Building Strong Collaborative Relationships for a Sustainable Water Resources Future

National Report
Responding to National Water Resources Challenges

Draft

December 2009
The findings contained in this report are based on the information collected from the assessments, interviews and the regional and national conferences for this initiative and should not be construed as an official Department of the Army position, policy or decision unless so designated by other official documentation.
Building Strong Collaborative Relationships for a Sustainable Water Resources Future:

National Report
Responding to National Water Resources Challenges

Draft

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Executive Summary

ES.1 Purpose and Objectives

The U.S. Army Corps of Engineers (hereafter the Corps) engaged in an objective assessment of states’ water planning in 2008 to 2009 to identify common water resources needs and opportunities for enhanced collaboration with states and Federal agencies to leverage joint resources for national water planning. The effort is called Building Strong Collaborative Relationships for a Sustainable Water Resources Future (hereafter Collaborating for a Sustainable Water Future). This assessment builds on a series of Listening Sessions the Corps conducted around the Nation between June 2000 and January 2001 to glean the major water resources challenges facing America. It follows on other assessments that described critical water resources needs, including the 1999 report by the National Academies’ National Research Council, New Strategies for America’s Watersheds, a series of Water Policy Dialogues sponsored by the American Water Resources Association between 2002 and 2008, and the 2006 and 2008 reports by the Western Governors’ Association (e.g., Water Needs and Strategies for a Sustainable Future: Next Steps, 2008).

The assessment conducted under the Collaborating for a Sustainable Water Future initiative aimed to identify key water resources challenges, needs and critical priorities among the 50 states, the major programmatic water resources activities within the Federal government agencies, and opportunities for collaboration; to build support among a national team consisting of Federal resource agencies, interstate organizations/river basin commissions, tribal governments, and non-governmental organizations (NGOs) in support of doing more integrated water resources management; to improve dialogue about key challenges and ways to meet them; and to gain support for a shared database in the form of a Federal Support Toolbox of information deemed useful in helping states in their water resources planning. This report is an interpretation of what participating Federal, tribal, state, interstate, and NGO representatives expressed during the course of this assessment.

The Corps led the Collaborating for a Sustainable Water Future initiative as a facilitator, coordinator, integrator, and convener of substantive conversations about a new way forward. This report provides recommendations and proposed actions based on objective review of states’ and Federal agencies’ water planning and management documents, interviews with selected state and Federal water officials, and discussions at three regional conferences (Eastern Region in Orlando, Florida, in February 2009, Western Region in Kansas City, Kansas, in April 2009, and Central Region in St. Louis, Missouri in June 2009). The discussion offered in this report also highlights recommendations that were proffered by Administration, Federal, and Congressional officials and attendees representing states, interstate organizations, tribes, and NGOs at a National Collaborative Water Resources Conference held in Washington, D.C., in August 2009. Summaries of state water resources planning activities and interviews with key state water resource agency personnel, regional trends reports, conference proceedings, fact sheets, a Federal Agency Assessment report, and PowerPoint briefings were developed to codify research findings and discussion; some of them are posted on a website (www.building-collaboration-for-water.org).
ES.2 Themes

Based upon data, information, and participant input obtained during the course of the Collaborating for a Sustainable Water Future initiative, eight major overarching themes emerged as courses of action to facilitate more collaborative and effective management of our Nation’s water resources. These themes and primary recommendations are identified below:

1. Integrated Water Resources Management (IWRM)
   Recommendation: Make Integrated Water Resources Management (IWRM) more understandable and a preferred way to plan and manage public water and related land resources as a system.

2. Future National Water Resources Direction
   Recommendation: Foster continued dialogue about a national (not Federal) water vision and create support for drafting a national vision and/or regional vision(s), and supporting policies and strategies.

3. Governance and Management
   Recommendation: Strive to reshape organizational structures and means to improve water resources management, decision making, and evaluation in ways that build the public will to act for integrated water resources planning and management.

4. Collaboration
   Recommendation: Promote opportunities and mechanisms for collaborative water resources planning and management.

5. Water Resources Investment Strategies
   Recommendation: Promote innovative and sustainable financing mechanisms for public water resources solutions, including water infrastructure, at Federal and state levels.

6. Managing Extreme Events
   Recommendation: Increase the ability to anticipate and manage natural and man-made disasters and climate change impacts.

7. Technology Transfer and Knowledge Capacity Building
   Recommendation: Base water resources plans and decisions in good science and information and technology sharing and increase scientific and management knowledge and capability at all government levels.

8. Enhanced Water Resources Leadership and Education
   Recommendation: Enhance the ability of public officials at all levels to understand and communicate priorities for water resources investments, raise awareness, and build stewardship for responsible water management.

For each recommendation, proposed actions that could be taken to advance water resources planning and management are presented in Section 4 of the report.
ES.3 Conclusions

The results of the assessment conducted under the Corps’ *Collaborating for a Sustainable Water Future* initiative highlighted the states’ need for more funding; for access to more complete, current, and comprehensive data and information about water resources conditions, use, availability, planning, and management; and for more integrated water resources management to address and balance a myriad of water and related land resources and their uses. The Federal government can take the lead in helping the states meet these needs through collaboration and a refocusing of some Federal programs.

Resource constraints may be the greatest handicap to moving forward toward a sustainable water resources future, although shortages provide the impetus for pooling resources through partnerships. The recommendation most often cited throughout the assessment was the need for funding to address water resources challenges. The funding situation is complex and complicated by legal mandates, authorities, precedents, and political realities. Mechanisms must be found to fund research and development, data collection and analysis, information sharing, professional meetings, and monitoring and protection of resources. What is needed first and foremost is to share information, examples (good and bad), best practices, lessons learned, and approaches for collaboration. Identifying the funds and mechanisms to create common data portals to enable access to those who need the information for their planning will facilitate developing ideas and plans for action. Funding must be sustained to develop the tools and processes that build the data, information, and knowledge for water resources planning.

The Federal government has a wealth of information and insight to share. The states have invaluable lessons learned that merit sharing with counterparts across borders. The means must be found to enable mutual sharing and learning. The states certainly have grown their water resources competency and can and have put together statewide water plans based on comprehensive and rigorous data collection and analysis. The states nonetheless call for Federal assistance to advance their planning at local, regional, and statewide levels.

Integrated water resources management (IWRM) is an ideal toward which to strive in order to manage multiple stakeholders intent on multiple water uses through multiple objectives for more balanced benefits. Robust concepts and models for IWRM hold the promise to manage the true complexity and interdependencies that exist for water managed at a watershed scale. Integration can bring economy of effort and save resources to enable government at all levels to do more with fewer resources. Sustainable water resources management is more likely to emanate from processes and models that are robust enough to address growing water uses and users as the world becomes more complex. Sustainability will take clear policies, roles, responsibilities, definitions, examples, and feedback. It will take technical assistance. The Federal government can provide such assistance to help states develop comprehensive and integrated plans at local, regional, and statewide levels.

A *Federal Support Toolbox* of Federal authorities, technical tools, and scientific and management information would facilitate Federal agencies in supporting water planning across the Nation. There are opportunities to begin collaborating: the need for a national water vision and unified policies requires continued conversation; governance issues must be addressed to clarify roles and responsibilities; data and information must be probed and shared to improve
understanding and mitigation of climate change impacts; implications of risk must be effectively communicated and built into decision models; and vehicles by which to share information across levels of government must be developed.

The Federal government, tribes, states, interstate organizations, and non-government organizations have important roles in the stewardship of our Nation’s water resources, which can be made even more effective through collaboration or joined roles. Appropriate roles and responsibilities for water planning and management can be more clearly defined. The Federal government has a legitimate role to ensure quality control and equity across groups, especially to protect the disadvantaged. The Federal government also has access to resources that can make a difference for research and development. A major role for the Federal government is to collect, manage, and provide access to aggregated databases for the wide spectrum of water and related land resources information and analyses. Having the Federal government assume the role as integrator may be appropriate role to foster IWRM. Many participants of this initiative extolled the supporting role of the interstate organizations as vanguards in furthering integrated approaches and outcomes. The lack of an appropriate governance mechanism at the Federal level, however, is a hindrance for integration across agencies and programs.

The Corps will continue to be a facilitator to move forward the collaborative dialogue about the Nation’s water challenges and ways to address them. The ideas and recommendations gained from this assessment will be presented to decision makers. The Corps should continue the dialogue with a national team of strategic allies joined by shared goals for the protection and enhancement of Nation’s water resources.
Section 1
Introduction

Building and sustaining a healthy environment, vital economy, high quality of life, and stable security for the homeland requires good planning and management of natural, fiscal, physical, social, human, and intellectual resources. Water resources management is integral to these objectives. States face growing challenges at multiple and interrelated scales for many water resources objectives with diverse stakeholders. Understanding the challenges faced by states and how they approach their water planning, sharing best practices and lessons learned, and finding ways to build a national water resources team from state to Federal levels can go far to preserve critical water and related land resources in today’s constrained fiscal environment.

The focus of the initiative that generated this report is building synergy collaboratively to address water systems holistically. Upon taking office, President Barack Obama issued a Memorandum for the Heads of Executive Departments and Agencies for Transparency and Open Government to promote public trust through transparency, public participation, and collaboration in the spirit of having openness strengthen our democracy and promote efficiency and effectiveness in government (the Executive Order can be found at http://www.whitehouse.gov/omb/assets/memoranda_fy2009/m09-12.pdf).

The Corps engaged in an objective assessment of states’ water planning in 2008 to 2009 to identify common needs and opportunities for enhanced collaboration with states and Federal agencies to leverage joint resources so as to do more or better for national water planning. The Collaborating for a Sustainable Water Future assessment builds on a series of Listening Sessions the Corps conducted around the Nation between June 2000 and January 2001 to glean the major water resources challenges facing America. It follows on other assessments that described critical water resources needs, including the 1999 report by the National Academies’ National Research Council, New Strategies for America’s Watersheds, a series of Water Policy Dialogues sponsored by the American Water Resources Association between 2002 and 2008, and the 2006 and 2008 reports by the Western Governors’ Association (e.g., Water Needs and Strategies for a Sustainable Future: Next Steps, 2008).

Why have these and many similar recommendations not been implemented? Perhaps a new approach is needed. The states certainly are moving in the direction of more comprehensive and integrated planning within their borders and collaborations and compacts across their boundaries. They realize, however, that they cannot do their planning without considering others. Collaboration and leadership are needed.

The objective of the Corps’ initiative is to build a sustainable water future through integrated water resource management and collaboration, i.e., to breed partnerships that can leverage resources, including data and information, best practices, lessons learned, and funding, in recognition that no single state or agency can tackle the growing complexity of water needs fully on its own — especially in the face of potential climate change impacts (e.g., severe droughts, flooding, etc.). As Mr. Steven L. Stockton, Director of Civil Works for the U.S. Army Corps of Engineers and leader for this initiative, stated, “This project is not about the Corps of
Engineers taking over planning responsibility from the states. It is about facilitating all interests to work together to solve common problems and to share responsibility.” A national— not Federal—initiative is needed. Water planning may be more successful if local objectives and initiatives are developed through an integrated water resources management framework or a regional watershed perspective within the context of a national vision for water sustainability that integrates needs, stakeholder interests, policies and programs, and scalable information on many levels, especially at the local level where implementation makes the difference.

Bringing resources from multiple levels to bear on common aims may move water resources solutions further, faster and better. Listening to Federal, state, interstate, tribal, and non-government stakeholders, and linking and leveraging the resources they bring to the table may be an astute water management strategy for the 21st Century. Comprehensive assessment of water resources use, availability, and conditions; policies that encourage planning at a broad watershed scale and within a systems context; active partnering; better coordination with and across Federal agencies; and shared views and values for effective water resources management and the policies needed to bring it to fruition have been recommended before.

The Corps led this initiative as a facilitator, coordinator, integrator, and convener of substantive conversations about a new way forward. This report provides recommendations based on objective review of states’ and Federal agencies’ water planning and management documents, interviews with selected state and Federal water officials, and discussions at three regional conferences (Eastern Region in Orlando, Florida, in February 2009, Western Region in Kansas City, Kansas, in April 2009, and Central Region in St. Louis, Missouri in June 2009) (see Figure 1, AWRA Recommendations

AWRA Recommendations

The Third National Water Resources Policy Dialogue (January 2007) urged government leaders to take action:

- Complete an up-to-date assessment of the Nation’s water resources challenges. The last assessment was 30 years ago.
- Establish a national water policy vision that translates into water policies with clearly defined roles and responsibilities for the government and the public.
- Reconcile contradictory water policies through better coordination among Federal agencies and across all levels of government.
- Encourage policies that promote watershed planning and change those that do not.
- Make available good science upon which to base water resource policy decisions.

The Fourth National Water Resources Policy Dialogue held in September 2008 with a more limited but focused group recommended that the incoming Administration and the 111th Congress do the following:

- Update an assessment of the Nation’s current state of water resources.
- Create a sustainable framework grounded in a national vision, guiding principles, and watershed context for water resources planning and management.
- Promote active partnering to guide Federal water resources development.
- Achieve better coordination among Federal agencies and Congressional committees.
- Reevaluate the Federal government’s role in water resources planning and management in concert with states.
Project Geographical Regions. The discussion also highlights recommendations that were proffered by Administration, Federal, and Congressional officials and attendees representing states, interstate organizations, tribes, and non-government organizations (NGOs) at a National Collaborative Water Resources Conference held in Washington, D.C., in August 2009. Summaries of state water resources planning activities and interviews with key state water resource agency personnel, regional trends reports, conference proceedings, fact sheets, the Federal Agency Assessment, and PowerPoint briefings were developed to codify research findings and discussion; some of them are posted on a website (www.building-collaboration-for-water.org).

Success of this initiative is an ongoing dialogue toward actions that sustain, protect, and restore the economic and environmental lifeblood and high quality of life in America.

![Project Geographical Regions](image)

The silence of the Water Resources Council (WRC) since the 1980s has left a void in coordinated and integrated public water planning at a broad scale. The WRC was established in July 1965 to provide a framework for integrated, multipurpose water resources conservation, development, and use of water and related land resources through comprehensive and coordinated river
basin planning by Federal agencies working with states, localities, private enterprise, and others. Funding for the WRC was curtailed by the Administration in 1981. Interstate entities like the Delaware River Basin Commission, the Susquehanna River Basin Commission, the Interstate Commission on the Potomac River Basin, the Upper Mississippi River Basin Association, the Red River Commission, the International Joint Commission, and the Mississippi River and Tributaries project have remained to coordinate interstate water planning in the U.S, although Federal contributions to them have declined and are perennially threatened. The 1986 Water Resources Development Act, which implemented cost-sharing between the Federal government and local sponsors for project-by-project water development, has focused water solutions on a more localized footprint than an integrated watershed scale; this has made water objectives quite particular and too often has neglected the interconnectedness of resources, stakeholders, issues, and objectives made possible through a broader view of the entire river system or watershed. The result is that solutions are downsized to where there is local sponsor and political support but are not necessarily sustainable or inadvertently cause new problems. The focus on individual projects, fragmented responsibilities, and under-funding leads to conflicts, voids, and difficulties in fostering cooperation among Federal agencies to support of state needs. It is left to Federal laws like the Clean Water Act to bring entities together for common aims.

The reality of water resources planning and management today is that needs are systemic and problems are interdependent; solutions are more powerful and support is more lasting if approaches and solutions can be interrelated. The call for planning that coordinates interests and aims in a system of interrelated players, variables, and objectives are becoming more universal. Today, more than ever, there is an appreciation for collaborative planning. A collaborative systems approach to integrated water resources management is not new but perhaps needs to be dusted off once again to become the orienting framework for water resources planning to address the real complexity of water problems facing states and the Nation today. Representatives from Federal agencies, states, interstates, tribes, and NGOs loudly extolled the virtues of the systems-oriented watershed approach called Integrated Water Resources Management (IWRM) for comprehensive statewide planning.

The assessment conducted under the Collaborating for a Sustainable Water Future initiative aimed to identify key water resources challenges and needs among the 50 states; to identify opportunities for collaboration; to build support among a national team consisting of Federal resource agencies, interstate organizations/river basin commissions, tribal governments, and NGOs in support of doing more integrated water resources management; to improve dialogue about key challenges and ways to meet them; and to gain support for a shared database of information deemed useful in helping states in their water resources planning. This report is an interpretation of what Federal, state, tribal, NGO, and interstate representatives said in the conduct of this assessment.
Section 2
Water Resources Drivers

Trite but true: the only constant is change. National attention to water resources is spurred by common social, technological, economic, environmental, political, and security drivers of change. These drivers may be legislation, population growth, population migration to coasts and city centers, assessments of the gap between available water supply and projected demand, the search for renewable energy sources, conservation, natural disasters, competing water uses, environmental changes (e.g., shrinking groundwater supplies, saltwater intrusion, point and non-point source pollution), and infrastructure breakdowns or insufficiencies given changing demands. A brief review of some of these drivers follows to illustrate what influences states in their water planning.

- **SOCIAL** drivers include population growth and migration, values, social networking and communication strategies, socioeconomic and educational factors. Population has grown by 40 percent over the past 30 years. Suburban population is growing faster than central city population, infrastructure is breaking down in city centers or is lacking in suburbs and exurbs.

<table>
<thead>
<tr>
<th>Social Concerns of Selected States</th>
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<tbody>
<tr>
<td>Between July 2000 and July 2001, the net U.S. population grew by 2.7 million people, more than half moving to California, Texas, New York, Illinois, and Florida, while population declined in Louisiana, Iowa, North Dakota, and West Virginia.</td>
</tr>
<tr>
<td>Population is expected to grow another 25 million people by 2060 and by one million people in Oregon by 2030.</td>
</tr>
<tr>
<td>Chicago, Illinois’ regional population is expected to increase 30 percent by 2040.</td>
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<tr>
<td>Water use grew 50 percent faster than population growth in Minnesota between 1995 and 2005.</td>
</tr>
</tbody>
</table>

- **TECHNOLOGICAL** drivers are advents in science and technology producing models, databases and data networks, and innovative approaches. Science and technology offer the hope of breakthroughs that can connect people, ideas, and continents in milliseconds. Modeling is one area of advancement. Models will be especially important in understanding climate change and its impacts by facilitating monitoring and design processes. Geospatial information system (GIS) technology, satellite imagery, and remote systems are transforming the way that floodplains and watersheds are evaluated and managed. The intermodal inland waterways transportation system benefits from the integration of global positioning systems and GIS data into radar systems to facilitate nautical charting. Technology and innovation can also affect supply, i.e., desalinization can
harvest runoff water or reuse brackish groundwater. Development of solar energy is widely promoted.

- **ECONOMIC** drivers are funding sources and means, budgets, priorities, economic conditions, fiscal policies, investment priorities and strategies, and public-private partnerships. Locks, dams, municipal water supply systems, reservoirs, levees, channels, turbines, and wastewater treatment plants are continuing to fall into disrepair and decay as capital investment in new water resources infrastructure decreased by 70 percent over the last 30 years. The American Society of Civil Engineers gave the Nation’s infrastructure a grade of D in its 2009 report card yet again. The current global recession is causing an unprecedented trade crisis in terms of trade restrictions and tariffs on imports, perhaps fostering an era of protectionism. States are faced with severe budget cuts, which reduce their water program funding, negatively affecting the ability to address nonpoint source pollution. In recognition of its economic impacts, infrastructure is a key part of the current Federal economic stimulus package.

<table>
<thead>
<tr>
<th>Investment Needs of Selected States</th>
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<tbody>
<tr>
<td><strong>West Virginia</strong> and <strong>Kentucky</strong> suffer from a lack of distribution pipelines.</td>
</tr>
<tr>
<td>The <strong>Missouri River</strong> states highlight the need to maintain rehabilitate, remove, or replace aging infrastructure with something new or different to meet changing conditions and emerging needs.</td>
</tr>
<tr>
<td><strong>California, Texas, and Oklahoma</strong> seek funding to implement the projects and programs in their comprehensive state water plans.</td>
</tr>
<tr>
<td>The <strong>Michigan</strong> Department of Environmental Quality identified over $500 million in unmet funding for nonpoint source pollution projects in 2004.</td>
</tr>
<tr>
<td><strong>Kentucky</strong> needs $8 billion dollars to improve/expand water supply infrastructure by 2020.</td>
</tr>
</tbody>
</table>

- **ENVIRONMENTAL** drivers include ecosystem conditions, environmental management policies, environmental changes and threats, climate change, global warming, sea-level rise, population growth and geographic redistribution, concomitant economic growth, increasing demand for ecosystem services, and water expended in energy production. There is increased competition for scarce water. Environmental *hot spots* include areas where water supplies, competing uses for water, and population growth create problems of balancing water demand and supply. For example the Washington, D.C. area; Charlotte, North Carolina; Atlanta, Georgia; and a major portion of the Florida Peninsula face expected high population growth in the face of limited available water. Wetlands have been lost or degraded, which endangers major groups of plant and animal life that depend on freshwater systems. Climate change is recognized as unequivocal and destined to affect water supply, ecosystems, water and power operations, water resources food security, human settlements, and human health—the future sustainability of the planet and resources. Climate change can slow the pace of progress toward sustainable development.
directly through exposure to adverse impacts or indirectly through the erosion of the capacity to adapt. Climate change will interact at all scales with other trends affecting water, soil and air pollution, increasing health hazards, disaster risks and deforestation. Impacts may be compounded by the absence of integrated mitigation and adaptation measures. The Western Governors’ Association reports that impacts may include smaller snowpacks, earlier snowmelt, changes in flood-control releases, more extreme flood events, receding glaciers, more evaporation and dryness, less groundwater, more droughts and wildfires, changes in water quality and hydroelectric generation, reduction in waterborne shipping and in recreation in streams and lakes from reduced river flows, and reduced biodiversity.

A top Administration priority is understanding and adapting to climate change through revisions to Federal policies and programs.

Mr. Jonathan Carson
Chief of Staff, President’s Council on Environmental Quality
National Collaborative Water Resources Conference
Washington D.C., August 27, 2009

Environmental Concerns of Selected States

The Great Lakes and Michigan are plagued by water quality problems from contamination.

The Susquehanna River Basin is suffering from inhospitable nutrients and invasive species.

The Potomac River Basin is wrestling with point and nonpoint source pollutants from farms and combined sewer and stormwater overflows.

Sedimentation is troubling planners in Maryland and Virginia as sediments move from upstream rivers and reservoirs into the Chesapeake Bay.

Oklahoma is most concerned that its reservoirs have reached capacity, adding to water shortages from droughts.

Georgia is dealing with competition and conflicts over water use from growing recreational pursuits and pressure for water withdrawals.

North Carolina state representatives voiced an appeal for more routine dredging in their coastal harbors.

Delaware spoke about the need for adequate wastewater and stormwater management and treatment.
POLITICAL drivers span governance, roles and responsibilities, Congressional relations, criteria for decision making, advocacy, and lobbying. How the Administration classifies and emphasizes benefits for water resources management interventions affects the nature and extent of solutions that are likely to be funded to improve the Nation’s water infrastructure. National economic development has been the primary criterion for making public infrastructure investment decisions for some time. There is increasing pressure to evaluate justifications for project approval through additional criteria of regional economic development, ecosystem restoration, and other social effects, such as benefits of adaptive management, watershed-based approaches, and risk-based planning. Changes to the Principles and Guidelines that direct project development for the Corps and other Federal resource management agencies have been proposed; such changes can impact the resiliency of the Nation to natural and man-made disasters. The American Recovery and Reinvestment Act of 2009 has spurred state governors to identify priorities for water resources projects designed to reduce flood and storm damages, to ensure unfettered navigation in inland and coastal waterways, to address aging locks and dams and ports not deep enough to welcome ships of increasing size, to protect and restore environmental water and related land resources (including wetlands and aquatic resources), to treat stormwater and wastewater, to generate hydropower, to provide water-based recreation, to store and allocate water supplies, and to provide responsive emergency management services. The lack of policies, fragmented policies and regulations, unclear policies, and poor communication and coordination befuddle states in their water planning. Many states cite the fragmentation of planning processes across their state agencies and across Federal agencies. At least 25 Federal agencies, 20 Congressional committees, and 50 states are dealing with water issues. Despite billions of dollars authorized, priorities are not established given earmarks; a plethora of legislative, procedural, and regulatory guidance; and a lack of knowledge about what is actually being achieved for the expenditures and effort contributed.

### Political Concerns of Selected States

The **Great Lakes** states have faced a lack of or inconsistent standards, policies, and decisions regarding water withdrawals.

**Arizona, California, Colorado, Idaho, Utah, and Washington** have experienced interstate conflicts over water transfers from rural communities to cities and from one state to another over shared water bodies that cross state boundaries.

**Wisconsin** is concerned about lower water levels on Lake Michigan, which affects commercial shippers and recreational boaters, potentially creating conflicts.

**Arkansas** seeks an adequate stream flow to support navigation and ecological needs on the White River, areas of competing use.

Over 300 infrastructure improvement projects are needed in the six-county **Gulf Region** of the Mississippi River between 2010 and 2025.
**SECURITY** to protect the homeland from internal and external terrorism and other threats is of utmost concern today. Threats come from the environment and infrastructure as well. Experts inform that as the natural system degrades and as climate change brings a greater incidence of extreme events, the natural system will provide less natural protection from storm surges and resulting erosion and destruction of coastlines, wetlands, and natural barriers – literally threatening the viability of the homeland. Natural disasters are growing in frequency and severity. Hurricane Katrina certainly impacted water resources infrastructure in the Gulf States. State officials cite a lack of data and information, tools and technology, models, guidance, research, and up-to-date maps. Aging infrastructure will be the weakest link in effective emergency response for both natural and man-made disasters and will slow down response and recovery efforts. Repeated floods on the Upper Mississippi River System are raising fundamental questions about models and data, flood risk management, and human impacts.

The various drivers or trends interact and are interlinked. Population growth and migration in high-risk areas (e.g., coastal zones) and depletion of natural resources (e.g., wetlands, barrier islands, and floodplains) from land use changes have reduced the resilience of the natural system and limited its ability to provide a buffer to natural disasters. Changes in transportation activity are driven by changes in foreign and domestic trade, logistics practices, environmental constraints, politics, technology, and resource parameters. Climate change is deemed an important factor affecting both water supply and maritime commerce. The drivers have implications for legislation and infrastructure funding priorities. They present challenges for water resources planning.

### Selected Impacts of Drivers

As droughts persevere, surface water supplies diminish and states turn to withdrawing water from their groundwater sources and addressing other threats from the change drivers.

**In the Western Region**, Arizona experienced a 2.5 million acre-feet overdraft of its groundwater, forcing the state to focus on conservation and long-term groundwater management. Montana faces surface water rights transfer of rural agricultural lands to meet urban growth. North Dakota faces its aquifers and streams becoming fully appropriated and permitted for municipal, agricultural, industrial, and recreational uses and thus must plan for droughts and floods and rising water levels in Devil’s Lake. South Dakota is besieged by flash floods, long-duration precipitation floods, snowmelt floods, dam failure floods, severe winter storms, wildfires, landslides and mudflows, and even earthquakes. The population of Texas is expected to more than double between 2000 and 2060; there is worry that water supply needs for irrigation, power generation, mining, municipal, and industrial use will not be able to be met in economically feasible ways, especially given the impacts of droughts.

**In the Central Region**, as water tables and instream flows have declined, Arkansas faces increased water usage for natural gas drilling in the Fayetteville Shales, which raises issues of how to treat or dispose of frac water from fracing. In Illinois the state’s levees are reaching the end of their design life and need major improvements, but there is a lack of funding to certify state levees. Missouri revised its Drought Response Plan given the 1999 to 2000 drought, which reduced agricultural crop production, increased costs to supply water to crops and livestock, threatened water quality, reduced water supplies, and decreased groundwater levels. Sedimentation and eutrophication (the increase of chemical nutrients such as nitrogen, phosphorus, pesticides, trace metals, bacteria, and chlorinated hydrocarbons) are seriously...
Selected Impacts of Drivers (Continued)

degrad ing the Mississippi, Missouri, Ohio, and Illinois Rivers, filling in backwater areas and increasing turbidity, carrying excessive nutrients into the aquatic ecosystem, and allowing pesticides and other toxic chemicals to invade waters. As a result of excess nutrients from the Mississippi River, a hypoxic zone is forming in the Gulf of Mexico, is limiting stratification or layering of waters in the Gulf, which prevents the mixing of oxygen-rich surface water with oxygen-poor bottom water, leading to the loss of fish and shellfish and perhaps the backwaters within the next 50 to 100 years.

In the Eastern Region, Alabama faces water supply stresses from population growth, urban sprawl, and discharges from point and nonpoint sources, which threatens water quality, kills fish, and creates consumption advisories. The low level of state funding for environmental protection threatens the state’s lakes and reservoirs. Water quality in the rivers and creeks around the District of Columbia is so bad as to ban all swimming in them. Budget pressures limit maintenance and upgrading of water infrastructure, construction of new water storage tunnels and stormwater infrastructure, and improvements to wastewater treatment plants. North Carolina is faced with changing water use from population and economic growth in the Piedmont Urban Crescent and in the Research Triangle; urban growth here is shrinking available agricultural land and testing water supplies — just as water-based recreation (fishing, boating, and swimming) gains in popularity, especially in Jordan Lake — and competes with water use for drinking water. Virginia faces population growth and development in high-risk coastal zones — such as the Chesapeake Bay watershed — which increases the difficulty of evacuating people during emergencies. Insufficient wastewater infrastructure (treatment facilities) will only increase nitrogen pollution. West Virginia is concerned that population increases in this region may force Washington, D.C. interests to seek water from West Virginia for consumptive use.
Section 3
Water Resources Challenges

Population growth and migration, climate changes, fiscal constraints, and environmental trends have been significant drivers in compelling states’ resource planning to meet their water resources challenges. Table 1 shows that many of these drivers present common challenges across states and regions.

<table>
<thead>
<tr>
<th>Western Region</th>
<th>Central Region</th>
<th>Eastern Region</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of science-based data and information, especially about water use and availability (surface and groundwater)</td>
<td>Lack of science-based data and information, especially about water use and availability (surface and groundwater); insufficient water use reporting; need for research and data systems</td>
<td>Lack of data and access to data based and information</td>
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<td>Lack of integrated data and databases</td>
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<td>Fragmented planning across state agencies and with Federal agencies</td>
<td>Lack of integrated water resources planning and management</td>
<td>Lack of holistic approaches to water planning and management</td>
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<td>Competing uses for water (especially to set minimum stream flows for diverse purposes)</td>
<td>Competing water uses</td>
<td>Lack of balance across competing water uses</td>
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<td>Population growth and shifts from farms to city centers or suburbs where water distribution systems are inadequate</td>
<td>Population growth and economic development</td>
<td>Impacts of population growth and economic growth</td>
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<td>Aging infrastructure that needs to be repaired, rehabilitated, upgraded, decommissioned, or replaced; lack of water storage capacity; inadequacy of distribution system</td>
<td>Aging infrastructure (need to replace it, upgrade it, rehabilitate, install new)</td>
<td>Aging infrastructure</td>
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<td>Degraded water quality from point and nonpoint source pollution</td>
<td>Degraded ecosystems, environmental pollution</td>
<td>Degraded water quality</td>
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<td>Budget cutbacks and loss of experienced staff</td>
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<td>Lack of sufficient funding for projects, modeling, monitoring, staff, state water plan implementation</td>
<td>Lack of resources (funds, staffing, processes to determine priorities)</td>
<td>Lack of funding</td>
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<td>Use of water to produce alternative fuel sources</td>
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<td>Increasing sedimentation in rivers and reservoirs</td>
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<td>Difficulty in meeting environmental standards</td>
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<td>Western Region</td>
<td>Central Region</td>
<td>Eastern Region</td>
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<td>Natural disasters, including floods and droughts</td>
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<td>Climate change and weather impacts</td>
<td>Climate change impacts and information; need for mitigation</td>
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<td>Lack of policies (e.g., for water withdrawals, wastewater management)</td>
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<td>Reservoir operations</td>
<td>Regulatory processes for permits; lack of authorities</td>
<td>Excessive regulatory requirements, too-lengthy regulatory processing time</td>
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<td>Conflicts in/competition for use of water</td>
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<td>Lack of guiding national water resources vision and unified guiding principles</td>
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<td>Loss of streamgages, inconsistent monitoring</td>
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<td>Interstate conflicts</td>
<td>Interstate issues</td>
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<td>Overuse of groundwater</td>
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<td>Drought planning</td>
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<td>Eroding coastlines</td>
<td>Coastal and beach erosion</td>
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<td>Resolution of Indian Water Rights</td>
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<td>Mitigation of climate change impacts</td>
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<td></td>
<td>Lack of awareness or understanding about water issues</td>
<td>Lack of awareness or understanding about water issues</td>
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</table>

Our water resources needs are great. Ports need dredging. The Inland Waterway System is congested. We are losing 90,000 acres of wetlands a year. Developers want to develop our wetlands and bogs, not appreciating their ecosystem value. Nearly half of our streams and lakes are assessed as not clean enough to sustain swimming and fishing. Our infrastructure has been given a “D” grade. The competition for water supply sources is fierce in the Southeast, especially in the Atlanta area. Climate change uncertainty is only making things worse. We are $58 billion short in investing in our water resources each year.

Chairman James Oberstar
U.S. House of Representatives Transportation and Infrastructure Committee
National Collaborative Water Resources Conference
Washington, D.C., August 27, 2009
3.1 Addressing the Challenges

States plan to meet immediate exigencies and increasingly to develop proactive approaches to anticipate and respond to challenges and needs. This assessment showed that there are at least 50 varieties of water resources planning among the 50 states. There is no standard planning approach, process, or structure. Water resource planning occurs most commonly in reaction to a crisis situation such as drought, flooding, or natural disaster. The impetus for planning also may be driven by substantial and substantiated research, observed or emerging trends, or the passion of a motivating vision. Shrinking budgets and financial crises compel planning as well. The challenges described above provide the impetus for planning that takes into account the idiosyncratic geography, topography, climate, culture, and history of states and their regions. Half of the states have comprehensive water plans that address at least two water functions, primarily planning to improve water quality and to ensure sufficient water supply.

The Western Region is a region characterized by an environment of extremes, most notably scarcity, interstate conflict, and rapid change. The Western Region states are challenged by droughts and water shortages, population shifts to coasts, eroding coastlines, wildfires, budget crises, and conflicts over water and Indian rights that find their way into the courts for resolution. Fifty percent of the U.S. population resides in the 17 contiguous Western Region states. Seven of the ten fastest-growing states in the U.S. are in the West, including Arizona, Colorado, Nevada, and Utah. Sixteen of the 19 Western Region states (including Alaska and Hawaii) have statewide plans — the highest proportion of any region. The West is a set of fiercely independent states. Solutions to water challenges in the West must respect the states’ individualism and the water doctrine of prior appropriation water rights. Data-driven collaborative planning is ubiquitous with planning largely occurring bottom up with local watershed groups. The rugged individualism and fierce independence of the West is grounded in the view that the states themselves are the primary water planners.

The Central Region is a riparian-rich region. This area has a nationally significant ecosystem and a nationally significant navigation system. The Central Region is challenged by flooding and occasionally drought, conflicts over water withdrawals, and serious water quality degradation. The rivers in this region have experienced severe floods, most severely from Hurricanes Katrina and Rita in 2005 on the Mississippi River. Environmentalists and fish and wildlife enthusiasts are most concerned about dredging associated with navigation. Furthermore, agricultural runoff has increased turbidity, siltation, pollution from pesticides, toxicity, and eutrophication, leading to loss of aquatic organisms and depletion of oxygen. The Central Region is a set of states with a deep partnering history grounded in compacts and agreements over water withdrawal and use. Planning is primarily bottom up and focused at the regional level.

The Eastern Region is defined by strong interstate compacts and active river basin commissions. This region is characterized by historic flooding and protracted droughts of historic proportions in the Southeast and problematic conflicts over water withdrawals in lakes and rivers as explosive growth strains water supplies. Citizens fear a lack of drinking water. Farmers fret over too little water for agriculture. Fragile ecosystems are threatened. Environmentalists decry the loss of freshwater mollusks at risk of dying off. Fishermen worry
about the multimillion-dollar fishing industry. Water for energy often conflicts with consumptive water use. Coastal erosion from storms is eating away at precious coastlines that buffer the effects of flooding. Aging water infrastructure is also giving way. Pipes are bursting, overwhelmed by volumes of water beyond their capacity, thus releasing billions of gallons of raw sewage into rivers and streams to sicken people, threaten drinking water supplies, and kill aquatic species. The Eastern Region states are challenged by Mother Nature and the lack of funding and a unified vision to address water needs holistically within and across states in the spirit of sharing information and resources for shared beneficial effect in an era of declining resources.

Common challenges across the three regions include climate impacts, increasing competition over water, limited water supply sources, maintenance of minimum flow levels in rivers and tributaries to serve multiple water uses, water supply pressures from population growth and migration, disconnects between upstream and downstream policies and impacts, inconsistent water policies and regulations, conflicting priorities, degraded water quality, conflicts over water rights and Indian water claims, water conservation, funding and staff shortages, aging infrastructure, lack of water data and information, lack of sophisticated tools and technology, outdated maps, growing water demands for energy production, poor stormwater management, and multiple responsibilities and jurisdictions for the same water.

States need many things to address their water challenges:

- Resources to implement their state water plans, to hire staff, and to achieve program goals;
- Integrated planning at a watershed scale to better balance diverse water needs, to set minimum flow levels, and to ensure that reliable water supplies will be available in the future;
- More concerted attention paid to aging infrastructure and justification for new infrastructure;
- Access to more complete, comprehensive, and current data and information, especially about water conditions, use, and availability;
- Investments in information creation and analysis, and more data sharing;
- Faithful and consistent reporting of water availability and use;
- Regular monitoring and assessment;
- Research;
- Modeling;
- Greater access to data and information;
- Regulatory processes streamlined to expedite permit approvals;
More case studies – both successes and failures – of integrated water resources planning;

- A national water vision supported by diverse stakeholders and implemented through clear guiding principles and strategies to implement the principles and achieve the vision; and

- Attention to governance and effective leadership and management with defined roles and responsibilities.

Planning and policy changes may be needed, especially to achieve improved water quality and reduced environmental pollution to protect ecosystems. Improved coordination and integration will be helped by planning at a watershed scale with integrated and systems-oriented approaches and models, by addressing key issues of policy and programmatic barriers to IWRM, by instituting constructive incentives, and by working with and through a network of stakeholders who support IWRM within political boundaries with clearly defined roles.

Attention to governance issues could provide effective leadership, scope of responsibilities, and national policy for integrated water resources planning and management with feedback provided by adaptive management strategies. Better coordination at a watershed scale will help to integrate land and water plans and policies at a regional level for sustainability of a wide range of economic, environmental, and social resources.

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**States' Top Needs**

1. Create an information hub for access to more comprehensive and accurate data and information, including GIS-based and risk-informed maps, in support of water resources planning and management. Share data and information more widely and readily.

2. Use comprehensive, holistic, and systems-oriented planning processes for integrated water resources management within a sustainability paradigm.

3. Attend to water infrastructure by ensuring its operation and maintenance, rehabilitation, removal, or replacement with new infrastructure.

4. Promote greater collaboration, coordination, and communication among water resources stakeholders to derive agreed-upon plans and management decisions.

5. Seek to balance competing water uses and to avoid or resolve conflicts over water use.

6. Seek technical planning assistance and expertise to improve water resources assessments, planning, and management within a holistic systems perspective that aims to balance objectives.

7. Improve regulatory processes to streamline permitting and reduce regulatory burdens.

8. Practice and reinforce adaptive management in collecting and analyzing water resources information to understand what is working or not and why and to improve performance.

9. Improve water quality in rivers, streams, tributaries, lakes, reservoirs, the ocean, and other water bodies.

10. Explore developing a unifying national water vision and guiding principles to reinforce the vision.
Section 4
Approach to a More Sustainable Water Future

The complexity of water issues is such that new approaches and solutions are needed. As Ms. Jo-Ellen Darcy, Assistant Secretary of the Army for Civil Works, told those gathered at the National Collaborative Water Resources Conference, “You go it alone and you may end up standing alone.” Problems are of a magnitude and so interconnected that they necessarily require joint approaches and solutions for water systems. Progress will require technical and administrative approaches to address water challenges and needs.

The data, information, insights, and opinions of those who participated in the Collaborating for a Sustainable Water Future initiative are voluminous. Two handicaps exist to provide a detailed set of recommendations: (1) no consensus process was used to gain agreement about priorities throughout the assessment (data were simply summarized), and (2) there is no structure at the Federal level authorized to set priorities or to act on the recommendations as a whole. Without a mechanism to promote integrated water resources management at the Federal level, recommendations fall into the purview of disparate Federal agencies and interstate organizations as their current authorities allow. Perhaps a first order of business is to address the need for an integrating mechanism or to find ways to unify the Federal agencies for concerted action to help the states in their water resources planning, especially for integrated water resources management. For now the needs and critical priorities of the states can be synthesized into eight overarching themes (areas) of recommendations that mutually reinforce one another. The recommendations under each theme will be fleshed out into a more specific implementation plan, taking state-specific information into account. The Corps will catalog specific state information generated by this assessment and will continue to facilitate collaborative efforts through an implementation plan. The recommendations are general with proposed actions that could be taken to advance water resources planning and management. Below are the eight overarching themes and proposed recommendations generated by the Collaborating for a Sustainable Water Future initiative.

1. Integrated Water Resources Management (IWRM)
   Recommendation: Make Integrated Water Resources Management (IWRM) more understandable and a preferred way to plan and manage public water and related land resources as a system.

2. Future National Water Resources Direction
   Recommendation: Foster continued dialogue about a national (not Federal) water vision and create support for drafting a national vision and/or regional vision(s), and supporting policies and strategies.

3. Governance and Management
   Recommendation: Strive to reshape organizational structures and means to improve water resources planning, decision making, and evaluation in ways that build the public will to act for integrated water resources planning and management.
4. **Collaboration**
   Recommendation: Promote opportunities and mechanisms for collaborative water resources planning and management.

5. **Water Resources Investment Strategies**
   Recommendation: Promote innovative and sustainable financing mechanisms for public water resources solutions, including water infrastructure, at Federal and state levels.

6. **Managing Extreme Events**
   Recommendation: Increase the ability to anticipate and manage natural and man-made disasters and climate change impacts.

7. **Technology Transfer and Knowledge Capacity Building**
   Recommendation: Base water resources plans and decisions in good science and information and technology sharing and increase scientific and management knowledge capability at all government levels.

8. **Enhanced Water Resources Leadership and Education**
   Recommendation: Enhance the ability of public officials at all levels to understand and communicate priorities for water resources investments, and raise awareness and build stewardship for responsible water management.

4.1 **Recommendation 1 – Integrated Water Resources Management (IWRM)**

   *Make Integrated Water Resources Management (IWRM) more understandable and a preferred way to plan and manage public water and related land resources as a system.*

Integrated water resources management (IWRM) is becoming a more familiar approach in states, although there is still confusion about what it means. There is no such thing as an isolated water resource; all resources are parts of larger systems. Decisions for one part of the system affect other parts of the system. IWRM highlights the interconnectedness of resources, resource managers, stakeholders, and resource decisions so as to pull elements together rather than leave them fragmented. Key IWRM concepts include holism, systems, watersheds, participation, balance, and sustainability. IWRM promotes a systems view of a water-land management (river basin, watershed, coastal zone) through a big picture of the system’s resources, stakeholders, activities, data/information, needs, and potential outcomes; it enables a holistic approach to planning and managing resources and decisions for the good of the entire system and for the long term. IWRM plans consider surface water and groundwater, quantity and quality, river and watersheds, inland and coastal waters together as a whole; place projects in the context of a large geographic region; entertain multiple stakeholder interests and priorities; and respect the perspective of diverse government levels.
International experts define Integrated Water Resources Management as:

- **Sustainable outcomes** — the practice of making decisions and taking coordinated actions so to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems;

- **Collaborative planning** — a process that avails collaboration to secure the input of all stakeholders about their interests and needs;

- **A systems perspective** — a systems approach that arrays interests and needs as input variables, modelling a system of interdependent variables with multiple outputs;

- **A geographic context** — a geographic perspective that examines who is doing what where at a broad geographic scale, e.g., a river basin, watershed, or coastal zone;

- **Balanced aims** — a process that seeks to balance multiple objectives as diverse desired outputs producing multiple benefits.

The Global Water Partnership, founded in 1996 among the World Bank, the United Nations Development Programme, the Swedish International Development Agency, and entities (governments, public institutions, private companies, professional organizations, multilateral development agencies) involved in water management, who are committed to principles of sustainability for a water-secure world, defined IWRM as a process that promotes the coordinated development and management of water, land and related resources in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.

The following definition was developed and used by participants for this initiative:

> **IWRM aims to develop and manage water, land, and related resources, while considering multiple viewpoints of how water should be managed (planned, designed and constructed, managed, evaluated, and regulated). It is a goal-directed process for controlling the development and use of river, lake, ocean, wetland, and other water assets in ways that integrate and balance stakeholder interests, objectives, and desired outcomes across levels of governance and water sectors for the sustainable use of the earth’s resources.**

States today reflect and are increasingly adopting a **watershed approach** to implement IWRM. Many of the states that have a state water plan seek to integrate water quality and water quantity at a minimum. States increasingly call for greater integration of land and water resources, especially surface and groundwater. Integration takes the form of multiobjective planning across diverse water uses with multiple stakeholders to balance needs and outcomes, plan jointly for water quality and quantity, consider downstream impacts of upstream actions, coordinate plans and actions across state agencies for horizontal alignment, integrate disaster planning into water resources planning, and look at an entire watershed or river basin as a system of interrelated parts.
The river basin commissions and other interstate organizations exemplify the practice of IWRM within a systems context for effective water management. They were formed to look expansively at multiple needs within a region across state borders. They model use of a watershed approach for water resources integration within a regional context. The Delaware River Basin Commission (DRBC) is a respected example. The DRBC’s mission is to provide leadership to restore the Delaware River and to protect water quality, resolve interstate disputes, allocate and conserve water and manage river flow. They serve as a policy-maker, regulator, planner, manager, educator, and mediator in partnership with four states (Pennsylvania, New York, Delaware, and New Jersey) and the Federal government. Their focus is comprehensive watershed and water resources planning, management, regulation, and conflict resolution with a focus on protecting surface and groundwater quality, water supply allocation and conservation, in-stream flow management, flood loss reduction, drought management, regulatory review and permitting, recreation, inter-agency coordination, mediation of interstate disputes, and public education and engagement. The DRBC uses

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**Examples of States’ Integrated Water Management**

**Oregon**'s 2007 *Oregon Water Supply and Conservation Initiative* aims to build an integrated water resources strategy that provides a long-term foundation through a statewide demand forecast out to 2050, an inventory of potential conservation projects, an inventory of potential above- and below-ground water storage project sites, and basin-yield and peak flow analyses.

**Rhode Island** has attempted to drive its water resources planning with a comprehensive systems model based on scientific knowledge, continuous baseline monitoring, and indicator-based trend analysis, and evaluation of program outputs and outcomes that emphasizes learning and adaptation. The Rhode Island General Assembly created the Rhode Island Bays, Rivers, and Watersheds Coordination Team in 2004 across state agencies to develop an integrated systems-level plan to coordinate projects, programs, and activities in five major challenge areas: climate change; waterfront, riparian, and coastal development; watersheds and water quality and supply; water-reliant economies; and habitat restoration and aquatic invasive species. The systems plan aims to provide an ecosystem-based management approach to water and watershed management and water-reliant economic development that acknowledges and functions within contemporary networks of environmental governance, economic development, and, increasingly, energy.

**California** espouses support for integrated, reliable and secure water resources management systems. Integrated regional water management enables regions to implement strategies to become more self-sufficient. The updated State Water Plan includes an integrated flood management emphasis with a focus on resource sustainability. The CALFED Bay-Delta Program has attempted to balance water supply, water quality, ecosystem restoration, and levee system integrity objectives.

**Hawaii’s Statewide Framework for Updating the Hawaii Water Plan** provides guidance to integrate the Commission on Water Management’s Water Resources Protection Plan, the Department of Health’s Water Quality Plan, the Department of Land and Natural Resources’ State Water Projects Plan, the Department of Agriculture’s Agricultural Land Use, and county Water Use Development Plans at a watershed level to manage land and water as a system from mountains to the ocean.

**Michigan** considers the entire hydrologic system of the Great Lakes as a single integrated system of interconnected surface and groundwaters treated as a whole.
planning principles to set sustainability goals within a unified water resources framework linked to Key Results Areas dealing with hydrology, water quality, living resources, and landscape. Together with state water plans and strategic plans, the DRBC provides plans and a tracking system for a systems view of the Delaware River with concrete data and integrated information that can help planners, policy makers, and decision makers. The DRBC’s The Water Resources Plan provides guidance and direction for setting policy and management decisions. The Comprehensive Plan documents the ongoing projects and activities designed to carry out The Water Resources Plan through a detailed Matrix of Goals and Objectives for multiple and balanced objectives, including milestones, desired outcomes, strategies, and quantifiable performance indicators. Results are described in the State of the Basin Report (2008) in terms of specific performance measures, targets, and baselines for each Key Result Area. Performance results are summarized in graphs, tables, and figures. These documents provide a system that answers “What do we Plan to do?” (inputs), “How will be do that?” (throughputs), and “What did we do and what difference has it made?” (outputs) in a highly transparent way to provide fundamental feedback about strategic actions taken for sustainability.

Holistic Strategy of the Delaware River Basin Commission

The Delaware River Basin Commission advocates the following strategy for the Land and Water Resource Management Key Result Area:

Land and Water Resources Management—seek the integrated management of land and water resources to sustain the quality of life in the Basin; preserving, restoring and enhancing ecological resources while recognizing the community’s social and economic relationships to these resources. Because land and water resources are inherently related — water resources are cycled within a watershed—it is necessary to consider the interconnections of land and water resources in decision making and to incorporate a watershed framework into community, regional, and statewide decision-making structures.

Progress toward integrated water resources management has been handicapped by many problems: a lack of or inadequate definition of terms; inadequate decision frameworks; unclear, conflicting, or emerging roles and responsibilities of different government levels; fragmented, limited, or conflicting authorities; the difficulty of incorporating science into decision making or taking science for granted; ambiguous criteria for effective management and policy decisions; data problems reflecting a lack of long-term records and baseline and trend data; lack of, or misuse, of systems and prediction models; fragmented or poor data management; insufficient data analysis; lack of sophisticated and powerful enough tools to provide forecasts, to illuminate trade-offs, and to balance outcomes and risks; disjointed and uncoordinated planning across state agencies charged with disparate responsibilities; a tendency to focus in on particulars rather than zoom out to address a holistic system of hydrologic, ecological, social, economic, security, and political factors and strategies; and limited use of adaptive management principles in broad-scale (watershed, river basin, coastal zone) planning. Fragmented responsibilities and ad hoc approaches are a real handicap.

Participants in this initiative touted IWRM as the preferred approach to planning to overcome fragmentation and adhocracy.
Conference Speakers Endorsed IWRM

Watershed thinking is needed along with good science to promote collaborative regional and local watershed planning to meet future needs.

Mr. Mark Miller
Director, Illinois Department of Natural Resources
Central Region, Collaborative Water Resources Conference
St. Louis, Missouri, June 2009

You need lots of interlocking arms, sound science, upfront time to build trust and transparency, and the willingness to be a good listener and to step into another’s perspective to make watershed management work.

Ms. Carol Collier
Executive Director of the Delaware River Basin Commission, to Western Region, Collaborative Water Resources Conference
Kansas City, Kansas, April 2009

We’re all in this watershed together. We have to find out how to work together to solidify relationships. Tribes have the chance to lead collaborative efforts to raise awareness of water issues and how they all fit together to better understand the water resources we need.

Mr. Wes Martel
Chairman, the Indian Water Working Group
Central Region, Collaborative Water Resources Conference
St. Louis, Missouri, June 2009

Integrated water resources management is tough. It takes time to build a common understanding but we must focus on a desired future. It takes a vision. It takes a comprehensive approach, clear priorities among water users and uses. It takes science-based and adaptive actions and a sound institutional framework. It takes the best and brightest. It takes leadership. It may take a change in policies and behavior. We need to start with the “sweet spots.”

Dr. Denise Reed
Professor, New Orleans University
National Collaborative Water Resources Conference
Washington, D.C., August 2009

We must overcome the ad hoc approach to water policy and work together in interdisciplinary teams toward a national water vision, based on overarching principles and sound science, for better coordination of Federal water resource policies for watershed-scale water resources assessment and planning.

Mr. Richard Engberg
Technical Director, American Water Resources Association
Eastern Region, Collaborative Water Resources Conference
Orlando, Florida, February 2009

All of the elements of an integrated water resources management approach are available in the Federal water agency programs. Moving forward will take better coordination between Federal agencies and state and regional entities through an inclusive process.

Dr. Matthew Larsen
Associate Director for Water, U.S. Geological Survey
National Collaborative Water Resources Conference
Washington, D.C., August 2009
Proposed Actions:

1. Promote understanding about Integrated Water Resources Planning and Management.
   a. Catalog definitions of integrated water resources management (IWRM) across Federal and state agencies, interstate commissions, Native American tribes, and selected non-governmental organizations and professional associations to identify common terms and commonalities.
   b. Catalog programmatic authorities related to integrated water resources management across Federal and state agencies, interstate commissions, Native American tribes, and selected non-governmental organizations and professional associations to glean the spectrum of authorities and responsibilities related to IWRM.
   c. Operationally define IWRM with case examples and exemplars (the best) of integrated planning and management at state and regional levels.

2. Promulgate policies, concepts, and definitions that support integrated planning.
   a. Facilitate consensus about a common working definition of IWRM.
   b. Illustrate alternative watershed-scale systems approaches to integrated water resources planning and management based upon concepts and definitions in practice by Federal, state, and local agencies, tribes, interstates commissions, and non-governmental organizations.
   c. Identify and catalog watershed-based programs across Federal agencies to clarify programs that can help states in promoting IWRM.
   d. Summarize integrated water resources planning in the states based on mining the data obtained through this assessment.
   e. Incorporate IWRM processes, data, and tools into the Federal Support Toolbox. Catalog ways to readily use them.

3. Do demonstration watershed-scale projects.
   a. Identify 8 to 10 (or more if appropriate) watersheds across Federal agencies to describe and assess for opportunities to promote more integrated water resources planning and management. Implement pilot projects in specific locations with identified stakeholders.
   b. Apply watershed authorities (e.g., WRDA Section 22 Planning Assistance to States), approaches (e.g., systems perspectives), and tools (e.g., Shared Vision Planning) to establish and manage objectives for watershed-scale work in the 8 to 10 watersheds.
c. Build on the work of the Corps’ Regulatory Business Line and other Federal agencies’ initiatives to develop a GIS-based map of key river basins in the U.S. to become a hub for collecting data and information about water resources stakeholders; resource condition, availability, and use; findings; needs; and opportunities for partnering. Work with Federal, state, interstate, tribal, and non-governmental partners to populate it with comprehensive data. Identify similar capabilities across Federal agencies.

d. Use the Corps’ (and other agencies’) GIS management tools in pilot projects.

e. Use the Corps and other Federal agencies to promote IWRM in and based on the pilot projects to address water resources needs and to build partnerships.

f. Conduct 2 to 3 Regional Stakeholder Workshops to continue the dialogue and to strengthen partnerships for joint efforts as developed in an implementation plan.

4. Collaboratively develop communication materials that highlight case examples of IWRM and strategically communicate about them to diverse audiences.

5. Pursue legislation.

   a. Participants recommended that the Corps be given the role to be an integrator and facilitator of Integrated Water Resources Management (IWRM). Broaden the U.S. Army Corps of Engineers’ authority to do IWRM and to serve in the role of integrator; for example, language was provided in the 2008 Water Resources Development Act for the role the U.S. Army Corp of Engineers can play in support of planning in Oklahoma.

   b. Expand Section 22 of the Water Resources Development Act of 1974 regarding Planning Assistance to States to a watershed scale.

4.2 Recommendation 2 – Future National Water Resources Direction

Foster continued dialogue about a national (not Federal) water vision and create support for drafting a national and/or regional vision(s) and supporting policies and strategies.

The expressed and implied vision statements and goals of states in their state water plans, strategic plans, or state agency/department mission statements generally express a desire to: sustain resources for future generations; protect human health and quality of life (including recreational pursuits); protect flora and fauna; and foster economic development through responsive, effective, and efficient policies, plans, programs, and management strategies. Sometimes this is achieved through integrated water resources management processes for beneficial uses of surface water and groundwater, and often through partnerships. Many expressed support for continuing the dialogue about the need for a national water vision (or regional visions) to the point where there is agreement about a compelling future for water resources management.
A vision is a vivid description of a desired future. It implies a picture of an ideal end-state or outcome years out. It is not a detailed plan sufficient to engage everyone in specific activities; rather, it influences future policies with recognizable and agreeable themes that imply supportive activities. The power of a vision is to drive the Nation’s water future through integrated water resources management for sustainability across the country. Professor Denise Reed likened a vision to a watercolor painting: it provides a recognizable image, not a photograph. It is compelling, powerful, and clear enough to incline people to move toward the desired end-state. As a mental picture of a target to aim for in planning to close the gap between current conditions and a desired future state, it inspires, energizes, motivates, and rallies the will to act. President-elect of the American Water Resources Association Dr. Ari Michelsen claimed that actions will remain ad hoc, fragmented, unlikely to achieved desired end-states, and potentially ineffective without a vision. Dr. Reed echoed that a future vision can promote integrated water resources management through a better understanding of the range of expected and unintended consequences, by identifying common goals, and by considering multiple water uses and the synergies, conflicts, and trade-offs involved. Ms. Deborah Ingram, Acting Administrator for Mitigation at FEMA, claimed that we need a national vision and can craft it with insights garnered from what is working in centers of excellence, pilot projects, and best practices. Ms. Carol Collier, Executive Director of the Delaware River Basin, summed up the imperative to come up with a program that works based on a vision, guiding principles, and specific strategies. “Then we need to get funding to make it work,” she exhorted.

Useful visions are lean, i.e., elegant in their simplicity. The Clean Water Act paints a clear and simple-to-understand vision of fishable, swimmable, and drinkable water resources, or for the Safe Drinking Water Act: reliable, safe drinking water across the Nation. In stating his intent to develop a 200-year vision for the Mississippi River—America’s River—at the Central Region Collaborative Water Resources Conference (April 2009), Major General Michael Walsh, Commander of the Corps’ Mississippi Valley Division and President of the Mississippi River Commission, said, “We must craft a vision to ignite the passions of people and an intergenerational commitment to value it and protect it. A vision will provide a roadmap to address issues of water quality, water quantity, ecosystem needs, and hydropower.” Mr. Joseph K. Hoffman, Executive Director of the Interstate Commission on the Potomac River Basin, summed up, “If you can dream it, you can do it. We all have a dream to see better water management in some form. Let’s find a way to do it better. Our water infrastructure won’t take care of itself.”

Throughout this initiative, several sample vision statements were offered by participants to initiate the crafting of a national water vision:

**Example 1:** We will manage the Nation’s water and related land resources holistically to provide groundwater and surface water of sufficient quality and in adequate supply to protect our natural systems and provide for potable supplies, agriculture, industry and recreation in a sustainable manner. Through enlightened planning for and management of water resources, the health,
safety, and welfare of citizens will be safeguarded during times of flooding and drought and an informed public will be involved in resolving water resources issues.

**Example 2:** Adequate supplies of sustainable freshwater of good quality that insure food production and manufacturing needs, protect sources and national treasures, share when necessary with neighboring countries, and are stored, transported and protected by safe and adequate water resources infrastructure, must be available to all persons and all other existing life forms in the United States.

**Example 3:** We will manage the Nation’s waters holistically to benefit the living world. We will protect natural systems and manage the land and water resources in a sustainable manner to provide for potable supplies, agriculture, industry, and recreation.

**Example 4:** We will manage the Nation’s water resources by implementing Integrated Water Resources Management (IWRM). IWRM involves planning and implementation championed by the tribes and states with financial resources and expert technical support provided by the Federal agencies. This collaborative effort involving tribes, Federal agencies, states, and local entities along with robust public participation will enable implementation of plans to provide adequate quantities of good quality water for all beneficial uses.

**Example 5:** We will manage our waters and watersheds in an integrated and sustainable manner to provide groundwater and surface water of sufficient quality and in adequate supply to sustain our natural systems and strengthen supplies for our homes, farms, businesses and recreation areas. We will enhance the health, safety and welfare of our communities, despite recurring floods, droughts and competition among uses, through science-based planning led by the states and interstates, robust expert evaluation, active collaboration across all levels of government and the direct involvement of a well-informed public. [Offered for consideration by the Interstate Council on Water Policy (ICWP).]

The revision of the *Principles and Guidelines*, the process used to direct Federal water project formulation, provides an opportunity to shape Guiding Principles and policy for water management and actually implies a vision even if not expressed explicitly.

A vision can be developed top down or bottom up, but most favor a bottom-up approach with a wide stakeholder group, especially those at the local watershed level. The Federal government can take the lead in facilitating a dialogue about a vision. Not everyone agrees that a national vision is needed, however. Most participants did agree that continuing discussion can sort out both the process and content of a vision for water management and how it can foster more integrated water resources planning.

Mr. Thomas M. Iseman, Program Director for Water Policy & Implementation of the Western Governors’ Association (WGA), emphasized at the National Conference that “The WGA supports many strategies for sustainable water resources planning and management. Let’s continue this conversation.” He offered the WGA’s vision statement:
Protect and wisely manage our national water resources for the benefit of present and future generations, including our environment.

People have called for both a vision and water policy, but water policy is not the same thing as a vision. Policy is what supports achieving a vision or may serve to provide guidance in lieu of it. The 1965 Water Resources Planning Act established the Water Resources Council as an integrating mechanism for wise water resources management and the Principles and Standards to facilitate interagency planning. A 1973 National Water Commission expressed concern about the lack of national water policy, however, and recommended multiobjective planning and management through a river basin approach. The 1981 report to the Water Resource Council, Impediments for Development of Water Resource Projects, agreed that a lack of a national water resource policy was a major impediment and recommended establishing such a policy. The 1981 report to the Water Resource Council, Impediments for Development of Water Resource Projects, agreed that a lack of a national water resource policy was a major impediment and recommended establishing such a policy. The 1998 Western Water Policy Review cited the need for Federal agencies to coordinate and integrate their programs and initiatives. The Bureau of Reclamation’s Water 2025 report (2003) called for principles to guide water management decisions. The Western Governors’ Association issued reports in 2006 and 2008 recommending a Federal-state cooperation framework for a sustainable future. The Congressional Research Service once again summarized the challenges of 35 years of water policy by executive and judicial actions and piecemeal legislation with no clear vision in its 2009 report, 35 Years of Water Policy: The 1973 National Water Commission and Present Challenges. Constructing a water vision has captured the attention of the World Water Forum and the European Union nations, who are working to fashion national visions for integrated water resources management and sustainability and to translate these visions into action through pilot programs.

Were a national water vision to be supported by laws, Presidential Executive Orders, regulations, policies, and revised Principles and Guidelines for water project development it could focus the Nation at multiple levels, including the private sector, on flexible and proactive water resources planning and management for the 21st Century and unify effort toward shared goals.

The majority of participants in this initiative recommended development of a national water resources vision, including strategic actions to develop it. As stated by the Interstate Council on Water Policy:

Some are concerned that developing a national vision statement will divert attention from the more important need to determine how Federal agencies and water programs can support and enhance state and interstate water planning. However, other members believe that establishing a national statement will help elevate sustainable water management as a national priority.

Proposed Actions:

1. In collaboration with the Corps, the American Water Resources Association (AWRA) should initiate an outreach effort for the development of a national water vision and policy, and proposals, tapping the sentiment of the water resources community at large.

   a. The Corps should keep the dialogue moving forward about a national water vision by forming and facilitating a working group consisting of state, Federal,
interstate, tribal, and NGO representatives, in collaboration with AWRA to craft and evaluate draft vision statements.

b. The working group should promote a process to draft a proposed national and/or regional vision statement(s) with the support of local watershed groups.

c. At the National Conference, AWRA offered to build a blog to collect proposals for a national water vision, which it will launch soon. Based on the proposals collected, AWRA will facilitate a visioning workshop to gain consensus on a national vision. Upon approval of the national water vision, AWRA will begin collecting proposals for supporting policies and strategies to put the vision into action through a small working group led by AWRA and the Corps and will seek consensus on them through one or two subsequent workshops in collaboration with the National Water Team (see Recommendation 3). The policies and strategies will be aligned with the implementation plan for this initiative.

d. In collaboration with other Federal agencies, the Corps will facilitate workshops to unify the Federal family around a common Federal vision for water resources management in support of a national water vision.

2. Collect and codify shared visions for water resources management for specific watersheds or river basins through contact with grassroots groups, beginning along the Mississippi River. The purpose of this action is to foster a relationship and network with the leaders of local watershed groups and to get a sense of their visions for their watersheds, river systems, and regions.

3. Correlate regional visions with the proposed national vision to promote integration and linkages.

4.3 Recommendation 3 – Governance and Management

Strive to reshape organizational structures and means to improve water resources planning, decision making, and evaluation in ways that build the public will to act for integrated water resources planning and management.

Action is propelled when people are enabled to act by virtue of some authority, structure, or function and have sufficient resources to act. Governance structures enabling consistent and complete data collection and analysis and management of integrated water resources are needed. Fragmentation regarding authorities and policies, overlapping and redundant responsibilities, conflicting foci and priorities, and differences in planning approaches hinder effective integration of efforts and aligned decisions about infrastructure investments. Roles need to be clarified. Mechanisms facilitating IWRM can join efforts toward common goals and across levels of government. Legislation may be needed to overcome the extant short-term view and attention to localized needs through a narrow lens. Mechanisms need to be found or established to facilitate information sharing, collaborative work, and joint budgeting. Times, conditions, and planning assumptions have changed and so must structures to accommodate
the water resources needs of today. The Western Governors’ Association summed up the situation in a 1989 White Paper on Federal Water Policy Coordination:

A principal characteristic of Federal water policy is that policies are made in an ad hoc, decentralized manner. No agency of the executive branch or committee of Congress is responsible for keeping an eye on the “big picture.” Thus Federal water policy lacks a unifying vision or even a set of guiding principles. A host of problems are created by, or at least are related to, the absence of a unifying vision, including redundancy of functions across programs, protracted disputes, interagency turf battles, absence of policies, and lack of finality of many water disputes.

Furthermore, a 1998 report entitled *Water in the West: The Challenge for the Next Century* by the Western Water Policy Review Advisory Commission and published by the Western States Water Council concluded, “At a time when our water resources policies are in such rapid transition, it is remarkable that there is no regular forum for discussion of these issues by involved Federal officials.”

The conclusion of the Second National Water Policy Dialogue sponsored by the American Water Resources Association in January 2005 highlighted the need for an effective governance structure:

*There is a need to reconcile the myriad laws, executive orders, and Congressional guidance that have created the current disjointed ad hoc national water policy and to clearly define our 21st Century goals and objectives. Many important laws were passed early in the last century, when national objectives and physical conditions were far different. Many of these documents conflict with each other, placing executing Federal departments in tenuous and sometimes adversarial situations by creating disharmony among states and localities.*

The *Federal Agency Assessment* report completed as part of this initiative noted that agency culture may hinder multiplicative thinking in favor of a single-minded way of approaching issues and potential conflict from different mandates and legislative authorities or duplication in authorities. An official interviewed for the report summarized that the culture in Congress does not necessarily promote a comprehensive approach:

- Congressional committee structure hobbles the ability to have a unified approach, although Federal agencies are doing what they can to better coordinate.

- Congressional committees need to be better aligned. They determine which agency gets work and the nature of the work. The lack of coordination and integration at the Congressional level creates alignment challenges for the Federal agencies.

- We need to examine the Federal role in light of today’s needs and realities. As previously discussed, states have increased technical capabilities and don’t need to rely on the Federal government for basic expertise. However, there is definitely a role for the Federal government in interstate water issues, in broad emerging issues like climate change, in R&D, and in tribal responsibilities.

- Reestablish something like a national water council to set national water goals and authorities.
Speaking at the National Conference, the Honorable Chairman James Oberstar, Chairman of the U.S. House Committee on Transportation and Infrastructure, noted the dysfunction that comes from fragmentation and suggested that the U.S. Army Corps of Engineers assume the role of integrator.

There are 24 Federal agencies with water responsibilities and this does not count the land management agencies with related responsibilities. Policy is ad hoc, implementation is decentralized, coordination is fragmented, and communication is non-existent or fails to connect. We need a national water policy and unifying vision and guiding principles. I want to introduce legislation to pull our Federal water resources together. I see the U.S. Army Corps of Engineers leading the coordination.

Others recommended that the U.S. Army Corps of Engineers be given an explicit mission for integrated water resources management, an authority Congress has granted the Corps to support water planning in Oklahoma.

A way forward is to streamline and reduce the redundancy and ambiguity in authorities – especially environmental authorities – under Federal purview and to clarify roles and responsibilities of agencies and levels of government. Maybe a consolidated national water agency or a water czar is merited, but it is unclear what the specific new structure should be. Nonetheless, a Federal role may well be to pull together key authorities, decision makers, and resources for better integration and alignment of purpose for water resources management toward sustainable development. As the attempt to integrate diverse agencies into the Department of Homeland Security showed, however, it is difficult, cumbersome, and time-consuming it is to recombine authorities and organization into more integrated structures and functions.

Integrated Federal management could be supported by a unified Federal policy for a watershed/system approach. The Departments of Agriculture, Commerce, Defense, Energy, and the Interior; the Environmental Protection Agency; the Tennessee Valley Authority; and the Army Corps of Engineers were joined on October 18, 2000, through a Unified Federal Policy for a Watershed Approach to Federal Land and Resource Management as an action item under the Clean Water Act to prevent degradation of high-quality waters and to accelerate the restoration of degraded water resources, but this initiative fell through the cracks in the transition of Administrations after the November 2000 election. Perhaps it should be consulted again.

Informal mechanisms have emerged, perhaps out of a growing need to develop sustainable strategies in the face of global warming. Agencies are communicating more and better. The Federal government is working more closely with states to solve problems innovatively through open dialogue. The WestFAST structure of an assigned liaison that coordinates across states in the Western Region and with Federal agencies is an example. Many think that a similar structure is needed in the Central and Eastern Regions. Interagency forums have spawned interagency working groups for follow-on work, some of which have led to formalized partnership agreements. Yet enabling formalized entities to work requires sustained resources, as the Water Resources Council discovered.
Were a horizontal structure in place across Federal resource agencies and a vertical structure working across levels of government and with non-government entities it would be possible to move ideas to action in more unified ways for economy of effort and greater effect. Simply getting all the players together within a river basin to find out what is going on and then discussing how work can be better coordinated and integrated is a way to start. There are many best practices of coordinated action and information sharing at the local watershed level to build on. Any mechanism must facilitate both bottom-up and top-down efforts.

The Integrated Water Resources Science and Services (IWRSS) project of NOAA provides a working example of how to align agencies through the governance structure of a consortium. The agencies involved (USGS, the Corps, NOAA) have proposed a governance structure that spans planning teams focused on specific activities up through a project management level to an executive level (an Executive Oversight Council), with frequent engagement with the Federal Advisory Committee for Water Information (ACWI) to receive further guidance. The notion is to develop a roadmap through regular meetings to plan and share information across scales (from small hill-slopes to large watersheds, from droughts to floods, and from historical analyses to long-range predictions) and to present joint budgets to the Office of Management and Budget based on a unified case for resources.

Many people believe that a unified vision with Guiding Principles and specified roles and responsibilities could go far toward focusing water resources priorities and integrating water and related land resources planning and management. Clear roles and responsibilities will enable a governance structure to work. Some of the fragmentation and lack of coordination may be due to the fact that roles and responsibilities have not been rationally defined or are not clearly understood. Roles and responsibilities should be clarified so as to accommodate new needs and capabilities among the various water resources stakeholders at multiple levels. There is a clear and compelling need for an integrator role to collect and share relevant information, to highlight key issues, to shine a laser beam on critical needs, to synthesize information, to bring resources to bear for viable solution options that promote sustainable results, and to target education to breed support for initiatives large and small. The Corps will step up to facilitate a continuing dialogue and will leverage its current authorities in ways that enable integrated water resources management. Continuing discussion is needed to evaluate if new authorities are needed by Federal agencies, including the Corps, and if funding mechanisms should change to better support states in their integrated water resources planning and management.

Proposed Actions:

1. Align water resources responsibilities among the Federal family of resource agencies in order to increase consistency and unity of effort for common aims.

   a. Reinforce the President’s Council on Environmental Quality (CEQ) in playing its leadership role across Federal agencies. Mr. Jonathan Carson, Chief of Staff of the President’s Council on Environmental Quality noted that the role of CEQ is to coordinate and collaborate across Federal agencies and is doing so for climate change adaptation, cleanup of the Chesapeake Bay, sustainable development, revision of the Principles and Guidelines for water resources project development
across Federal water resources agencies, development of a green economy, and floodplain management.

b. CEQ should establish a Federal interagency working group — the Federal Principals Group for a Sustainable Water Future — to focus on joint or aligned watershed or systems management or integrated water resources management; at a minimum to share information.

c. Identify all current or planned watershed-scale authorities, activities, initiatives, and programs of the Federal agencies that support integrated water resources management, building on this initiative’s Federal Agency Assessment and identify overlaps, gaps, and conflicts for resolution.

2. Study what makes successful compacts and agreements work, e.g., the Rio Grande Compact between Colorado and New Mexico; the Colorado River Shortage Sharing Agreement to figure out a process for sharing shortages among the Upper and Lower Colorado River Basin states; the Inter-Tribal Councils in Oklahoma; the Missouri-Arkansas Bi-State Memo of Agreement to address different regulations, authorities, water quality standards, priorities; the Great Lakes Water Compact with the Council of Great Lakes Governors and Canadian Provincial leaders to address consumptive water use in the Great Lakes; and the Columbia River Water Management Treaty between the U.S. and Canada for flood risk management, hydropower, and environmental needs. This will reveal generalizable success strategies.

3. Sustain and promote the role of the interstate organizations as a mechanism to facilitate decision makers and planners in implementing a regional view and a holistic approach to water resources assessment/evaluation, planning, management, and conflict resolution. As effective advocates and models for integrated water resources management, interstate organizations have much to share about their policy, consensus-building, regulation, and collaborative planning successes.

4. Explore establishing groups with access to state governors in the Central and Eastern Regions to support interagency and Federal-state coordination and collaboration like the WestFAST group. Work with Federal agencies to establish a coordinator for each region.

5. Develop a vertical National Water Team of Federal, state, regional/interstate, and non-government entities to serve as a working group to provide information about watershed-based planning and management, including lessons learned and best practices.

4.4 Recommendation 4 – Collaboration

Promote opportunities and mechanisms for collaborative water resources planning and management.

The states heartily endorsed collaborative planning and indicated that they availed it and were planning to expand opportunities for collaboration to identify water resources needs, define
problems, develop solution alternatives, and reach out to inform and educate others. Partnerships are both formalized and informal to focus effort on common goals related to planning, problem solving, and implementing plans together.

There are many benefits to collaboration: adding perspectives on a problem, aligned goals and objectives, exchange of information and technologies, coordinated implementation efforts, identified and corrected voids, pooled resources, avoidance of needless duplication of effort, and attempts to build strategic alliances to make the most of the resources and effort expended.

Partnering is promoted both top down and bottom up. Public involvement, partnerships, and outreach are signatures of water resources planning in the states. On the front end of the planning cycle, stakeholders provide input about their concerns and needs at programmed points in the planning cycle stipulated by policy, law, opportunity, or when moved to action; on the back side of the cycle they provide feedback and insights about the feasibility and success of specific policies, programs, and interventions. States currently — and more so would like to — get together to share information, tackle problems jointly, coordinate efforts (especially for emergency response), and form strategic alliances. Informal alliances and formal partnerships achieve economy of effort, fill neglected gaps, and foster joint action for targeted results. As one member of a regional small workgroup said, “You can’t go wrong with collaboration, so just do it.” Former Secretary of the U.S. Department of the Interior, Dirk Kempthorne, told the Western Region Conference attendees that “We must collaborate or we will die. It’s that important.”

There are many examples of effective partnerships. The Intergovernmental Flood Risk Management Program among the Corps, FEMA, the Association of State Floodplain Managers (ASFPM), and the National Association of Flood and Stormwater Management Agencies (NAFSMA) aim to identify common issues regarding flood risk mapping and management and to communicate flood risks. They are reporting on the effectiveness of flood risk reduction programs, developing mutual guidance, fostering communication and information sharing through joint workshops and conferences, and providing information to levee districts. The ‘Minnesota Recovers’ Task Force is a flood response team among Minnesota, USACE, NOAA, USGS, counties, mayors, sheriffs, and other partners established to cut through red tape for local emergency response based on the California Silver Jackets program offered by FEMA and USACE. The partners engage in daily coordination for hazard mitigation, restoration, buyouts, and relocation of individuals away from the floodplain.

Throughout this initiative participants consistently voiced their appreciation for the opportunity to interact with counterparts in other states and other professionals engaged in similar work. Sharing lessons learned can help planners avoid bad starts and provide insights and networking points of contact to jump start projects forward.

Collaboration is not necessarily easy. It takes time, effort, reinforcement, funding and commitment. Understanding common challenges and the culture and politics of the situation, knowledge of relevant authorities, incentives to act or not to act, and funding, all spur collaboration. Partnerships are codified through Memoranda of Understanding and Agreement and compacts signed by the parties involved. Partnerships may be between public entities or with non-governmental entities and the private sector (public-private partnerships). State representatives and other conference attendees called for revitalizing the river basin...
commissions to facilitate collaborative interstate and regional planning at a watershed scale. Joint watershed work was noted as an area ripe for collaboration and, in fact, is under way.

There are many examples of collaboration across the Federal agencies. The USGS and EPA have joined on the STORET (STOrage and RETrieval) database of biological, physical, and chemical data about ground and surface waters, and the National Water Information System (NWIS) with a common data portal. The USGS recently partnered with NOAA, EPA, and the Corps to produce USGS Circular 1331, a comprehensive overview of the impact of climate change on water management. Mr. James Hess, Associate Director of Operations for the Bureau of Reclamation offered that there is a need to define collaboration better with stakeholders; collaboration is more than holding a public meeting.

There are many initiatives to foster partnering between the Federal government and the states, e.g., the USGS Cooperative Water Program since the 1920s, the Chesapeake Bay Program, the Bay Delta Conservation Plan, the Great Lakes Regional Collaboration, and the Comprehensive Everglades Restoration Plan. California’s Office of Water Resources and Game and Fish Department, the Sacramento Flood Control Authority, the U.S. Fish and Wildlife Service, the Corps, and FEMA developed a framework to address vegetation and levee deficiencies in the Sacramento Delta so as to balance removal of vegetation with protection of endangered species – a model adopted by Los Angeles and New Mexico.

Opportunities for collaboration and partnering include data gathering, monitoring, adaptive management, project development, ecosystem restoration, interstate conflict resolution, infrastructure maintenance and upgrading, emergency management planning, innovation (e.g., carbon trading, nutrient banking), and the desire to be proactive. Membership in professional associations and non-governmental organizations, such as the American Water Resources Association, Association of State Floodplain Managers, National Association of Flood and Stormwater Management Agencies, Indian Water Working Group, Missouri River Association of States and Tribes, National Mississippi River Museum and Aquarium, The Nature Conservancy, and the Western States Water Council, meet regularly to discuss common interests.

**Proposed Actions:**

1. Avail the missions, roles, experiences, networks, and proven track record of the interstate river basin commissions to facilitate coordination and collaboration across member states and for regional water planning and consensus-building. Ensure sustained funding for them.

2. List and describe the ongoing activities of selected active watershed groups working under Federal, state, and local auspices in each watershed/river basin.

   a. Mine exemplars, best practices, and watershed-scale work in the data provided by this assessment to identify opportunities for partnering, e.g., the Bay-Delta Conservation Plan aimed at restoring habitat for fisheries in the California Bay-Delta while also addressing water supply within a stable regulatory framework. Add examples.
b. Build a database of points of contact for partnering within specific watersheds, building on information collected for this assessment.

c. Identify tribal and interstate activities ongoing in each watershed. Work with tribes to raise awareness of water issues on Indian reservations and in partnership with others. Develop a strategy/plan as appropriate.

d. Identify gaps and opportunities for building partnerships, building on the lists of gaps and opportunities obtained through this initiative, and propose ways to resolve or constructively exploit them.

3. Initiate an effort for **50 States and 50 Watersheds** or **United Watersheds** to develop regional multipurpose watershed plans, building on bottom-up collaborative efforts basin by basin.

   a. Mine the data in the trends reports, regional conference proceedings, and Federal Agency Assessment report to identify state-Federal partnerships and outreach activities that are working well or can be enhanced and summarize in a separate report.

   b. Identify the top 10 educational outreach programs of the Federal resource agencies and seek natural linkages to them.

   c. Each Federal agency should identify current or develop 3 to 5 pilot or demonstration projects to promote strategic alliances and partnerships across levels of government and with the public and private sectors to promote integrated water resources management. Build on the Eastern, Western, and Central Region Conference recommendations (worksheets) offered by this initiative’s participants, e.g., encourage the EPA and USGS to form a partnership with Great Lakes states in the Great Lakes Basin for ballast management given biological impacts of Zebra mussels and discharges from ships on water supply in fresh and brackish waters.

   d. Build on current forums for collaboration among Federal agencies in supporting state/regional water management, e.g., the Sustainable Water Resources Roundtable, created under the USGS Advisory Committee on Water Information (ACWI); it provides a forum to share information and perspectives to promote better decision-making about sustainable water resources development.

   e. Align with efforts underway that support the intent of this initiative, e.g., the Southeast Regional Water Resource Alliance, the Southeast Natural Resources Leaders Group, and the Conference of Southern County Associations regarding solid waste and wastewater, the Corps’ effort to form a southeast regional entity around common needs.
4. Identify effective Federal interagency efforts, e.g., the Executive Order on the Chesapeake Bay to examine biological pollution impacts on water supply and to protect the aquatic ecology of the Bay downstream.

5. Explore mechanisms to forge public-private partnership, building on a White Paper produced for the Corps’ by the Institute for Water Resources on how and why such partnerships can or do work. Suggest models and examples for public-private partnerships.

6. Promote ongoing interchanges across the Federal agencies, states, tribes, and with NGOs.
   a. Develop an annual catalogue of professional water resources and related conferences, symposia, meetings, and workshops and strategize ways to obtain information from representatives who have attended them for the purpose of targeting specific conferences to attend by envoys who promote IWRM and sustainable development.
   b. Plan and conduct annual or bi-annual regional meetings to enable water planners to share information and experiences and to learn about integrated water resources management failures and successes from one another.

7. Develop a communications strategy and communicate about partnerships for integrated water resources management.
   a. Develop a multimedia Strategic Communications Plan.
   b. Develop a strategy to enhance outreach and educational efforts for specific water systems. Increase and formalize partnering agreements for these outreach and education activities as appropriate.
   c. Building on the information collected through this initiative, develop and publish case examples of what is working well (best practices) or not working and why for selected partnership efforts within specific watersheds.
   d. With the help of NGOs actively engaged in public outreach and education (e.g., the National Mississippi River Museum and Aquarium in Dubuque, Iowa and the National Great Rivers Research and Education Center in Godfrey, Illinois), explore and identify ways to avail multimedia communication means and strategies to inform and educate about integrated water resources management and current and emerging water issues. Incorporate these suggestions in the communications strategy.
Current Examples of Collaboration by Selected States

_The Arkansas and Illinois Conservation, Reserve, and Enhance Program (CREP)_ is a collaborative riparian restoration program to repair riparian zones on the Illinois River, to restore water quality caused by runoff from the poultry industry, and to avoid interstate litigation. This partnership is bringing together public (Natural Resources Conservation Service) and private resources ($30 million, with $6 million contributed by non-federal partners such as Wal-Mart). Funds have been spent to plant trees and grasses, and state tax credits have been offered to landowners as an incentive to offset their costs.

_The Kentucky Drought Management and Response Plan_ (2008) is a proactive effort among a broad spectrum of 35 to 40 agencies, including Federal and state agencies, farm bureaus, industry (e.g., Toyota), and water companies to develop a drought response plan that is responsive to homeland security issues as well as prevention and mitigation needs.

Although prompted by litigation, the _Columbia River Federal Principles Group_ (NOAA Fisheries, U.S. Fish & Wildlife Service, Forest service, Bureau of Reclamation, EPA, USACE, the Bonneville Power Administration, four states, and several tribes) has been working for 10 years to develop a mitigation agreement.

_The Kansas City, Missouri Wet Weather Community Panel_ is a panel of developers, regional planners, civic leaders, businesses, environmentalists, regulators, the public, and neighboring communities to develop plans for combined sewer systems (sanitary sewer and stormwater systems). It is working on policy and goal development, seeking funding sources, and recommending solutions through consensus.

_Maryland, the District of Columbia, Pennsylvania, and Virginia,_ the U.S. Environmental Protection Agency and the Chesapeake Bay Commission are signatories to the regional _Chesapeake Bay Agreement_ with the U.S. Departments of Agriculture, Commerce, Defense, Education, Interior, Transportation, the General Services Administration, the U.S. Postal Service, states (New York, Delaware, West Virginia), academia (e.g., Pennsylvania State University, Smithsonian Institution, University of Maryland, University of Virginia), and local watershed organizations (e.g., Alliance for the Chesapeake Bay, Anacostia Watershed Society, National Fish and Wildlife foundation, Interstate Commission on the Potomac River Basin, Ducks Unlimited) to restore the Chesapeake Bay through a unified plan. President Obama signed Executive Order 13509 on Mary 12, 2009, to revitalize leadership to restore the Bay with bold new approaches and renewed commitment.

EPA will chair a leadership committee to develop an integrated restoration strategy to reduce pollution and meet water quality goals, promote targeted conservation, strengthen stormwater management at Federal facilities, adapt to impacts of a changing climate, conserve landscapes, strengthen science for decision making, and conduct habitat and research activities studies to improve outcomes for living resources.

_Virginia_ has developed educational strategies to target youth and students local public officials, and the private sector through web-based and mass media resources and signage programs to engage all persons and corporations interested in or directly affected by an proposed or existing plan or programs so that they all become advocates for watershed-based planning and management at the community level. Similarly, the _District of Columbia_ (Watershed Protection Division in the Department of Environment) trains students and teachers through teacher training programs and fellowships and camps.
4.5 Recommendation 5 – Water Resources Investment Strategies

Promote innovative and sustainable funding mechanisms for public water resources solutions, including water infrastructure, at Federal and state levels.

The need for funding to meet a variety of state water needs was highlighted throughout interviews and conferences during this initiative. Participants seek a streamlined funding mechanism and reliable funding stream to counteract ad hoc, project-centric, year-by-year approach to funding water needs today. State representatives also called for more joint budgets to enable joint projects and initiatives. Chairman Oberstar of the House Transportation and Infrastructure Committee told national conference attendees that the Nation falls short in investing in its water resources.

Infrastructure consists of the physical and organizational structure needed for a society and economy to function. Water infrastructure is critical to move cargo on rivers from towns and farms to markets and back to communities to sustain economic development. It conveys water from rural areas to cities and back. It treats water so that it is potable and usable and makes it accessible. It protects people and property from devastating floods and pools water for multiple uses. It generates hydroelectricity for homes, businesses, schools, and other institutions. It provides natural buffers and wetlands to sustain ecosystems. It provides a venue for recreation. It removes or stores water for drinking and other uses and treats and removes sewer/wastewater and stormwater.

Investment in water infrastructure is needed. Much of the Federal water infrastructure in place is nearing the end of its planned design life and too often breaks down from under-maintenance or simple wear and tear. The American Society of Civil Engineers consistently rates the Nation’s infrastructure as a D, near a failing grade. Failing dams and septic systems are problematic. Not all levees are built or maintained to the same standard, which increases risks of failure. There have been dam and levee breaks, most notably in New Orleans given the force of Hurricane Katrina. Irrigation systems on Indian reservations need to be rehabilitated, and Native American tribes have an ability-to-pay issue. Municipal water systems are not sufficient in growing metropolises. Wastewater treatment facilities and stormwater management strategies are inadequate. New needs are emerging but infrastructure lacks the capacity to address them, or is simply lacking. Some infrastructure is not performing as designed because invasive species (e.g., zebra mussels) are clogging intake valves. Sedimentation in reservoirs and its impact in reducing water storage capacity is a concern. Levees and dams are decaying, increasing risks to people and property and creating seepage problems and underground water contamination. Dams that are not up to current safety codes necessitate lower pool elevations and water release restrictions. Mining is making this situation worse. Shrinking surface waters from droughts and urbanization/population growth and increasingly tap groundwaters and testify to the need for new water supply infrastructure and water treatment plants and increased aquifer storage. Routine maintenance, removal of outdated infrastructure that no longer serves a useful purpose, upgraded infrastructure to meet changing conditions, and new infrastructure to meet emerging needs are needed.
The Congressional Research Service says a renewed focus on funding is coming from the financial requirements of meeting regulatory requirements, failing infrastructure, costs to protect and secure critical infrastructure, emerging problems that are not being met by existing solutions, and the stimulus to the economy provided by infrastructure projects in the current economic downturn. The costs of funding public infrastructure are high, however. EPA estimated in 2003 that $276.8 billion was needed just to improve drinking water infrastructure over the next 20 years to comply with the Safe Drinking Water Act. The Water Infrastructure Network of state, municipal, environmental, professional, and labor groups, the H2O Coalition of associations for water companies, water and wastewater equipment manufacturers, and the National Council of Public-Private Partnerships identified an annual gap of $24.7 billion for municipal wastewater and drinking water infrastructure, $940 billion for improvements and new systems and over $1 trillion for water and wastewater. The Congressional Budget Office estimated the costs at between $25.6 to $41.0 billion for water and wastewater combined (2001 dollars). A gap analysis by EPA predicted an average annual cost increase of 2.8 percent to 85.8 percent for capital investment and O&M combined for the years 2000 to 2019. These costs are just for this type of water infrastructure and not the full spectrum of water-related infrastructure. Unlike highway and aviation infrastructure, most water infrastructure does not enjoy long-term trust fund revenues, which may be why the notion of an infrastructure bank, seeded by Federal funds and long-term bonds, is gaining interest.

Participants in this initiative extolled moving away from crisis-driven funding toward deliberate investment within a watershed context. A comprehensive water resources investment strategy is needed for research and development of models and technology, and data collection and assessment. Also, Congressional support is needed for legislation to ensure

**States Seek Investments in Infrastructure**

In the Western Region, California reports needing funds to rehabilitate and fortify levees in the Central Valley so as to reduce risks, and to develop additional water supply sources. The state desires to renovate drinking water facilities. Kansas is faced by sedimentation in Corps reservoirs, degradation of channels in the Missouri River and would like to conduct a comprehensive assessment of existing flood control infrastructure and current storage capacity. Washington desires new infrastructure to meet growing municipal and agriculture demands.

In the Central Region, Kentucky is interested in exploring alternative financing approaches to fund infrastructure systems and would like at least $8.2 billion to expand, upgrade, and replace public water supply infrastructure to meet requirements of the Safe Drinking Water Act and $5 billion to address aging infrastructure needs, especially to treat sewerage. Missouri expressed concern about its aging public water supply systems (especially small public water supply systems), abandoned wells and coal mines, and the inadequate state of private water wells. Small communities are having difficulty affording upgrades to their water supply infrastructure. Mississippi desires to create an infrastructure backbone at a regional level rather than to rehabilitate many local systems, beginning with a pre-Katrina inventory of infrastructure conditions for communities.

In the Eastern Region, the District of Columbia wants to replace lead pipes in its water supply distribution system. New Jersey desires wastewater treatment plants. North Carolina wants dredging and harbor restoration.
reliable funding streams, so consultation with Congressional members and their staff is desirable. In the meantime, better management and efficiency improvements may prove fruitful in getting more from available funding. The Congressional Research Service concluded that a watershed-based approach may help because it favors looking more broadly at water resources in a coordinated way to ensure that actions achieve the greatest benefit.

The American Recovery and Reinvestment Act of 2009 (February 17, 2009) has allocated emergency supplemental appropriations for Fiscal Year 2009 and 2010 to modernize the Nation’s water infrastructure in an attempt to spur the economy and generate job growth, including improvements to water infrastructure (e.g., drinking water supply, sewage collection and disposal, drainage systems, irrigation systems, flood control systems such as dikes, levees, pumping stations, floodgates). There are concerns, however, as to how these Recovery funds will influence decisions on regular appropriations bills beyond Fiscal Year 2009 for these agencies and cost-sharing (unless project assistance is provided as a grant, communities and project sponsors will need to come up with matching funds — a challenge in the current economic environment). States also wonder how they will continue funding once the Act expires.

Proposed Actions:

1. Develop a comprehensive water resources investment strategy that shifts investment in water resources solutions away from crisis-driven funding toward integrated water resources management. Note that California requires any new projects to show that they are part of a regional plan before receiving funds.

2. Develop a database of current Federal funding approaches and authorities to paint the big picture of funding options, e.g., State Revolving Funds, FEMA’s Section 404 hazard mitigation assistance, the Corps’ Section 22 Planning to States and Section 729 river basin planning cost-sharing, USDA’s PL 83-566 Section 406 watershed-scale funding, the Bureau of Reclamation’s Challenge Grant Program, partnership grants, set-aside funding for regional planning.

3. Extend use of funding mechanisms for regional or watershed-scale work, e.g., WRDA Section 22 Planning Assistance to States, Section 729(b) for watershed-scale assessments, 219 program for regional environmental infrastructure, Section 216(5x) for reallocation of water at Federal reservoirs.

4. Review publications about infrastructure funding, to glean specific investment strategies, e.g.,
   b. Reports by the American Society of Civil Engineers, which has issued report cards on the Nation’s infrastructure;
c. EPA’s Environmental Financial Advisory Board’s Environmental Finance Center Network’s recommended investment strategies for the Nation’s public water infrastructure; and


5. Prioritize funding needs within Federal agencies with the aid of decision support models/tools with explicit criteria to assist in prioritizing infrastructure maintenance needs and new construction.

6. Develop an inventory of asset management programs across Federal agencies; augment it with state data and prioritized infrastructure based on condition assessments.
   a. Review inventories of dams and levees, noting their condition assessments and risk levels.
   b. Build on the Corps’ Levee Inventory Program.
   c. Build on the Corps/Bureau of Reclamation Dam Safety Classification.

7. Work with the states to develop plans or advocate policies for new options for funding public water infrastructure, including public-private partnerships and cost-sharing incentives.

8. Consider innovative funding strategies, e.g., surcharges or fees for water use, withdrawals, permits, effluents, chemical feedstock, growth, green applications, impacts; rebates; demand management; more efficient water pricing; incentives; water banking; an infrastructure bank; bond sales, tax-exempt private activity bonds, combining funding strategies (e.g., trust funds, public-private partnerships, impact fees, cost-sharing and cost-sharing incentives, direct appropriations, rebates, general surtaxes of surcharges, regulatory fines, loan guarantees, bonds, pooled funds, State Revolving Funds, state and local grant and loan programs, block grants, or general taxes). Explore the use of subvention funds to permit the pooling of resources and enterprise funds from diverse sources/ agencies.

9. Fund or sustain funding for critical programs and strategic opportunities, e.g., USGS National Streamflow Information Program, LIDAR technology to assess total maximum daily loads (TMDLs), multiobjective and multipurpose studies and projects, USGS National Water Census to provide a current baseline of water availability and use throughout the nation.

10. Promote legislation that fully funds a project throughout a project’s lifecycle of planning, design, construction, operation and maintenance (O&M) rather than tackle O&M funds on after-the-fact basis per project. Require an Operational Plan before project approval.
11. Promote legislation that changes the cost-share formula from 50/50 (Federal-local sponsor) to 75/25 for systemic watershed-scale planning and regional planning (note that State Revolving Fund grants may not suffice and that local governments may only be able to make small relative contributions).

12. Develop an education/communications strategy and designated team to consult with Congressional members and staffers about water needs and funding options.

13. Work with the Office Management and Budget to develop joint budgets across Federal agencies for shared goals.

14. Provide funding to enhance states’ implementation of their state water plans based on the states’ having a comprehensive watershed/basin-scale plan that puts projects in the context of regional water system needs and ongoing activities.

4.6 Recommendation 6 – Managing Extreme Events

*Increase the ability to anticipate and manage natural and man-made disasters and climate change impacts.*

In this era of a high incidence of natural disasters brought on by changing weather patterns and man-made disasters wrought by terrorists, it is an imperative for the Federal, state, and local governments to be prepared to thwart or respond effectively to extreme events. Extreme events seem to be growing in frequency and severity. The ferocity of Mother Nature should not be underestimated. The September 2009 flooding in Atlanta, Georgia, where more than 20 inches of rain dropped in torrents in a short period of time, swept victims’ cars into rain-swollen creeks and made living rooms muddy fields. South Dakota is chronically besieged by floods in the Red River, wildfires, severe winter storms, landslides, and mudslides. California similarly sees mudslides become more severe given the loss of vegetation from wildfires whose season has become prolonged. Buoyed by an enormous winter snowfall that melted and drove river levels to record highs, severe weather and extreme floods threatened the banks of the Red River in North Dakota and Minnesota to overflow in late March 2009, and, in fact, a portion of the floodwall broke and submerged a school campus in Fargo, North Dakota. The threat was worsened by a huge sheet of ice that moved slowly toward Oslo, Minnesota, creating a major jam on the river whose waters were above flood stage. A special problem is that the very flat terrain presents few opportunities for drainage.

Climate change is a key variable in creating extreme conditions. In 2007 the Intergovernmental Panel on Climate Change (ICPP) released its fourth assessment, *Climate Change 2007*. The report details how climate change is unequivocal and is observed as increases in average air and ocean temperatures globally, widespread melting of snow and ice, sea level rise, precipitation change, and extreme events (presumed to be caused by greenhouse gasses and use of aerosol cans). Climate change is impacting ecosystems, water resources, food security, settlements, society, and human health, making the American physical and social structures more fragile. Impacts include enlargement and increased numbers of glacial lakes, increasing ground instability — to include rock avalanches — in permafrost regions and mountain regions, affecting plant and animal species, e.g., earlier green vegetation and bird migration and egg-laying. Changes in
marine and freshwater biological systems are correlated with rising water temperatures and related changes in ice cover, salinity, oxygen levels and circulation, causing changes in algal, plankton, and fish abundance and migration in oceans, lakes, and rivers. Sea level rise and human development have contributed to loss of coastal wetlands and mangroves and increased damage from coastal flooding. The U.S. Climate Change Research Program notes projected increases in heavy downpours; lengthened growing seasons; alterations in river flows; threats to crops and livestock from increased heat, pests, water stress, diseases, and weather extremes; and adverse impacts to human health from heat stress, waterborne diseases, poor air quality, and diseases transmitted by insects and rodents.

Potential climate changes in the Central Great Plains Region (Colorado, Kansas, Wyoming, and Nebraska) include effects on winter snowfall, growing season rainfall amounts and intensities, minimum winter temperatures, and average summer temperatures. Average temperatures in the Upper Great Lakes region are expected to increase by 2 to 4°C, while precipitation could increase by 25 percent by the end of this century. Increased temperatures are blamed for a drop in water levels on Lakes Huron, Erie, and Michigan, which concerns commercial shippers, hydroelectric companies, and recreational boaters, raising serious concerns for ecosystems and the economy. Crops can mature too quickly in warmer climates. Global warming is leading to a hotter and drier summer season in the Western Region of the U.S. and a parched landscape and less robust Colorado River, which serves the needs of 27 million people for agricultural, municipal, and commercial and residential use. Less runoff from decreasing snowpacks and less rain suggest that the Colorado River—the lifeline of the Southwest through Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming and into Mexico—will not be able to allocate water to meet consumption needs for homes, farms, and businesses by 2050 if climate changes warnings prove true. Hoover Dam’s Lake Mead reservoir could run dry by 2021. Sea level rise and storm surges along the Eastern and Gulf Coasts increase the risk of erosion and flooding. Contamination from animal wastes following storms becomes a problem. Flooding has negative implications for the region’s fisheries and coastal ecosystems. Farmland and wetlands are lost, which means reduced habitat for species and shorebirds.

**Reflections on Climate Change**

The Intergovernmental Panel on Climate Change notes that the Northern Hemisphere snow cover and sea ice are decreasing and freezing seasons are becoming shorter; sea ice is becoming thinner; and glacier melt and permafrost are decreasing. At the same time, soil temperatures are increasing. Snow cover area is expected to contract while heat extremes, heat waves, and heavy precipitation events will become more frequent, typhoons and hurricanes will become more intense with larger winds and heavier precipitation in the 21st Century, and sea level could rise 7 m the future.

Weather extremes are being documented. The National Climatic Data Center characterized the 2008 Atlantic hurricane season as the fourth busiest year since 1944 and the only year on record in which a major hurricane existed in every month from July through November in the North Atlantic.

Many believe that having or having access to timely, accurate, and complete information is the best preparedness. State representatives universally expressed their desire for information about what might happen as a result of climate change and how to prevent it or mitigate its
adverse effects. This concern was validated by the Federal agency representatives from the Department of Interior and its representatives from the Bureau of Reclamation, USGS, Fish and Wildlife Service, and Bureau of Land Management; EPA; NOAA; FEMA; USDA Headquarters and its U.S. Forest Service and Natural Resources Conservation Service; the Department of Defense; and the President’s Council on Environmental Quality.

Droughts precipitate much emergency planning and overall water resources planning because the thought of the water spigot running dry is most frightening. As populations grow and move, development ensues but the water infrastructure does not necessarily follow. States (especially those in the South, Southwest, and Southeast) consistently seek reliable future water sources. The U.S. Drought Monitor (a partnership among the Department of Agriculture, the Department of Commerce, the University of Nebraska’s National Drought Mitigation Center, USGS, USDA’s Natural Resource Conservation Center’s National Water and Climate Center, NOAA’s Climate Diagnostics Center and the National Weather Service’s National Weather Service Hydrology, regional climate centers, and state climatologists) shows that Texas and Wisconsin are suffering the most extreme or exceptional droughts, with California, Nevada, and Arizona suffering severe droughts as well, as of September 29, 2009. Washington, Oregon, Idaho, Montana, Utah, Colorado, and New Mexico have not escaped droughts. Droughts are projected to remain in the Southwest and Northwest through the winter and to begin in the Southeast come June, July, and August of 2010.

New Orleans, Louisiana exemplifies the danger of not being adequately prepared for potential disasters. New Orleans was built on a delta marsh and half of it sits below sea level. Preparedness planning using alternative scenarios suggested that the chances of a Category 5 hurricane directly striking New Orleans was a one-in-500 year event, yet Hurricane Katrina struck and created the worst engineering disaster in U.S. history. Evacuation plans proved inadequate, and blame for the lack of preparedness was spread around all levels of government. For five days civil order broke down, infrastructure failed, and 80 percent of the city flooded without significant Federal response. There were serious communications failures (telephones and internet service went out), damage to buildings and roads (bridges collapsed and the airport closed), levee failures putting the city under water for days, and 1,464 people died. Violence ensued from the breakdown of transportation, communication, and the fact that police and civil entities were overwhelmed.

Certainly in the aftermath of Hurricane Katrina and before, states have engaged in emergency management activities, especially drought planning, to ensure they have sufficient water supply sources for the future and to conserve current resources. Katrina changed the way the Federal government addresses its preparedness and water infrastructure planning and raised awareness that the infrastructure systems were not developed with a systems view sufficient to provide a high level of protection. Most often emergency planning is engaged in by departments or agencies separate from water resources planning such that emergency/drought management and hazard mitigation plans are not necessarily integrated into state water plans. A few states are exceptions.

Chairman James Oberstar of the U.S. House Transportation and Infrastructure Authorizing Committee noted at the August 2009 National Conference that we tend to only think about
water when there are floods and droughts. Although we know that droughts will occur, we tend not to develop long-term drought plans. We have paid $31 billion in flood insurance since 1978, but drought management plans tend to be shelved when the rains finally come. Then we get worried when a hurricane washes an area away. We use our water supplies as if they will last forever but once we take water from groundwater aquifers, it will take years to replenish them from snow packs, and scientists predict a 20 percent reduction in snow packs (snowmelt) by the end of the century. This *seesawing* is characteristic of our water planning, Mr. Oberstar said.

**Examples of Integrated Water and Emergency Management Planning**

- **Rhode Island’s** Emergency Management Agency incorporates natural hazard mitigation and storm and flood response planning in emergency response planning.
- **Virginia and Connecticut** include drought management and emergency management planning in their statewide planning.

Sharing and pooling information about trends, best practices, external threats, and lessons learned from responding to extreme events are deemed invaluable. At the August 2009 National Conference, Ms. Deborah Ingram, Acting Administrator for Mitigation at the Federal Emergency Management Agency, called for collaborative planning to ensure readiness and responsiveness. FEMA’s mission is to ensure adequate preparation, mitigation, response, and recovery from flood and other disasters — increasingly through flood risk damage reduction strategies and grants in concert with other Federal agencies and state, local, and tribal governments. FEMA is trying to be proactive and build relationships with local personnel ahead of crises. FEMA is initiating a risk-based map modernization program to assist communities to be more aware of flood risks and to better prepare and respond to severe flooding. Tribes acknowledge the value of including information about Indian reservations on these maps. FEMA is collaborating with NOAA and the USGS to bring in Earthlink data to assess hazards at multiple levels and their impacts on water resources. The USGS Circular 1331 on climate change, produced by NOAA, the Corps, and FEMA, will facilitate informing organizations inside and outside government about the potential impacts of climate change.

**Proposed Actions:**

1. Mine the data in state summaries, the trends reports, and regional conference proceedings from this assessment to prepare a summary of what states are doing for their drought, flood mitigation, and general emergency planning and create a database summarizing the results. Coordinate with state representatives interviewed for this assessment.

2. Summarize concisely the impacts of potential climate change based on USGS Circular 1331, *Climate Change and Water Resources Management: A Federal Perspective* and ask Federal resource agencies to comment on their expected impacts given the factors identified in that report.
3. Build climate change assumptions and data and risk-management methodologies into planning models based on the latest research.

4. FEMA should lead a combined interagency and national team (or build on a team it currently has) to report on the state of the state of readiness of Federal and state agencies for specific watersheds.

5. Federal and state agencies should add information about the state of their readiness to the Federal Support Toolbox.

6. Coalesce and widely publish condition assessments of water infrastructure.

7. Provide technical planning assistance to states to develop comprehensive state water plans that integrate disaster/emergency/drought management plans and water resources plans in a single document or aligned documents.

8. Provide states with information and tools that support integrating water resources planning, land management planning, and hazard mitigation planning within a proactive framework that enables recovery to be responsive to future needs and probabilities rather than to past conditions.

9. Support FEMA in updating flood risk maps with relevant information across Federal agencies and promote sharing with states widely. Seek to include tribal information on these maps.

10. Expand the Silver Jacket emergency readiness program to all 50 states.

4.7 Recommendation 7 – Technology Transfer and Knowledge Capacity Building

Base water resources plans and decisions in good science and information and technology sharing and increase scientific and management knowledge and capability at all government levels.

Information goes stale and decision-making is too often based on outdated data and information. Farmers and city planners need current and complete information. Government at all levels needs to make data dissemination more efficient and streamlined. Decision support systems require information in which people have confidence. Data and information are the foundation for describing, understanding, predicting, and decision-making in the water world. When decisions are not grounded in science but rather are politicized, decisions are skewed, reflect favoritism, and alienate scientific and professional communities of practice, often producing bad decisions that are not likely to have desired effects. Many experts, especially the National Academies, including the National Research Council, have long espoused the importance of basing decisions on a solid and rational foundation. Scientific work is difficult and expensive and thus needs to reflect attention to scientific ethics, principles, and protocols in order to breed confidence about methods, findings, and conclusions. As Ms. Barbara
Naramore, Executive Director of the Upper Mississippi River Basin, told attendees at the National Collaborative Water Resources Conference,

_We do not need perfect knowledge to take sound action. We need to bring better and more relevant information to decision makers to make better decisions with limited resources. It is our responsibility to help decision makers anticipate needs and take smart action with a wide range of players._

Mr. Michael Wells, Deputy Director of the Water Resources Center in Missouri’s Department of Natural Resources, recounted at the Central Region Conference that the Central Region states endorse a systems approach, desire quantitative data and information, call for increased monitoring, and seek technical expertise and Federal funding for locally-led and sustainable projects.

The development and use of enhanced data, science and technology, and management processes for deepening knowledge and capability about water issues can infuse planning, decision-making, and evaluation processes with a scientific foundation. The knowledge and wisdom of experienced scientists and technology professionals is deemed invaluable. Technical assistance, tools, information, and funding support to obtain baselines and long-term trends and to assess and monitor resource availability and conditions on a continual basis are of utmost importance to states. States desire to share findings widely and easily and to translate raw data and analyzed information into knowledge to inform comprehensive planning and astute decision making. Mr. Michael Bogert, former counselor to the U.S. Secretary of the Interior, Dirk Kempthorne, exhorted the Western Region Conference attendees: “Let’s share the data and information we have now!”

More complete maps and maps that use graphical interface systems (GIS) technologies are needed. Consistent baseline information across Federal programs about flow levels in rivers
and streams and minimum levels required to successfully execute diverse water functions (e.g.,
navigation, flood and coastal storm damage reduction, ecosystem restoration and
environmental stewardship, water supply, protection of wetlands and species and habitats,
hydropower generation, recreation, and regulation of private development) are also needed.
Continual streamgage monitoring can provide consistent baseline information important to set
minimum flow requirements for diverse water uses and help address point and nonpoint
source pollution, survival of species, the Gulf of Mexico hypoxia problem, timing of flows and
flow cycles, sediment impacts along the Louisiana coast, management of nutrients and invasive
species in waters, intrusion of saltwater into freshwater supplies, and water supply sources and
quality, especially for potable water. Climate change models, risk management methodologies,
decision-support systems, and predictive and interactive processes are desired, for example, to
develop both site-specific and regional approaches to advance the science of ecological flows.
Investment in research and development activities to develop models and technology can
facilitate sophisticated analyses and innovative breakthroughs to further understanding of
water processes, methodologies, and impacts. Mr. Duane Smith, Executive Director of the
Oklahoma Water Resources Board, highlighted the importance of technically rigorous analyses
from rigorous data collection and analysis for state water planning in the Western Region.

In summarizing the Federal Agency Assessment undertaken as part of this initiative (See Text Box
for a list of agencies) at the National Conference, Dr. Matthew Larsen, Associate Director for
Water at the U.S. Geological Survey, highlighted examples of the many programs, models, and
databases which the Federal agencies can offer states in their water planning to provide
hydrologic data/information for a watershed-scale assessment of water availability and quality
in interstate waters. He suggested that a means to move forward is through the National
Science and Technology Council’s Subcommittee on Water Availability and Quality (SWAQ), a
group that has fostered collaboration toward IWRM through information exchanges but that
lacks governance authority.
The Federal agencies have much to offer for technology transfer and knowledge capacity building. In particular, the Bureaus of Land Management (BLM) and Reclamation (BOR), the Environmental Protection Agency (EPA), the Federal Emergency Management Agency (FEMA), the National Park Service (NPS), the Natural Resources Conservation Service (NRCS), Fish and Wildlife Service (FWS), the Forest Service (FS), the National Oceanic & Atmospheric Administration (NOAA), the Tennessee Valley Authority (TVA), the Corps, and the U.S. Geologic Survey (USGS) reflect a myriad of capabilities or functions (planning, data collection and management, models and methods, regulations, project development, operations and maintenance, mitigation, research and development, demonstration projects, water education, technical assistance, and funding and grants) and programs for land resource management, water infrastructure and development, environmental protection, disaster preparation and response, and science and information. Federal resource agencies develop and maintain analytic methods and models for understanding, estimating, forecasting, and predicting water resources parameters; they develop and maintain databases and geospatial information systems (GIS) of water resources information.

A real problem in sharing information, tools, and models; however, is that the budgets of Federal agencies are managed by 14 different House and Senate Authorizing and Appropriation Committees in support of 117 Federal water programs for water quality and quantity, water supply, navigation, hydropower, recreation, climate change, natural hazards management, and integrated water resources management. This fragmentation makes true integration difficult. Nonetheless, there are initiatives on which to build. NOAA’s Hydrology
Program has an incipient effort to produce the Integrated Water Resources Science and Services (IWRSS) database in concert with the USGS and USACE focused on People, Technology, and Science for summit-to-sea modeling and predictions, including physical and social strategies. The USGS National Water Resources Information System intends to provide high-resolution water resources information and forecasts from summit to sea by integrating information, increasing information accuracy and timeliness, and simplifying access to this information. A role the Federal government can play is to collect and manage data and to provide consolidated databases.

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**Federal Agencies Have Models and Data to Share**

Models that the Federal government can share include hydraulic flow models, run-off and sedimentation models, water quality models, climate change models, groundwater models, dam safety models, shared vision planning models, water supply forecasting models, and coastal decision-making models. Examples include the Drought Monitor, national environmental satellite data and information service (SEEDIS), STORET, Hydromet monitoring stations, national water information system web (NWISweb), Stream Stats, the USGS National Streamflow Information Program, NRCS’s SNOTEL Program (automated SNOpack TELemetry system to collect snowpack and related climatic data for water supply forecasts and water resources planning), NOAA’s precipitation data, the Bureau of Reclamation’s agricultural and meteorological and evapotranspiration (ET) data under the AGRIMET (AGRicultural and METeorological) Program to foster water and energy conservation, and water quality data from EPA’s National Pollutant Discharge Elimination System permit system to control water pollution by regulating point sources that discharge pollutants into U.S. waters.

The Federal Agency Assessment also supported development of the Federal Support Toolbox containing key information (authorities, policies, programs, data and databases, best practices, lessons learned, tools and methods) made accessible on the internet via a common data portal. Dr. Carol Couch, Director of the Environmental Protection Division in the Georgia Department of Natural Resources, told National Conference attended, that “The states are definite customers for a Federal Support Toolbox of science-based tools.” The Federal resource management agencies can initiate building this toolbox with data and information they have collected, analyzed, and stored, and enhance it with state and local data so as to provide a common set of water and related resources data and information to ground planning assumptions from local to Federal levels. Having access to a GIS-based map that catalogs and provides information electronically for specific river basins, watersheds, and coastal zones can deepen knowledge and understanding and provide a vehicle to facilitate partnering, planning, and adaptive management. The Federal Support Toolbox can provide updated and complete databases and the latest tools and models, foster innovation and integration, ground planning...
in the same assumptions, and facilitate wider access to data and information needed to plan, manage, and develop water policy. Additionally, technology transfer and public information and education activities of Federal laboratories can test and apply scientific developments. Enhanced collaboration, networking, and information sharing across Federal laboratories and science centers can promote technology transfer and integration of scientific findings and technology. Promulgation of data and information through appropriate data portals can transfer information to an audience beyond the Federal government.

Information is dynamic; it always changes and hopefully evolves in its meaning and significance and thus needs to be treated as a living resource itself.

Data and information that are not shared have limited effect. Technology that is not promulgated has limited impact. A concerted effort is needed to share data and scientific information about common river systems and watersheds and to transfer scientific findings and technology from the ivory tower and laboratory to a wide audience— including the general public (in order to build the will to act) and decision-makers who can make the decisions to act on such information and knowledge.

**Proposed Actions:**

Improve data collection, sharing and use and development and transfer of science, management, and technology to obtain baseline data, to deepen knowledge about water issues and needs, and to infuse planning, decision-making, and evaluation processes with a scientific foundation.

1. Provide access to the data and information collected during the *Collaborating for a Sustainable Water Future* initiative, including the summaries of state water resource planning and management activities, example state water plans, example state legislation, etc. Update the [www.building-collaboration-for-water.org](http://www.building-collaboration-for-water.org) website (or similar data portal) with all information collected.

2. Mine the Western, Central, and Eastern *Trends Reports* for examples of what particular states and Federal agencies are doing to advance science and technology. Create a database of this information (specifying tools, models, databases for particular applications and water uses/functions) organized by states and Federal agencies with points of contact for follow-up probing.

‘Stationarity’ is a dead concept. Water resources planning must consider change, especially climate change, in a dynamic model that builds in system flexibility, uncertainty, robust alternatives, and adaptive management. Collaboration on research and monitoring are needed.

Mr. Wayne Staubitz
Coordinator for the U.S. Geological Survey’s Cooperative Water Program
Eastern Region, Collaborative Water Resources Conference
Orlando, Florida, February 2009
3. Formalize, augment, or inform standing groups already dedicated to sharing and promulgating scientific information related to integrated water resources management, e.g., NOAA’s IWRSS working group, SWAQ, ACWI, others.

4. Support joint efforts through a working group led by NOAA to develop a decision briefing to secure support and funding to produce the Federal Support Toolbox. An interagency steering group comprised of NOAA, USGS, and the Corps is already working to create a master plan for development of the Federal Support Toolbox that enables decisions about what to include in the toolbox and how to construct, manage, and maintain it, steps to develop a Federal Support Toolbox of integrated hydrologic and planning/management data at all levels of geography, an inventory of models and analytic methods and metadata and services. Activities to formalize it, recommended in the Corps’ Federal Agency Assessment, include:

   a. Form a steering committee (governance structure) with additional Federal water agencies and with state and other stakeholder involvement.

   b. Document cross-agency funding requirements and a programming strategy.

   c. Recommend an executive agency governance structure.

   d. Identify priorities for development and pilot projects to demonstrate interoperable infrastructure, science, and technology.

   e. Prepare an implementation plan and a business case to quantify the expected benefits of the Federal Support Toolbox.

5. Explore cross-agency funding for the Federal Support Toolbox, including through discussions with relevant Congressional committees and OMB.

6. Identify current Federal agency initiatives (e.g., USGS National Water Census) that directly support the goals of this initiative and water resources needs. Prioritize them and recommend joint funding to the Office of Management and Budget.

7. Link databases as appropriate, e.g., the National Drought Information System and the National Streamflow Information Program.

8. Canvass the internet and professional associations for examples of data toolboxes, e.g., the Global Water Partnership Toolbox of Integrated Water Resources Management (www.gwpforum.org and www.gwptoolbox.org) to learn about how they were set up and to avoid needless duplication.

9. Canvass the laboratories of Federal agencies and state universities and agencies to create a list of water resources and IWRM-focused tools and information. Publish a Federal Support Toolbox website.

10. Seek, adopt/adapt, develop holistic, multicriteria hydrologic and climate, models that connect and provide information at multiple geographic scales, e.g., energy and water.
Develop and apply simulation models to describe complex processes. Apply consensus-building processes, scenario analyses, and simulation models.

11. Match the data/information/science/technology/management needs expressed by states in the trends reports and at regional meetings for this initiative with authorities, capabilities, programs, models, and other available tools identified in the Federal Agency Assessment report in order to garner how the Federal government can support the states.

12. Propose opportunities for data/information sharing and technology transfer and, if appropriate, codify this in a plan that specifies who will do what when to share and transfer specific information.

13. Develop an online link to make the Federal Support Toolbox available through a common data portal. For example, develop a waterexpedia.com internet site for integrated databases and data systems, especially about hydrologic data (including climate and flow data) that can reinforce an optimized streamgage network or groundwater network. Enable data searches with a search engine like Google (Woogle for water). Populate the data fields with information from the Federal level (e.g., USACE, USGS, NOAA, and National Weather Service) down to the local level.

14. Share the USACE GIS-based management tool for key river basins with others in the spirit of technology transfer. Ensure this tool is included in the Federal Support Toolbox.

15. Promote policies that ensure that decisions are based on independent and science-based technical reviews and policies reflect sound science.

16. Support the ability of public personnel to participate in professional and scientific associations and meetings and to share information and technology. Require those returning from professional conferences to share information gleaned or gathered with subordinates and others.

17. Provide the means and mechanism(s) to maintain the Federal Support Toolbox to ensure that data are complete and updated with new information and developments.

18. Develop formal partnerships (MOUs) with other entities—especially among the Corps, USGS, and NOAA— to develop the Federal Support Toolbox.

19. Develop a Federal Support Toolbox Framework which will provide the road map for development of the toolbox and implementation of it. NOAA, USGS and the Corps are already working to develop this framework.
4.8 Recommendation 8 – Enhanced Water Resources Leadership and Education

Enhance the ability of public officials at all levels to understand and communicate priorities for water resources investments and solutions, and raise awareness and build stewardship for responsible water management.

The notion of raising awareness, better informing, and grounding decision-making in responsible science was exclaimed often by many during this initiative. Decisions can be enhanced if policy makers better appreciate the seriousness of situations, the options available for approaches to resolve them, and the quality of solutions possible. Leadership, environmental education, and public outreach are critical to building awareness and commitment to the stewardship of a precious natural resource. These factors were highlighted frequently and fervently. Many diverse groups have played and can play an important role in promoting understanding about what needs to be done and how solutions might be developed and implemented to sustain critical economic, environmental, and social/human resources. The power of public information and outreach has been demonstrated but can be enhanced.

Federal agencies have at last 117 programs that address multipurpose management; climate change; water supply; water quality; growth and development impacts; infrastructure; energy development impacts through planning; data collections and management; modeling; regulatory; project development; operation and maintenance; technical assistance; water education; mitigation; research and development; and demonstration projects and services involving water quality, water supply, climate change, navigation, hydropower, natural hazards management, integrated water resources management, and recreation. Leadership is needed to link and leverage these programs better.

Leadership means collecting and sharing data and information and turning data into knowledge through partnerships and collaboration. More synthesized reporting on water use and progress at multiple scales will help, as will more consistent standards, performance measures, routine assessments (e.g., species inventories to assess biodiversity), reporting, and accountability. Publication of statewide water use (total versus consumptive use, timing of use, trends) expressed within a systems view will promote understanding of how groundwater supply pumping for water supply decreases water tables and affects stream flows and groundwater quality—perhaps stimulating surface water withdrawals in a vicious cycle. A regular statewide assessment and inventory of water availability would reveal current status and potential future conflicts or threats to desired uses for surface waters and ground waters. Funding is needed to produce regular reports, however. A sign of leadership is approval for consistent and sufficient funding for programs to collect, analyze, and share data and knowledge.

States can continue to lead in water resources planning but desire technical and financial assistance from the Federal government to do so. There is a much duplication of effort and information, which may not be cost effective; moreover, there are voids that create gaps in information, understanding, and capability that are not being closed. Having a means to share information will promote state leadership; access to state-of-the-art tools and comprehensive information supports this.
The Federal agencies can exercise leadership by providing information about emerging issues. Federal agencies presently provide assistance through the NRCS Conservation Technical Assistance program, the USACE Planning Assistance to States program, the Bureau of Reclamation’s Basin Studies Program, and the USGS National Streamflow Information Program.

Partnerships support leadership by furnishing, pooling, and leveraging resources. The river basin commissions and interstate compacts have demonstrated this. The interstate organizations play important roles in obtaining baseline information; analyzing needs in broad-scale and regional contexts and integrated frameworks; bringing key stakeholders together; facilitating conflict resolution; advocating for particular needs and funding; publishing reports, summaries, and evaluation of conditions and steps taken to address problems; and conducting active outreach and public education. Informal partnerships add the power of information and insights and the flexibility to make connections. They can, and often do, lead the way in providing baseline assessments of regional needs. With guaranteed funding to enable them to perform their authorized roles, the river basin commissions and regional associations can play a significant leadership role.

Native American tribes share resources with states and deserve a leadership role in conserving these resources. Tribal claims on land and water rights must be resolved to enable them to play an integral role.

There are abundant local watershed groups that are already working to assess, monitor, report on, advocate for, and conduct outreach to sustain resources in and around oceans and coastlines, rivers, streams, lakes, wetlands, and the like. These groups are making progress because of visionary pathfinders who are able to mobilize and focus energy and effort in an aligned direction. They build and breed commitment. They are guided by local leaders whose work needs to be nurtured and connected to larger and more regional efforts. Watershed groups are important components that need to be linked as part of larger leadership system for integrated water resources management.

Non-governmental organizations already play a key leadership role in raising awareness and commitment to protecting water resources for the future and can augment the states’ and Federal government’s water resources roles. As Mr. Jerry Enzler, Executive Director of the National Mississippi River Museum and Aquarium (NMRMA) in Dubuque, Iowa, emphasized at the Central Region Conference, his NGO offers public information and educational programs to reveal information, educational technology, and a powerful network/consortium of 22 leading aquariums, 35 non-governmental organizations, and partnerships with Federal entities all dedicated to promoting awareness and understanding about the value of an ecosystem management approach to stewardship of the Mississippi River from Minnesota to the Gulf of Mexico. The educational span of NMRMA engages visitors, teachers, students, farmers, producers, legislators, water professionals and scientists, libraries, interpretive and learning centers, and the general public in conserving and restoring the basin through dynamic, hands-on/interactive exhibits and programs. The Corps’ St. Louis District has a relationship with the National Great Rivers Research and Education Center (NGRREC), a partnership among the St. Louis District, the University of Illinois at Urbana-Champaign, the Illinois Natural History
Survey, Lewis and Clark Community College, and the private sector to do research, modeling, monitoring, development of management strategies using a watershed approach, and education and outreach to a K-university student population and the scientific community for the purpose of studying the unique river ecology of the confluence of the Illinois River, the Missouri River, and the Mississippi River. Professional associations such as the American Water Resources Association, the National Association of Stormwater Management Agencies, the Association of State Floodplain Managers, and the Missouri-Arkansas Association have led in promoting understanding of water resources challenges, needs, and solution alternatives through active engagement with Federal agencies, states, and local groups.

Paradoxically education is a benign but powerful strategy for a wide-ranging audience that reveals how and how well government at all levels can lead collaboratively in water resources arenas.

Proposed Actions:

1. The Assistant Secretary of the Army for Civil Works should accept these recommendations and share them with the Council for Environmental Quality (CEQ). The Corps will continue to facilitate proposed actions in this report that are already underway as follow-on efforts.

2. As the lead agency within the Federal government with the responsibility to coordinate across the Federal agencies, CEQ should establish an interagency working group—the Federal Principals Group for a Sustainable Water Future—to build upon the recommendations presented in this report. The Corps is willing to serve as the Executive Secretary of this group, providing facilitation and documentation support.

3. The Federal Principals Group for a Sustainable Water Future should serve as a steering group and endorse an integrated horizontal committee of key representatives across the Federal agencies, hopefully opening membership to include selected state, tribal, and non-governmental representatives.

   a. The Federal Principals Group for a Sustainable Water Future should designate agency representatives who can meet on a regular basis to conduct focused reviews based on the recommendations in this report and to make recommendations for decisions and feedback by the Federal Principals Group.

   b. The Federal Principals Group should establish a vertical National Water Team of state, tribal, local, and NGO water resources leaders with proven track records of watershed-scale and integrated water resources planning and management who volunteer to bring resources (time, ideas, talent, funding) to the table. This team should evaluate and build upon the proposed actions in this report for development of an Implementation Plan. The National Team can:

      i. Identify conferences, symposia, workshops, and meetings, and working groups to leverage or follow on to in order to share information and create opportunities for collaboration, e.g., the USGS/DOI Advisory
Committee on Water Information’s (ACWI) Sustainable Water Resources Roundtable, the USGS Advisory Committee on Water Information (ACWI). Develop a catalogue of these events and share it through the Federal Support Toolbox.

ii. Identify 5 to 8 top educational/outreach programs of each Federal agency and develop a multimedia communications strategy that seeks ways to connect and leverage them for greater impact.

iii. Promulgate best practices and good examples of cooperative agreements and partnering agreements that promote outreach and education; identify way to build on them.

iv. Establish demonstration projects to affect sustainable outcomes at the broadest and most meaningful scale.

4. CEQ should revisit the intent and terms of the October 18, 2000, Unified Federal Policy for a Watershed Approach to Federal Land and Resource Management for the Departments of Agriculture, Commerce, Defense, Energy, and the Interior; the Environmental Protection Agency; the Tennessee Valley Authority; and the Army Corps of Engineers and consider reissuing it to support a unified Federal team, or work toward a mechanism for a similar alliance for shared aims in support of IWRM.

5. Study opportunities and mechanisms to engage the private sector in sustainable water resources management and issue a recommendation.

6. Work with Native American tribes to raise water resources awareness and conservation on Native American reservations and to integrate their needs and interests.

7. Develop communications products (e.g., speeches, Fact Sheets, PowerPoint briefings, brochures, handouts, an online newsletter, etc.) that convey common and key themes about water resources management, stewardship, and sustainability. Share with agency leaders and water resources specialists.

8. Develop an education campaign to educate state and Federal legislators (see Iowa’s program).
Section 5
Conclusions

The results of the assessment conducted under the Corps’ Collaborating for a Sustainable Water Future initiative highlighted the states’ need for more funding; for access to more complete, current, and comprehensive data and information about water resources conditions, use, availability, planning, and management; and for more integrated water resources management to address and balance a myriad of water and related land resources and their uses. The Federal government can take the lead in helping the states meet these needs through collaboration and a refocusing of some Federal programs.

Resource constraints may be the greatest handicap to moving forward toward a sustainable water resources future, although shortages provide the impetus for pooling resources through partnerships. The recommendation most often cited throughout the assessment was the need for funding to address water resources challenges. The funding situation is complex and complicated by legal mandates, authorities, precedents, and political realities. Mechanisms must be found to fund research and development, data collection and analysis, information sharing, professional meetings, and monitoring and protection of resources. What is needed first and foremost is to share information, examples (good and bad), best practices, lessons learned, and approaches for collaboration. Identifying the funds and mechanisms to create common data portals to enable access to those who need the information for their planning will facilitate developing ideas and plans for action. Funding must be sustained to develop the tools and processes that build the data, information, and knowledge for water resources planning.

Contemporary needs—not the least of which are ways to cope with portended deleterious climate change impacts—compel the search for ways to coalesce resources, reduce needless duplications, and fill voids that must be addressed for safety and opportunity’s sake. Just as funding is crucial, information is critical for good planning and management. What is needed is information about what is working or not working and why, and about future demands on increasingly scarce resources. Information does not take care of itself; we must take care of it with reliable tools and a commitment to understand it and to proliferate it to promote deeper understanding about what it means and how it can be used better. The Federal government has a wealth of information and insight to share. The states have invaluable lessons learned that merit sharing with counterparts across borders. The means must be found to enable mutual sharing and learning. The states certainly have grown their water resources competency and can and have put together statewide water plans based on comprehensive and rigorous data collection and analysis. The states nonetheless call for Federal assistance to advance their planning at local, regional, and statewide levels.

The complexity of today’s world merits the attention of the best and the brightest to develop and avail the tools and assistance that join people and ideas together. One mechanism is a holistic-systems perspective that affords a means to link ideas to stakeholders to results through an appreciation of how they are all interconnected. Integrated water resources management is an ideal toward which to strive in order to manage multiple stakeholders intent on multiple water uses through multiple objectives for (more) balanced benefits. Robust concepts and models such as IWRM hold the promise to manage the true complexity and interdependencies
that exist for water managed at a watershed scale. Integration can bring economy of effort and save resources to enable government at all levels to do more with fewer resources. Sustainable water resources management is more likely to emanate from processes and models that are robust enough to address growing water uses and users as the world becomes more complex. This will take clear policies, roles, responsibilities, definitions, examples, and feedback. It will take technical assistance. The Federal government is positioned to provide such assistance to help states develop comprehensive and integrated plans at local, regional, and statewide levels.

A Federal Support Toolbox of Federal authorities, technical tools, scientific, and management information would facilitate Federal agencies in supporting state water planning. There is growing recognition that water resources management is a both/and rather than an either/or. Increasingly planners recognize that water quality and quantity must be addressed together, that upstream and downstream planning must be instituted comprehensively and regionally, that surface and groundwater supplies must be planned for holistically as part of a unified water system, that diverse water purposes and objectives must be better balanced for use of common water bodies, and that multiple stakeholders and resources must be brought together to the same planning table so as to coalesce their perspectives, interests, ideas, and resources.

The Honorable Lisa Jackson, Administrator of the U.S. Environmental Protection Agency, told the National Conference attendees that “If we are going to lead the way, we must use all our foresight and creativity.”

There are opportunities to begin collaborating: the need for a national water vision and unified policies requires continued conversation. We can wrestle with governance issues to clarify roles and responsibilities. We can probe and share information to improve understanding and mitigation of climate change impacts. We can communicate implications of risk better and build risk factors into decision models. And we can create vehicles by which to share information across levels of government better and more readily. We need to start now from where we are and leverage strategic alliances.

The Federal government, tribes, states, interstates, and non-government organizations have important roles to play, which can be made even more effective through collaboration or joined roles. Participants in this assessment offered the following role clarification.

### Roles in Water Resources Management

<table>
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<tr>
<th>Federal Government</th>
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<tr>
<td>• Set policies and provide guidance for water resources management.</td>
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<tr>
<td>• Fully utilize existing Federal authorities to support effective partnerships for sustainable water resources planning and management.</td>
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<tr>
<td>• Support more reliable and comprehensive data and information collection, more rigorous and robust analysis using GIS-based processes, risk-informed maps, and state-of-the-art science and technology.</td>
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<tr>
<td>• Provide technical assistance for comprehensive and systems-oriented water planning at state, region, and even local levels that attempts to balance competing needs through integrated water resources plans and management strategies.</td>
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<tr>
<td>• Pay attention to degraded and new infrastructure for water supply, wastewater treatment, flood control, navigation, hydropower, etc.</td>
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<tr>
<td>• Provide funding to maintain programs, protect resources, promote innovation, promote good science.</td>
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### Roles in Water Resources Management (Continued)

#### Federal Government (continued)
- Assist in mediating conflicts and disputes.
- Set standards and ensure compliance with regulations.
- Provide oversight.

#### Interstate Entities
- Synthesize regional needs using a systems framework.
- Facilitate integrated basin planning and coordination.
- Build consensus and engage stakeholders.
- Foster understanding and consensus through education and advocacy.
- Unify member states of compacts and agreements through data sharing and advising.

#### Tribal Governments
- Set policy about resource management on Native American reservations.
- Monitor and practice adaptive management to protect, conserve, and enhance resources and resource situations.
- Develop and implement plans within Indian water rights.
- Participate in information sharing about water resources.
- Inform about unique needs and characteristics.

#### States
- Identify and prioritize water resources needs and develop land, water, and emergency management or hazard mitigation plans to meet these needs.
- Allocate water to meet critical water needs.
- Seek sustainable water supplies as a basic safety net for current and growing populations.
- Improve water quality for confidence about drinking it; bathing in it; swimming in it; fishing in it; boating in it allowing plants and species to survive in and by it; sustaining agricultural, industrial, and municipal livelihoods; and simply finding the joy in water and all it can do for us.
- Ensure consistent and persistent assessment and monitoring.
- Identify and prioritize water resources needs and develop land, water, and emergency management or hazard mitigation plans to meet these needs.
- Allocate water to meet critical water needs.
- Providing funding to maintain programs, protect resources, promote innovation, and promote good science.
- Assist in mediating conflicts and disputes.
- Set standards and ensure compliance with regulations.
- Provide oversight.
- Set policies and provide guidance for water resources management.
- Fully utilize existing federal authorities to support effective partnerships for sustainable water resources planning and management.
- Support more reliable and comprehensive data and information collection, more rigorous and robust analysis using GIS-based processes, risk-informed maps, and state-of-the-art science and technology.
- Seek sustainable water supplies as a basic safety net for current and growing populations.
- Provide technical assistance for comprehensive and systems-oriented water planning at state, region, and even local levels that attempts to balance competing needs through integrated water resources plans and management strategies.
- Attend to degraded and new infrastructure for water supply, wastewater treatment, flood control, navigation, hydropower, etc.
Perhaps additional thought needs to be given to appropriate roles and responsibilities for water planning and management. The Federal government has a legitimate role to ensure quality control and equity across groups, especially to protect the disadvantaged. The Federal government also has access to resources that can make a difference for research and development. A major role for the Federal government is to collect, manage, and provide access to aggregated databases about a wide spectrum of water and related land resources information and analyses. Having the Federal government assume the role as integrator may be appropriate role to foster IWRM. Many participants extolled the supporting role of the interstates as vanguards in furthering integrated approaches and outcomes.

Moving forward is difficult because of the lack of an appropriate governance mechanism at the Federal level for integration across agencies and programs and the lack of funding, but we must begin. The following actions are recommended to diverse entities to enable them to move forward now.

1. Congress
   a. Consider legislation or strengthen authorities that broaden Federal agencies’ ability to do Integrated Water Resources Management and to support states more fully in developing comprehensive state water plans.
   b. Reauthorize an entity that enables integrated water resources planning and appropriate the funds to make it viable and more inclusive with interstate and state representation. A mechanism that promotes alignment and integration across the Federal agencies is needed to overcome the fragmentation, conflicts, voids, and inconsistencies that stymie concerted action toward IWRM and sustainability.
c. Sustain the ability of the river basin commissions to play a major role in promoting integrated water resources management, including regional assessments and partnering.

d. Ensure that programs that foster integrated water resources management (e.g., USGS Water for America, National Water Census, and National Streamflow Information Program) and watershed/system studies have sustained funding.

e. Promote life-cycle funding for water infrastructure, to include operations and maintenance (O&M).

2. President’s Council on Environmental Quality

a. Coordinate across Federal agencies to better balance environmental, economic, and human/social/quality of life objectives, programs, and pursue aligned initiatives through an interagency working group, for example by forming a Federal Principals Group for a Sustainable Water Future.


c. Ensure that the revised Principles and Guidelines reflect a watershed approach and integrated water resources management.

3. Office of Management and Budget

a. Facilitate joint interagency budgeting for common aims toward more integrated water resources management.

b. Sponsor a study on new funding mechanisms for integrated water resources management

c. Ensure that programs that foster integrated water resources management (e.g., USGS Water for America, National Water Census, and National Streamflow Information Program) and watershed/system studies have sustained funding.

d. Support the integration of water plans and emergency management plans, to include contingencies for climate change impacts on water resources.

e. Change cost-sharing formulas to encourage state participation in integrated water resources plans.
4. Federal Agencies

a. Encourage the U.S. Army Corps of Engineers to adopt the role as facilitator and integrator for integrated water resources management.

b. Engage the U.S. Corps of Engineers to serve as Executive Secretary for the interagency Federal Principals Group for a Sustainable Water Future, which will advise the Administration about water issues within a systems context for integrated water resources management, evaluate progress, and discuss lessons learned.

c. Establish an inclusive (Federal, state, tribal, interstate, NGO) but manageable national working group (National Water Team) to focus and leverage high-impact initiatives for integrated water resources management. Engage them in planning for a national discussion about the need for/value of a national water vision and policy. This group may assign specific lead agency responsibilities for particular recommendations proffered in this report. Engage the Corps as a facilitator and convener of this team.

d. Mine the data/information collected through this assessment to consolidate lists of technical objectives, tools, models, strategies, programs, etc. for inclusion in an Implementation Plan.

e. Engage the Corps to partner with NOAA and USGS on the Integrated Water Resources Science and Services (IWRSS) prototype, and align and unify the Federal family of resource management agencies to build a Federal Support Toolbox based on the IWRSS that can be shared with states and expanded with state, tribal, interstate, regional, and NGO contributions and accessed by many through a single internet-based data portal.

f. Select 8 to 10 major watersheds or river systems (water systems) as learning laboratories for integrated water resources management, building on current efforts and successes (e.g., the Columbia River, the Colorado River, the Sacramento-San Joaquin River Basin, the Great Lakes, the Ohio River Basin, the Mississippi River, the Everglades, the Gulf of Mexico, etc.).

g. Identify and catalogue opportunities to integrate ongoing water and related resources efforts of Federal agencies within each water system.

h. Leverage GIS-based technologies of Federal agencies to develop dynamic maps for each designated water system to account for current activities and stakeholders. For each major water system, catalog current activities on GIS-based maps to engage discussion with local, state, and regional officials for future plans and opportunities.
i. Engage the vertical National Water Team to support the development of the Implementation Plan within a systems framework that evaluates and integrates the proposed actions approved on the basis of this report.

j. Review summary reports that propose recommendations for water resources management in the 21st Century (e.g., the American Society of Civil Engineers’ Report Card for America’s Infrastructure; the Western Governors’ Association, June 2008, recommendations; AWRA Policy Dialogue recommendations, etc.); add supportive recommendations to the list of proposed actions for the Implementation Plan where there is a consensus among the National Water Team.

k. Continue initiatives directed at greater integrated water resources management, e.g., the National Water Census.

l. Identify and develop partnering opportunities.

m. Promote science and technology development, sharing, and transfer.

n. Align water initiatives and programs into integrated plans and share data and information about them.

5. National Water Team (vertical team of selected local, state, interstate, tribal, non-governmental, and Federal representatives)

   a. Promote understanding about Integrated Water Resources Management (IWRM).

   b. Promulgate policies, concepts, definitions, and case examples that reflect and support IWRM.

   c. Collaborate on communications materials to promote responsible conservation, stewardship, and water resources planning and management aimed at IWRM.

   d. Sponsor studies about successful collaboration and IWRM.

   e. Explore means to foster coordination across Eastern and Central states, such as the Western States Federal Agency Support Team or others as appropriate for these regions.

   f. Explore and recommend public-private partnerships to further joint efforts toward integrated water resources in specified river systems /watersheds.
g. Support an effort for **50 States and 50 Watersheds** to provide technical assistance to states in developing their statewide and regional watershed plans.

6. **Non-Governmental Organizations**

   a. The American Water Resources Association shall engage a dialogue about the national water vision proposals/examples including proposed policies and strategies at a national scale and/or regional scales.

   b. Build a database of points of contact for partnering on watershed-scale initiatives.

   c. Promote education and outreach and linkages across NGOs.

7. **States**

   a. Develop statewide comprehensive and integrated water plans as supported by the Governor and Legislature.

   b. Collect and codify regional and river basin visions for effective and integrated water resources management.

   c. Support consolidating data and information for the **Federal Support Toolbox**.

   d. Develop interstate partnerships.

   e. Contribute key data and information to the **Federal Support Toolbox**.

8. **Tribal Governments**

   a. Raise awareness of water issues on Indian reservations.

   b. Work with the Federal government, interstate organizations, and states to resolve water rights issues.

   c. Update floodplain maps for reservations.

   d. Hold workshops to discuss water issues affecting tribes and Native American reservations.

In his speech to the national gathering, Chairman Oberstar noted that water is indispensable — the essence of life and a basic human right — but we take it for granted. Our Nation was founded on the water and by the water but most of the water on earth is unfit for human use; very little freshwater available on the planet is available for human use. Unlike energy, water cannot be created; it can only be discovered. Chairman Oberstar called for a continuing conversation about water policy. This policy must address comprehensive Federal and state water planning at a watershed level. There is no justification for not acting, he said. “We must
hand off a better planet to our grandchildren as custodians of our land and waters,” he
concluded.

In the spirit of promoting collaboration and integrated water resources across the Nation, the
Corps will continue to be a facilitator to move a dialogue about the Nation’s water challenges
and ways to address them holistically and collaboratively forward. The ideas and
recommendations gained from this assessment will also be presented to decision makers in the
Corps’ chain of command. The Corps will sponsor meetings to continue with the next steps.
The momentum exists to move forward as a national team of strategic allies joined by shared
aims for important work that has begun to protect and enhance our Nation’s precious water
resources—and that must continue.