACE Chief of Engineers at the Third World Water Forum in Kyoto, Japan in March 2003, and renewed for an additional five-year term on 26 February 2008. The IA names the Chief of Hydrology and Hydraulics at the St. Louis District as the Technical Program Officer (TPO), responsible for the technical exchange on behalf of the USACE and names the Director of Civil Works as the oversight authority for the exchange. The national project management oversight authority has been delegated to IWR and within the Institute to HEC. To date, the exchange has consisted of annual technical exchange meetings alternating between sites in the U.S. and Japan and facilitation of requests for information between USACE and the Water and Disaster Management Bureau.

Under the auspices of the agreement with MLIT, Mr. Leonard Hopkins, the USACE TPO, and Mr. Tom Evans of HEC Water Management Systems Division, took a USACE delegation headed by Civil Works Director Steve Stockton, to Tokyo, Japan in September 2011 to attend a technical exchange meeting. Topics discussed at technical sessions included "*Recovery and Reconstruction from Mega Disasters*", "*Response to Large-Scale Disasters*", and "*Concepts of Project Evaluation*". Both agencies handled responses to large-scale events in 2011—the Great East Japan Earthquake and Tsunami for MLIT and the Mississippi and Tributaries floods for USACE—and the wide-ranging discussions following the formal presentations gave both sides ample opportunity to discover similarities and differences in their methods and experiences in water-related emergencies. This year's meeting coincided with the 5th International Conference on Flood Management (ICFM5) and members of both delegations attended that conference as well.

The U.S. and Japanese delegations agreed to hold their next meeting in Portland, Oregon. Because of an unusual degree of uncertainty regarding budgets and staff availability at both USACE and MLIT, scheduling and selection of topics for the next meeting was deferred. The TPOs will address this early in CY 2012.

In October 2010, two members of the staff of the Institute, Drs. Jerome Delli Priscoli and Kate White accompanied the Honorable Jo Ellen Darcy, Assistant Secretary of the Army for Civil Works at the 8th Ministers Forum on Infrastructure Development in the Asia-Pacific Region, held in Tokyo, Japan. The theme of the forum was "Adaptation of Infrastructure to Increasing Water Related Risks under the Influence of Climate Change." The meeting was hosted by the Ministry of Land, Infrastructure, Transportation and Tourism.

Dr. Delli Priscoli, a senior policy advisor at the Institute, delivered a presentation on international water development issues and Dr. White, a senior lead on global and climate change efforts at the Institute, delivered a presentation on climate change impacts and adaptation related to water resources.

International Technical Reimbursable Activities: In FY 2011, the Hydrologic Engineering Center was involved in a wide range of international activities. Listed below are examples of a few of these activities.

Afghanistan: During FY 2010 and FY 2011, staff from HEC participated in the Watershed Assessments for Afghanistan Project. The Watershed Assessments for Afghanistan project is a collaborative project led by the Corps' Transatlantic Division office with multiple districts participating and local experts with the objective of locating and analyzing potential dam and reservoir sites. Initially, HEC analyzed potential dam and reservoir sites in the Helmand basin but then assisted in other provinces as well. The goal of the project was to identify possible small dam sites (5- to 10-meter high) for impoundment of water for seasonal irrigation and micro-hydropower generation. The location of the sites was made based on snowmelt and precipitation records, and terrain, soils and land use data. The identification of the sites is preliminary, as a full geotechnical evaluation for proper site selection was not performed at this time. The focus on the smaller basins is so that local communities can operate and maintain these structures. There is no intention of providing flood protection. Instead the idea is to retain a portion of the seasonal runoff that can then be metered out over a longer growing season for the production of more and better crops. The landscape within a total of twenty-seven provinces was evaluated and 733 potential dam sites initially recommended. This project set the bar for the ability of multiple offices of the Corps to work together.

Iraq**:** In FY 2011, HEC entered into a contractual agreement with an American firm, Exponent, Inc., to support the second phase of the Strategy for Water and Land Resources of Iraq (SWLRI) project. The objective of the SWRLI project is to define the strategy and the related investment plan that will guide the sustainable management and development of the water and land resources of Iraq for the next two decades (from 2010 to 2030). HEC assisted in providing technical assistance on the construction and use of the reservoir simulation tool HEC-ResSim which was initially developed by HEC for the Tigris and Euphrates basin through Iraq for real-time forecasting and water management operation.

Mongolia**:** In October 2010, Mr. Jeff Harris and Mr. Cameron Ackerman participated in a training course held in Ulaanbaatar City, Mongolia. This class provided GIS training. During the training, Mr. Harris and Mr. Ackerman had the opportunity to go into the field to collect data for use in developing an HEC-HMS (Hydrologic Modeling System) rainfall-runoff model and HEC-RAS (River Analysis System) hydraulic model of the Selbe River Basin. These models developed from data collected during the October visit were then used in an HMS and RAS training class conducted by Mr. Harris and Mr. Ackerman in Ulaanbaatar City in January, 2011. Representatives from multiple Mongolian Flood control and disaster related agencies participated as well as academics. The models were used as a teaching tool and then turned over to the agencies for their future use.

Kazakhstan: Mr. Cameron Ackerman participated in a Civil Military Emergency Preparedness (CMEP) program workshop in Shymkent, Kazakhstan in September 2011. The workshop concentrated on Hydrology, Hydraulics, GIS and dam break analysis. Mr. Ackerman presented data on GIS and performing dam break analysis with the River Analysis System (HEC-RAS) software. This workshop provided opportunities and technology to the participants and provided hands on experience.

UNESCO: Mr. John Hickey, Senior Hydraulic Engineer, attended the UNESCO International Workshop on Challenges and Solutions for Dam Re-operation held at UNESCO Headquarters in Paris in October 2010. The workshop consisted of a small group of professionals from around the world working with reservoir operations for environmental purposes presenting their efforts in hopes of identifying characteristics that are common to successes and failures. Mr. Hickey and Mr. Andy Warner of The Nature Conservancy presented the Sustainable Rivers Project as a case study for North American Rivers/Flood Control Reservoirs.

World Meteorological Organization (WMO): Dr. William Scharffenberg, Hydraulic Engineer, represented the United States at the Workshop on the Intercomparison of Flood Forecasting Models held in Koblenz, Germany during 14-16 September 2011. The workshop was part of the WMO Flood Forecasting Initiative. The WMO Flood Forecasting Initiative focuses on improving flood forecasting by the National Hydrological Services (NHSs) through the publication of guidance documents on best practices for flow monitoring, hydrological simulation, and related topics. During the workshop, a task team was created to produce a guidance document that will help the NHSs select a hydrological simulation tool (software) that meets their forecasting needs within the confines of their geographic environment and data availability. Because of his role as the lead developer of HEC-HMS and familiarity with other simulation tools, Dr. Scharffenberg was selected to chair the task team and play a prominent role in editing the output guidance document. The task team is scheduled to complete the output guidance document in time for the

Commission on Hydrology XIV which will be held in Geneva, Switzerland in November 2012.

International Joint Commission: HEC provided technical support to activities led by the International Joint Commission (IJC) at the request of another Corps office. Since 2006 HEC has contributed specialized expertise to the International Upper Great Lakes Study, managed by IWR, for modeling of upper lakes routing and Lake Superior regulation and alternate plan formulation. In addition to project work through field offices and IWR, HEC supported other IJC initiatives. For example, HEC participated in a workshop regarding the IJC's International Watersheds Initiative.

Columbia River Treaty: HEC is a participating study team member for the Columbia River Treaty (CRT) 2014/2024 Study. The CRT is an agreement between the United States and Canada. The purpose of the CRT, which became effective in 1964, is to provide flood control and power benefits to U.S. and Canadian regions. HEC supports the study project development team, including the Hydrology and Hydraulics, Plan Formulation and Integration sub-teams, provides technical and policy guidance, coordination and development of the HEC-WAT and HEC-ResSim software features specific to CRT and provides overall risk assessment methods to the CRT team.

PIANC – The World Association for Waterborne Transport Infrastructure

When it was founded in 1885, PIANC was the Permanent International Association of Navigation Congresses. Over the years, the Association has changed its name several times, but has retained the PIANC acronym. PIANC's current name is The World Association for Waterborne Transport Infrastructure. It is an international association composed of governments, private sector companies, academics, and individual professionals that works to advance the sustainable development of maritime and inland navigation. As a non-political and non-profit organization, PIANC brings together the best international experts on technical, economic, and environmental issues pertaining to waterborne transport infrastructure. International working groups provide guidance to public and private partners through high-quality technical reports on pressing global navigation issues.

The U.S. has been a national member of PIANC since 1902, and USACE provides leadership and secretariat support to PIANC. PIANC USA organizes and holds technical conferences, an Annual Meeting, and participates in the PIANC International Annual General Assembly (AGA).

PIANC USA Management Structure: The United States National Commission constitutes the governing body of the U.S. Section. In 2011 the ex-officio officers of the U.S. National Commission were: Chair, The Honorable Jo-Ellen Darcy, Assistant Secretary of the Army (Civil Works); President, Major General William T. Grisoli, U.S. Army Corps of Engineers' Deputy Commanding General for Civil and Emergency Operations; Secretary, Ms. Anne Cann, U.S. Army Corps of Engineers. The other eight members of the U. S. National Commission were: Mr. James McCarville, Vice President representing the Eastern Region and Executive Director of the Port of Pittsburgh Commission; Dr. Robert Engler, Vice President representing the Central Region and Senior Environmental Scientist, Moffatt and Nichol; Mr. Dale Miller, Vice President representing the Western Region and Vice-President, Tetra Tech; Mr. John Headland, Senior Vice President and Regional Manager, Moffatt and Nichol; Mr. Dave Sanford, Director of Navigation Policy and Legislation, American Association of Port Authorities; Dr. Craig E. Philip, President and CEO, Ingram Barge Company; Mr. Dominic Izzo, Project Director, KBR; and Ms. Helen Brohl, Director of the Executive Secretariat of the Committee on the Marine Transportation System. The U.S. Commission held two meetings in 2011 (in January at the Transportation Research Board's meeting in Washington, D.C., and at the Smart Rivers Conference in September in New Orleans, Louisana).

In 2011, the PIANC Executive Committee (ExCom) and Council nominated a new Vice President to serve amongst their ranks. The U.S.'s Mr. Shiv Batra's (Tetra Tech) term as the Western Hemisphere Vice President ended and the U.S. Section's nomination to replace him, Mr. John Headland (Moffatt & Nichol), was accepted.

Presidential Election: The US Section was delighted to participate in the 2011 historic PIANC Presidential election by putting forth a candidate, Mr. James McCarville of the Port of Pittsburgh Commission (Eastern Region Vice President on the PIANC USA Commission). For over thirty years, Mr. McCarville has been an advocate for waterborne transportation and has worked both in the US and internationally. The election took place during the AGA in Berlin, Germany, even going to a second round with the United States and France as the two

finalists. In the end, the US Section was happy to congratulate the winner, Mr. Geoffroy Caude from France. It was an exciting event in the history of PIANC since this was the first time an election has been held for the position of PIANC President.

Annual Meeting: More than fifty people gathered in June 2011 to hear technical presentations at PIANC USA's sponsored session at the US Army Corps of Engineers' Infrastructure Systems Conference in Atlanta, Georgia. PIANC USA leadership including The Honorable Jo-Ellen Darcy and Dr. Robert Engler provided opening remarks to the conference attendees, and Ms. Anne Cann spoke about PIANC and the US Section. Two US Section working group members gave technical presentations on PIANC reports: "Innovations in Navigation Lock Design" and "Water Injection Dredging and Nautical Depth." PIANC USA also had a booth in the conference exhibit hall, with more than eighteen-hundred people strolling by to learn about PIANC, talk to Commissioners, and review copies of the featured working group reports. It was a wonderful opportunity for outreach and to spread the word about PIANC and the latest advancements in the field of inland and maritime navigation and ports.

Smart Rivers Conference: PIANC USA welcomed almost 300 of the world's top professionals in all aspects of inland and river transportation to New Orleans September 13-16 for the Smart Rivers 2011 Conference. Attendees came from more than 20 nations and included private sector, government, and academic participants. This international conference included nearly 100 technical presentations on a diverse array of topics such as systems/technology; environmental management; safe operations; service design and innovation; public policy and finance; and infrastructure and network management. The main objective of the conference was to analyze the latest trends in policy, technology, and innovation in the field of inland waterway transportation.

The opening plenary focused on the Inner Harbor Navigation Canal (IHNC) Hurricane Surge Barrier in New Orleans, the largest surge barrier of its kind in the world. Later in the week, conference attendees had the opportunity to view the entire New Orleans Hurricane and Storm Risk Reduction System, including the IHNC Surge Barrier, on a technical tour organized by the U.S. Army Corps of Engineers, New Orleans District. Conference luncheons featured keynote presentations by Mr. Roland Hoerner, President of the European Federation of Inland Ports, who discussed the significant role of inland ports for hinterland transportation, and Mr. Felipe Menendez, CEO and President of Ultrapetrol Ltd., who discussed the long term prospects of the Hidrovia Region in South America. The conference ended with a closing plenary keynote address by Rear Admiral Roy Nash, Commander, 8th U.S. Coast Guard District; a discussion of the future of Smart Rivers by Mr. Geoffrey Claude, President of PIANC International; the signing of the Smart Rivers merger agreement; and a look ahead to Smart Rivers 2013.

The Smart Rivers Conference organizers wanted to enhance the conference experience for Young Professionals and students by providing them with opportunities to network with each other and industry leaders. Over sixty young professionals participated in the conference, and PIANC USA was able to provide travel scholarships to support seven students to participate in the conference.

The conference also had excellent support and participation from the waterways industry, with more than twenty exhibitors and sponsors, and more than thirty cooperating organizations. Industry participants such as Ingram Barge Company organized vessel tours, and there were technical visits to the U.S. Coast Guard Vessel Traffic Center, the AEP River Operations fleeting operations center and Zennoh Grain facility in Convent, Louisiana.

The main conference was preceded by workshops on Innovations in Navigation Lock Design (PIANC's working group report); Sediment Management Solutions for Ports and Waterways; and Lock Operations Management Application. In addition, the American Society of Transportation and Logistics organized a full day Yangtze-Mississippi Rivers Forum to continue an ongoing dialogue between U.S. and Chinese private and public entities regarding the use of inland waterways.

InCom Working Group Visit to Portland, Oregon: PIANC USA hosted InCom Working Group 139 'Values of Inland Waterways' in Portland, Oregon, in June, 2011. The group co-located its meeting with the Waterways Committee of the Coasts, Oceans, Ports and Rivers Institute of American Society of Civil Engineers (ASCE/COPRI) in order to share expenses and knowledge through networking and technical exchange. The groups participated in a technical tour of the Bonneville Lock and Dam and the John Day Lock and Dam on the Columbia River, hosted by the U.S. Army Corps of Engineers' Portland District. The participants particularly impressed with the fish ladders and hatchery, as well as the new lock gate recently installed at the John Day lock. It was a great opportunity to visit

impressive examples of inland navigation facilities and to view first-hand the extensive protective measures that enhance fish migration and survival on the Columbia River.

Newsletter and Website (**www.pianc.us**): PIANC USA produces a bi-monthly electronic newsletter containing information on the US Section's events, members and partners, as well as industry news of interest to those working in the navigation community. The website and newsletter serve as the main source of communication to the members and others in the industry. Ms. Kelly J. Barnes, U.S. Army Corps of Engineers, is the editor of the PIANC Bulletin.

Representatives to Commissions: The U.S. Section is represented by Principal and Co-Principal Members of the Commissions managing technical working group activities. In 2011 the U.S. representatives were:

- **Environmental Commission** — Dr. Susan Rees, U.S. Army Corps of Engineers, Mobile District; Dr. Todd Bridges, U.S. Army Corps of Engineers, ERDC. Young Professional Representative: - Ms. Sandra Brasfield, U.S. Army Corps of Engineers, ERDC.
- **Inland Navigation Commission** — Mr. John Clarkson, U.S. Army Corps of Engineers, Huntington District; Mr. William Ronald Coles, WR Coles and Associates.
- **Maritime Navigation Commission** — Mr. E. Dan Allen, Moffatt and Nichol, and Mr. Vahan Tanal, Vahan Tanal Consulting.
- **Recreational Navigation Commission** — Mr. Robert Nathan, Moffatt and Nichol; Mr. Jack C. Cox, HDR. Young Professional Representative: Ms. Jessica McIntyre, Moffatt and Nichol.
- **International Cooperation Commission** – Mr. David Grier, U.S. Army Corps of Engineers; Mr. Bengt Bostrom, Consultant. Mr. Edward Schmeltz, AECOM, serves as the Chair of the Commission.
- **Promotion Commission** – Mr. Nicholas Pansic, MWH; Ms. Kelly Barnes, U.S. Army Corps of Engineers.
- **Young Professionals Commission** – Ms. Jessica McIntyre, Moffatt and Nichol.

Technical Working Group Reports Completed in FY 2011: In 2011, three Working Group Reports were published. The reports are listed below along with the name of the U.S. Representatives.

MarCom 113-2011 (Application of Geosynthetics in Waterfront Areas)—Doug Gaffney, Ocean & Coastal Consultants, Inc.
MarCom 114-2011 (Stability of Pattern Placed Revetment Elements)—Margaret Boshek, RETEC Group
EnviCom Task Group 2 (Towards a Sustainable Waterborne Transportation Industry) – Keith Hofseth (Chair of WG) USACE, Alfred Cofrancesco USACE, Nick Pansic MWH

New Technical Working Groups formed in FY 2011: In 2011 seven new Working Groups were formed. The groups are listed below along with the name of the U.S. Representatives.

InCom 154 (Mitre Gate Design and Operation): Jerry Castro USACE; Thomas E. Hood, USACE; Michael Hough (YP), TetraTech INCA
InCom 155 (Ship Behaviour in Locks and Lock Approaches): Richard Styles, USACE; Terry Sullivan, USACE
InCom 156 (E-Navigation for Inland Waterways): Richard Lockwood USACE, Jeff Lillycrop USACE, Brian Tetreault USACE
MarCom 158 (Masterplans for the Development of Existing Ports):
MarCom 159 (Renewable Energy):
MarCom 161 (Interaction Between Offshore Wind Turbines and Navigation): George Detweiler USCG(ret), Ron Hefron, Moffatt & Nichol
EnviCom 157 (Environmental Aspects of Dredging and Port and Waterway Construction Around Coastal Plant Habitats): Deborah J. Shafer University of Maryland; William Hanson, Great Lakes Dredge and Dock Company; John Henricksen (YP), Manson Construction

IWR and U.S. Section PIANC Coordination with the Organization of American States, Inter-American Committee on Ports: During FY 2011, members of the Institute, through the U.S. Section-PIANC, participated in the OAS-CIP XII Executive Meeting of the Executive Board, held in March 2011 in Viña del Mar, Chile. The OAS-CIP also co-sponsored along with PIANC-US the "Smart Rivers 2011 Conference" held in New Orleans, Louisiana in September.

The CIP serves as a permanent Inter-American forum for port related issues among the 34 member states of the OAS. Its purposes include serving as the principal advisory body of the OAS on all topics concerning development in the port sector. It proposes and promotes hemispheric cooperation policies, improvements and port sector cooperation

agreements, and the collection and dissemination of data and information. The U.S. delegation to the OAS-CIP is led by the U.S. Maritime Administration (MARAD), under guidance of the State Department, and with participation by the Coast Guard, EPA, and the Corps (through observer status for PIANC-US). The CIP currently has four active Technical Advisory Groups (TAGs). These include Port Operations, Port Security (chaired by the U.S.), Navigation Safety, and Environmental Protection. The U.S. became a new member of the TAG on Environmental Protection in 2007 and is now a member of all four TAGs.

The U.S. Section-PIANC is engaging the CIP to explore opportunities to share expertise on port management, development of common standards, improving dredging technology, addressing ballast water issues, and potentially assist plans for inland waterway development in the Amazon and Parana-Paraguay river basins. IWR, through PIANC-US, plans to participate in three CIP meetings in FY 2012, including the Seventh General Assembly of the CIP and XIII Meeting of the CIP Executive Board, scheduled to take place in March 2012 in Lima, Peru, and the Third Hemispheric Conference on Port Environmental Management, scheduled to take place in Montevideo, Uruguay, in May 2012. Mr. David Grier, U.S. Army Corps of Engineers, serves as the PIANC USA Latin American liaison.