The Sustainable Water Resources Roundtable: Understanding, Measuring, and Promoting Water Resources Sustainability through Innovative Strategies

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ABSTRACT

The purpose of this paper is to familiarize readers with the work of the Sustainable Water Resources Roundtable and provide a summary of the proposed project agenda for the next two years. The Roundtable was established to engage federal, state, corporate, non-profit and academic entities in advancing understanding of the nation's water resources and developing tools for sustainable water management. Some of the topics the Roundtable has been involved with include the United States Geological Survey's national Water Census, the Alliance for Watershed Stewardship's International Water Stewardship Standard, and the promotion and evaluation of linkages between energy and water. The Roundtable has promoted a framework of water sustainability indicators for understanding how well the nation and its communities are doing in meeting social, economic and ecological needs associated with water management.

THE SUSTAINABLE WATER RESOURES ROUNDTABLE

History, Composition and Purpose

Since 2002, the Sustainable Water Resources Roundtable (Roundtable) has brought together federal, tribal, state, corporate, non-profit and academic leaders to advance understanding of the nation's water resources and develop tools for sustainable water management (see SWRR 2005 and 2010). As a national

collaboration on water, the Roundtable is one of four natural resource roundtables originally formed to advise the White House Council on Environmental Quality in its efforts to develop a comprehensive set of national environmental indicators. The other roundtables address the issues of forests, rangelands, and minerals and energy. The Roundtable is also a subgroup of the Advisory Committee on Water Information (ACWI), which advises federal agencies responsible for managing water resources. That status enables the forum to receive federal dollars required to discharge its responsibilities.

Sustainable Water Resources Roundtable
http://acwi.gov/swrr

Mission: "promote sustainability of our nation's water resources through the evaluation of information, development and use of indicators, targeting of research, and the engagement of people and partners to improve the management, conservation, and use of water and related resources."

Vision: "a future in which the nation's water resources support the integrity of economic, social, and ecological systems and enhance the capacity of these systems to benefit people and nature."

The Roundtable is an open, ongoing forum for the exchange of ideas, information, and policies on the concepts, principles, criteria, indicators, practices and research needed for sustainable water management. The forum is designed to facilitate collaborative, interdisciplinary discussion and outreach to raise awareness of the need for sustainable water resource management and to promote policies and activities informed by science to achieve that end. More than 600 participants from federal, tribal, state and local governments, corporations, nonprofits, and academia have been engaged in Roundtable activities, with meetings in California, Colorado, Maryland, Michigan, Minnesota, Virginia and Washington, D.C. The Roundtable recognizes the importance of maintaining a broad range of interests among its participants and works diligently to achieve and maintain diversity.

To date, the Roundtable has:

- Developed a framework for understanding indicators of sustainable water management and contributed to the development of national-level ecological, social and economic criteria and indicators to characterize the sustainability of water resources and their uses.
- Facilitated discussions with the Alliance for Water Stewardship's International Water Stewardship Standard.
- Assisted the state of California in developing water sustainability indicators for the California Water Plan.

- Engaged several federal agencies in interactive discussions about their water-related responsibilities, including ACWI discussions on climate change mitigation and United States Geological Survey's national Water Census.
- Identified priority research needs to better characterize and improve the sustainability of the Nation's water resources.

CONCEPTS OF WATER SUSTAINABILITY

Local and global water issues

Managing water resources sustainably is one of the most important challenges the world faces. Water is an essential resource needed to maintain the health of our communities and economy. Functionally intact and biologically complex watersheds provide many economically valuable commodities and services to communities (often called ecosystem services), in addition to direct water supply. However, water systems are finite, and face many threats compounded by human activities including climate change, growing population, degradation of water quality and declining water-dependent ecosystems. There is a growing understanding that we need to actively address these threats at a time of increasing demands for water and greater uncertainty about future water management conditions.

Water shortages or inequitable access to safe water causes poverty, environmental degradation, and conflict in communities around the world. There is constant conflict in the Missouri River among navigation, power generation, and environmental concerns (Flint and Wade, 2010). Canada and the U.S. have a treaty that restricts export of water from the Great Lakes basin to prevent further degradation of the quality and quantity of water in the Great Lakes basin. Mexico and the U.S. have a long-standing treaty for maintaining a certain level of water flow in the Colorado River that the U.S. has had major difficulty in meeting in recent years. Israelis and Palestinians have argued for years over how to share the Mountain Aquifer beneath the West Bank (Daggett, 2011). While the Syrians press for an Israeli withdrawal from the Golan Heights, water, not land is the crucial issue with the Golan Heights providing water to meet more than 12% of Israel's requirements (Chellaney, 2011).

Directionality of sustainability

Sustaining the nation's water resources is an urgent environmental and socio-economic challenge. Sustainable development is the centerpiece to water resource quantity and quality management, as well as national security, economic health, and social well-being. Sustainable development implies working to improve our productivity while being accountable to an ecological imperative to protect our ecosystems and a social equity imperative to create equitable access to resources and minimize human suffering (Flint, 2004). The foundation of sustainable development is often represented by the three overlapping circles or three-legged stool of sustainability: ecologic, economic, and social equity interconnections (e.g., Flint, 2012). These three elements interact with each other and are so intertwined that we

cannot achieve sustainable water policy without considering the effects and costs upon all three simultaneously.

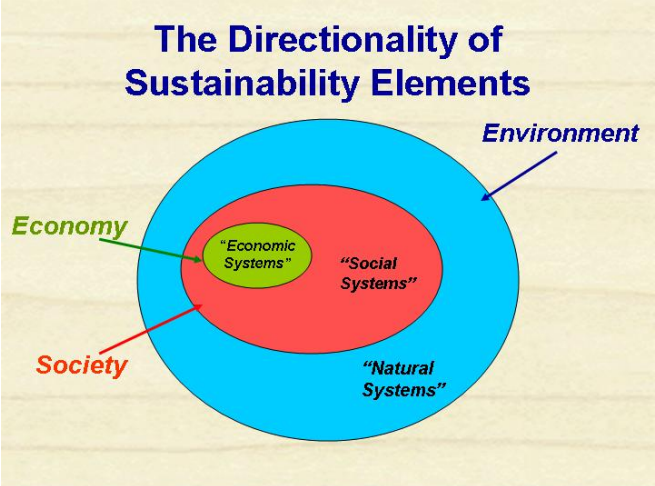

Figure 1 Three Elements of Water Sustainability

In understanding the three overlapping circles referenced above, it is also critical to recognize there is "directionality" to each element's dependence on the others (Figure 1). While it is true that all life depends on natural resources (Wackernagel and Rees, 1996), the economy and society are no less important to humanity than ecology. Rather there is a "directionality" of dependence. Sustainable development does not try to merely attain a "balance" between economics and environment as if they were two distinct entities. Rather, it considers directionality, where economic and cultural activities are integrated into natural processes in a cyclic fashion so as not to degrade the environment upon which economic prosperity and social stability rest.

Consider the production of electricity: in order for electricity to be produced to power our economies, society must develop the appropriate technologies, as well as regulate its demand for this electricity, so that water is used in a sustainable way for producing electricity. Electricity requires sources of cooling water in traditional fossil fuel power production plants and also requires the continuous supply of flowing water in hydropower production facilities. Thus, the directionality of this scenario (Figure 1) indicates that our economic ventures cannot be driven by electricity if society does not provide the human capital resources and there are inadequate supplies of freshwater. Similarly, the use of water as a natural resource for creating electricity must not impair other users of the water by activities of power production releasing polluted or in other ways degraded water as an output. In short, the existence of economies is based solely on the existence of societies and their capacity to add value to natural resources. By the same token, society cannot exist without an acceptable environment and the resources that environment provides for basic human needs – providing another example of the directionality of water resources sustainability.

Five Part Water Sustainability Indicators Framework

A growing number of policy frameworks are evolving to support sustainable water strategies. These efforts include new approaches to planning and management that incorporate principles of sustainability. As the fundamental building block of a sustainability framework, indicators represent a way to measure progress. They can provide a metric for understanding the extent to which water resources are managed to meet the long term needs of our social, economic and environmental systems. A set of appropriate indicators can help us understand whether or not the nation is on a sustainable course in its management of water and related resources.

To promote sustainability of the nation's water resources, the Roundtable defined a set of general water principles, criteria, and indicators in order to describe a flexible, general, and adaptable water sustainability indicator framework (SWRR 2008). This framework developed in 2005, and refined in 2008, included five major foci of water sustainability and 14 indicator criteria. The framework provides a toolbox and set of illustrative examples to assist entities with conducting water sustainability analysis at different geographic scales. By utilizing the Roundtable framework, local and regional water agencies may improve their water sustainability through an evaluation of condition and trends of relevant indicators reflective of their particular needs. The analysis may help identify issues and data gaps to inform future data monitoring needs in order to enable better quantification of water sustainability. The framework is organized around the following key water resource issues:

- Water availability: People and ecosystems need sufficient quantities of water to support the benefits, services and functions they provide. These indicator categories refer to the total amount of water available to be allocated for human and ecosystem uses.
- Water quality: People and ecosystems need water of sufficient quality to support the benefits, services and functions they provide. This indicator category is for composite measures of the suitability of water quality for human and ecosystem uses.
- Human uses and health. People benefit from the use of water and water-dependent resources, and their health may be affected by environmental conditions.
- Environmental health. People use land, water and water-dependent resources in ways that affect the conditions of ecosystems.
- Infrastructure and institutions. The infrastructure and institutions communities build enable the sustainable use of land, water and water-dependent resources.

SUMMARY OF RECENT ROUNDTABLE ACTIVITIES

One of the Roundtable's primary goals is to facilitate collaborative, interdisciplinary scientific research on sustainability indicators related to the quality and availability of water and related resources. A key tool for achieving this goal is through regular Roundtable supported multi-stakeholder meetings to disseminate activities of our partners by providing forums for discussion and feedback. Meetings are held throughout the country as often as needed and at locations designed to

promote and strengthen sustainability efforts by Roundtable members. In addition, the Roundtable has helped organize other meetings and provide panels and speakers on water sustainability with the National Environmental Status and Trends effort, National Council on Science and the Environment, the Water Environment Federation, the Ecological Society of America, and the Sustainable Forestry Roundtable, among others. It has also participated in meetings of the other ACWI roundtables to lend its water expertise to their discussions.

This section highlights some of the important water sustainability activities supported by the Roundtable in 2011 and 2012. During this time the Roundtable hosted three meetings. Two were held in the Washington D.C. area and a third in Davis, California.

Water Census

During 2010 and 2011 the Roundtable participated in an ad hoc stakeholder committee organized by the United States Geological Survey (USGS) to improve the concepts, efforts, and products proposed for inclusion in the National Water Census so they can best meet stakeholder's needs. The National Water Census is an initiative designed to support development of technical information and tools to answer basic questions about the current availability of freshwater to meet human and ecological needs and how water availability might change in the future. The Roundtable also served in a support role to help arrange periodic meetings of the ad hoc stakeholder committee. The Water Census has the following six components:

1. Define the current availability of water in the United States.
2. Identify significant trends affecting water availability.
3. Quantify the withdrawal and use of surface water and groundwater by various sectors.
4. Identify significant trends in changing water use patterns.
5. Identify significant water use conflicts or shortages.
6. Identify factors influencing water use conflicts or shortages.

The Alliance for Water Stewardship's International Water Stewardship Standard

At the May 2012 meeting in Washington D.C. the Roundtable facilitated a summary review of the first draft of the Alliance for Water Stewardship's International Water Stewardship Standard. The world's water users, from agriculture and industry to cities and citizens, recognize the acute need to more sustainably manage the water resources on which they depend. In parts of the world, water scarcity threatens the social, environmental and economic health. Flawed decision-making processes around water-related policy are leaving millions without access to clean water and sanitation. The viability of business operations and economic activity is also being threatened. Shareholders, governments and consumers are increasingly demanding that companies use natural resources in ways that are environmentally and socially sustainable. Water users are also realizing that improving water quality and reducing water consumption can result in significant savings and increased profits.

The Alliance for Water Stewardship's International Water Stewardship Standard (the Standard) is designed to be an international, ISEAL-compliant, standard that defines a set of water stewardship steps, principles, criteria, and indicators for how water should be stewarded at a site and watershed level in a way that is environmentally, socially, and economically sustainable. The Standard is intended to provide water stewards with an approach for evaluating the existing processes and performances within their sites (or facilities) and watersheds, and ensuring that responsible water stewardship actions are in place.

The California Water Sustainability Indicators Framework

At the December 2011 meeting in Davis, California, the Roundtable helped support discussion on several water sustainability initiatives within California with a focus of recent work by the California Department of Water Resources (DWR) on the California Water Sustainability Indicators Framework (Framework). As part of the California Water Plan Update 2013, a partnership between DWR, the University of California, Davis (UCD), and the U.S. Environmental Protection Agency Region 9, have developed this analytical and quantitative framework, and a set of preliminary water sustainability indicators.

The Framework is intended to help identify, compute, and evaluate a set of relevant sustainability indicators that would help monitor progress towards sustainability of natural and human water systems. The Framework uses the structure of a vision-goals-objectives-indicators nested hierarchy (Figure 2). It is organized into a series of steps and each step builds on the previous one. Completing each step leads to subsequent steps and all steps are necessary for a full evaluation of water sustainability. A sequence of steps begins with developing vision, goals, and objectives, identifying indicators for each objective, evaluating indicator condition relative to reference conditions, and reporting indicator conditions to inform knowledge development and policy decisions. Thus indicators can be used to assess and monitor achievement of objectives and progress toward goals.

Specific geometric shapes are used in the Framework (Figure 2) to illustrate a group of related activities, stakeholder interaction, or process outputs. The steps used in the Framework are represented by rectangles, while the inputs to the various steps in the form of modeling, data, and analysis are represented by parallelograms. The agency interaction, input, and feedback in the development of vision, goals, objectives, and indicators are represented by circles, while how assessment of indicator performance may relate to agency mission and public education and influence public policy and decision making are represented by ellipses.

In a related effort to the Sustainability Indicators Framework, DWR and its partners are developing a water footprint, and a decision support tool. The project is supported by funding from the USEPA’s Advance Monitoring Initiative and DWR. A water footprint and an ecological footprint at a state scale are being developed for the first time to pilot the decision support tool as a Global Earth Observation System of Systems project. The indicators suite also includes statewide indicators derived from satellite remote sensing data -- a plant growth index and a total water and groundwater flux indicator. Collaborators include USEPA's Office of Research and

Development, DWR, UCD, NASA's Jet Propulsion Laboratory, California State University - Monterey Bay, and US Geological Survey.

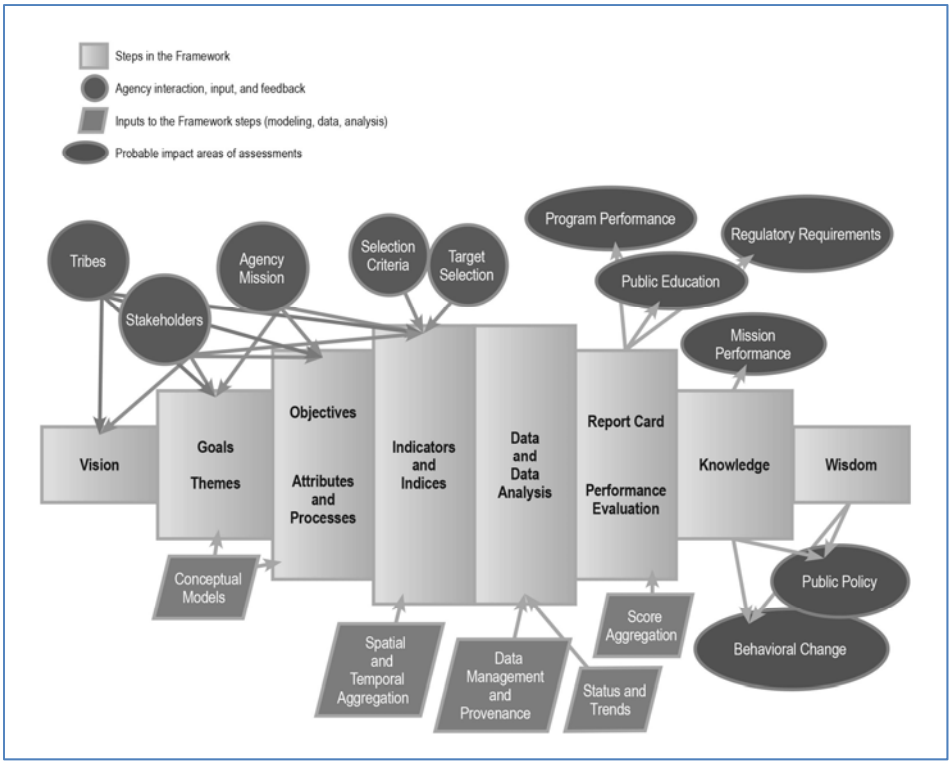

Figure 2. The California Water Sustainability Indicators Framework

Department of Defense Sustainability Projects

At the May 2012 meeting in Washington D.C. the Roundtable facilitated a session on water sustainability projects within the Department of Defense (DOD). The Roundtable provided feedback on a number of DOD sustainability initiatives with a focus on activities by the U.S. Army. These included the Army Water Security Strategy, The Army Net Zero Water Initiative, Army Corps of Engineers Climate Change Actions, and the Army Water Boot Print.

DOD views water from a mission standpoint. How do water and lack of water impact the ability of DOD to complete its mission summarized as the 4 D's: deter, defend, and defeat decisively? DOD has never defined how much water is needed to accomplish its mission. They use water but haven't considered long term sources for future needs. DOD has begun to strategically think about water from a mission perspective.

Water is a big part of the DOD portfolio and water security for DOD facilities is being evaluated through the DOD security vulnerability assessments. A military base has everything a small town has: hospitals, daycare, grocery stores, schools, fast food outlets, bowling alleys, big gyms - all are water users. DOD water use in buildings averages 53 gallons per gross square foot in Fiscal Year 2009. In Fiscal

Year 2009 DOD reduced the gallons of water consumed per gross square foot of building space by 4.6 percent relative to the 2007 baseline.

WHAT'S NEXT FOR THE ROUNDTABLE?

Project Agenda for 2012-2014

The Roundtable has identified several prospective projects to assist the nation in adopting long-term approaches for water sustainability. In line with the Roundtable's mission, these projects would be conducted through a forum for exchange of ideas and cross-sector collaboration. These projects are designed to promote sustainability of the nation's water resources by helping people and organizations manage water for the long run health of watersheds, communities, and the nation. Although the projects collectively address facets of water sustainability, each may be pursued independently based on the priorities of the organizations involved. The scope and deliverables for six of these prospective projects are summarized below, but the scope may change in response to needs and interests of potential collaborators. The authors invite contact by organizations interested in participating in implementation of the projects.

- **A nationwide assessment of indicators to evaluate how they contribute to understanding water sustainability and how they might best be used.** The project would assess indicators in use nationwide to gauge their contribution toward understanding water sustainability. Indicator assessments would be displayed on the Roundtable website. For example, the Office of Management and Budget developed sustainability and energy scorecards to measure progress toward the "business" sustainability goals of government agencies, and they have completed scorecards explaining their progress. Are there lessons here for measuring sustainability of the nation's water resources?
- **An evaluation of water footprint tools to identify the elements of a realistic gauge of water sustainability.** Water footprint estimates have been developed by organizations with diverse missions and diverse objectives for making the estimates. Water sustainability was not always their primary focus. This project would examine objectives, assumptions and features for a cross section of footprint estimates to assess their suitability as gauges of water sustainability. The results would assist organizations in addressing whether to use existing tools and what modifications may be needed.
- **An approach for extending the water footprint to include quantification of the associated energy requirements and carbon emissions.** Water is required to obtain and use energy, and energy is required to obtain and use water. Efficient water use minimizes associated energy use, and vice versa. Water sustainability indicators such as the water footprint may be broadened to include quantification of the associated energy use and carbon emissions, which provide a more comprehensive picture of resource sustainability. This project would develop an approach for establishing these links quantitatively.

- **A flexible framework for organizations to develop water sustainability indicators in any watershed regardless of scale.** A number of frameworks have evolved to support sustainable water strategies, often designed in isolation and with varying objectives. This project would examine existing frameworks to define a set of general water principles, criteria, and indicators. They would be used to establish the project deliverable - a general framework and associated processes for guiding development of local indicators to meet the needs of watershed communities with different values.
- **A tool for creating a watershed sustainability index to enable organizations to create a watershed-specific barometer.** Watershed management involves economic, social, and environmental factors, though they are often treated in isolation. A comprehensive watershed sustainability index can provide a framework for identifying bottlenecks to achievement of basin sustainability. The project's focus would be on design of a process to create this index. This would enable watershed stewards to integrate information on the status and trends of their watershed's hydrologic, environmental, economic and social features.
- **A handbook for watershed management to empower communities to make sustainable land and water choices.** There are a number of community engagement and planning materials that discuss bottom-up processes to develop their goals and objectives for watershed improvements. This project entails examination of these "how to" documents to develop a comprehensive handbook to assist communities to make sustainable land-use and water choices for their watersheds. The material would be integrated in an easy-to-use format for the practitioner or user community.

CONCLUSION

The purpose of this paper was to familiarize readers with the work of the Sustainable Water Resources Roundtable. This included a summary of the overall objectives of the Roundtable, its history, concepts of water sustainability, and the Roundtable's current and future activities. The heart of the Roundtable is a core group interested in improving the sustainability of water resources at local, regional, national, and global scales. The activities of the Roundtable are prioritized around the particular needs of this group who represent a diverse set of organizations. The Roundtable welcomes questions and comments about its activities and how individuals or organizations may participate in them. Specifically we encourage readers to contact the authors with feedback on the following:

1. Impressions and questions about the Roundtable's current activities and projects.
2. Ideas for future Roundtable meeting themes, regional emphases and locations.
3. Suggestions for improving the projects proposed under the 2012-2014 Project Agenda to be more useful to your organization.
4. Suggestions to improve existing activities or promote new activities by the Roundtable that would make its work more useful to your organization.

5. Opportunity and interest to participate in and fund collaborative projects around the theme of the proposed projects under the 2012-2014 Project Agenda.

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