Water Reuse Economic Framework Workshop Report

WateReuse Foundation

Water Reuse Economic Framework Workshop Report

The mission of the WateReuse Foundation is to conduct and promote applied research on the reclamation, reuse, and desalination of water. The Foundation's research advances the science of water reuse and supports communities across the United States and abroad in their efforts to create new sources of high quality water through the reclamation, reuse, and desalination while protecting public health and the environment.

The Foundation sponsors research on all aspects of water reuse including emerging chemical contaminants, microbiological agents, treatment technologies, salinity management and desalination, public perception and acceptance, economics, and marketing. The Foundation's research informs the public of the safety of reclaimed water and provides water professionals with the tools and knowledge to meet their commitment of increasing reliability and quality.

The Foundation's funding partners include the U.S. Bureau of Reclamation, the California State Water Resources Control Board, and the Southwest Florida Water Management District. Funding is also provided by the Foundation's Subscribers, water and wastewater agencies, and other interested organizations. The Foundation also conducts research in cooperation with two water research coalitions – the Global Water Research Coalition and the Joint Water Reuse Task Force.

Water Reuse Economic Framework Workshop Report

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National Water Research Institute
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Sponsored and Published by:

WateReuse Foundation
1199 North Fairfax Street, Suite 410
Alexandria, VA 22314

Cosponsored by:

U.S. Bureau of Reclamation
California State Water Resources Control Board
Southwest Florida Water Management District

Additional funding provided by:

Las Vegas Valley Water District
Inland Empire Utilities Agency
Santa Clara Valley Water District

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The research on which this report is based was funded, in part, by the U.S. Bureau of Reclamation (USBR) through Cooperative Agreement No. 00-FC-81-0248 with the WateReuse Foundation. Unless a USBR logo appears on the cover, this report is a publication of the WateReuse Foundation, not USBR. Funds awarded under the Cooperative Agreement cited above were not used for editorial services, reproduction, printing, or distribution.

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ISBN: 0-9747586-2-0
Library of Congress Control Number: 2004108481
WateReuse Foundation Project Number: WRF-03-006
WateReuse Foundation Product Number: 03-006-01
Printed in Alexandria, Virginia of the United States of America

FOREWORD

The WateReuse Foundation, a nonprofit corporation, sponsors research that advances the science of desalination, reclamation, and reuse of water. The Foundation funds projects that meet the water reuse research needs of water and wastewater agencies and the public. The goal of the Foundation's research is to ensure that water reuse projects provide high-quality water, protect public health, and improve the environment.

A Research Plan guides the Foundation's research program. Under the plan, a research agenda of high-priority topics is maintained. The agenda is developed in cooperation with the water reuse community including water professionals, academics, and Foundation Subscribers. The Foundation's research focuses on a broad range of water reuse research topics including the following:

- Defining and addressing emerging contaminants;
- Public perceptions of the benefits and risks of water reuse;
- Management practices related to indirect potable reuse;
- Groundwater recharge and aquifer storage and recovery;
- Evaluating methods for managing salinity and desalination; and
- Economics and marketing of water reuse.

The Research Plan outlines the role of the Foundation's Research Advisory Committee (RAC), Project Advisory Committees (PACs), and Foundation staff. The RAC is tasked with prioritizing and recommending projects for funding in addition to providing advice and recommendations on the Foundation's research agenda and other related efforts. PACs are convened for each project and provide technical review and oversight. The Foundation's RAC and PACs consist of experts in their fields and provide the Foundation with an independent review, which ensures the credibility of the Foundation's research results. The Foundation's Project Managers facilitate the efforts of the RAC and PACs and provide overall management of projects.

The Foundation's primary funding partner is the U.S. Bureau of Reclamation. Other funding partners include the California State Water Resources Control Board, the Southwest Florida Water Management District, Foundation Subscribers, water and wastewater agencies, and other interested organizations. The Foundation leverages its financial and intellectual capital through these partnerships and funding relationships. The Foundation is also a member of two water research coalitions – the Global Water Research Coalition and the Joint Water Reuse Task Force.

This publication is a summary of a water reuse economic framework workshop sponsored by the Foundation and is intended to document the results of the 20 participants attending the workshop who provided their expertise to answer the question: *What are the essential components of an economic framework that would promote broad recognition of the full range of services and benefits that water reuse provides?* This question was intended to prompt discussions among the workshop participants about the types of benefits, costs, and services as well as explore how to build meaningful bridges by embracing stakeholder perspectives of value. This workshop was part of research project funded by the WateReuse Foundation.

Ronald E. Young
President
WateReuse Foundation

G. Wade Miller
Executive Director
WateReuse Foundation

ACKNOWLEDGMENTS

The project team would like to acknowledge and thank the 20 water reuse professionals, Federal and state officials, and academics that participated in the WateReuse Foundation's Water Reuse Economic Framework Workshop. Through their hard work, the participants identified 62 issues that were consolidated into 10 overarching themes. The contributions of these volunteers were critical to the success of this water reuse economic framework workshop and the Foundation is grateful for their efforts. The list of 20 participants is provided in Appendix C.

The workshop was organized and facilitated by the National Water Research Institute, under subcontract to Stratus Consulting Inc. Special thanks are extended to the National Water Research Institute staff for their outstanding efforts in organizing and facilitating the workshop, and editing and producing the materials in this document.

This workshop was funded by the WateReuse Foundation in cooperation with the U.S. Bureau of Reclamation (USBR), California State Water Resources Control Board, and Southwest Florida Water Management District. Additional funding was also provided by the Las Vegas Valley Water District, the Inland Empire Utilities Agency, and the Santa Clara Valley Water District.

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Water Reuse Economic Framework

NGT WORKSHOP REPORT

Facilitated by:
National Water Research Institute

On behalf of
Stratus Consultants Inc.

May 10-12, 2004

Kellogg West Conference Center
California Polytechnic University
Pomona, California

FOREWORD

Water utilities throughout the world are increasing their interest in water reuse – a viable option for increasing water supplies. This enthusiasm has come to a greater degree because of the many advances in technologies which have enabled utilities to produce high-quality water from used-water sources at more and more reasonable costs. Water reuse therefore, is considered by many today as the "best available technology" for delivering a high quality, reliable, and sustainable product.

Nevertheless, a host of challenges remain. One that faces the global community today is defined by a simple question: If water is so widely recognized as the most essential substance to sustain life, why then is it among the most undervalued resources in the world? In general, people have limited knowledge of the wide range of services water provides to sustain a nation's economy, the well being of its population, or a nation's variable ecosystems. This lack of understanding is probably due in part to the success of the water utility managers who provide high-quality water 24-hours-a-day, 7-days-a-week to their customers. Their customers, on the other hand, take this service for granted and perceive that water will always come uninterruptedly from their taps.

How can the full range of services and benefits be made more apparent and more tangible to more people? If reused water is an asset, then it is important to identify both the easily recognized and more difficult unrecognized benefits and services that it provides to consumers. Unrecognized services might include stakeholder goodwill, watershed protection, sustainable ecosystems, or less monitoring costs. It must be remembered that the real value of water is not its price nor costs associated with its production – the real value of water is related to the services it provides.

This workshop was facilitated by the National Water Research Institute (NWRI) for Stratus Consulting Inc. and was part of a broader research project funded by the WateReuse Foundation. The workshop is based on the nominal group technique (NGT), which offers a format that addresses a focused question that no single person can answer but in concert with others can identify issues and define options to approaching a resolution to the question.

This report documents the results of the efforts of the 20 participants attending the workshop who provided their expertise to answer the question: *What are the essential components of an economic framework that would promote broad recognition of the full range of services and benefits that water reuse provides?* This question was intended to prompt discussions among the workshop participants about not only the types of benefits, costs and services but also to explore how to build meaningful bridges by embracing stakeholder perspectives of value.

This report comprises two parts: Part 1 (Working Group Reports) presents a more detailed version of the top 6 issues that were prioritized from the 10 consolidated issues generated from the 62 issues that were identified by the participants during the NGT portion of the workshop. Participants were assigned to one of the 6 working groups that were assigned to digest and synthesize all of the individual issues consolidated under their particular overarching issue. The power point slides used by the working group during their presentations can be found in Appendix B.

Part 2 (NGT Workshop) reports the results of the issue identification and consolidation elements of the workshop. The participants identified 62 issues that were consolidated into 10 overarching themes. The fact the participants were able to identify 62 issues suggests the significance of the workshop question from their individual perspectives.

The success of any activity is due in great part to the participants and their enthusiasm for engagement in the process. The participants in this workshop are to be commended for just that, great enthusiasm!

Thanks is extended to the NWRI team that facilitated the workshop; Brian Brady, who so masterfully served as the Workshop Secretary and kept track of the issues to ensure their clarity; and to Tammy Russo, Workshop Coordinator; Patricia Linsky and Carolee Brady, Editors; Barbara Close, Graphic Coordinator; Raymon Thomas, Graphics Assistant; Keith Murphy, Victor Padilla, and Daniel Woltsz, Word Processors; and Teresa Taylor, Photographer.

Ronald B. Linsky
Executive Director
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GROUP PHOTOGRAPH OF PARTICIPANTS

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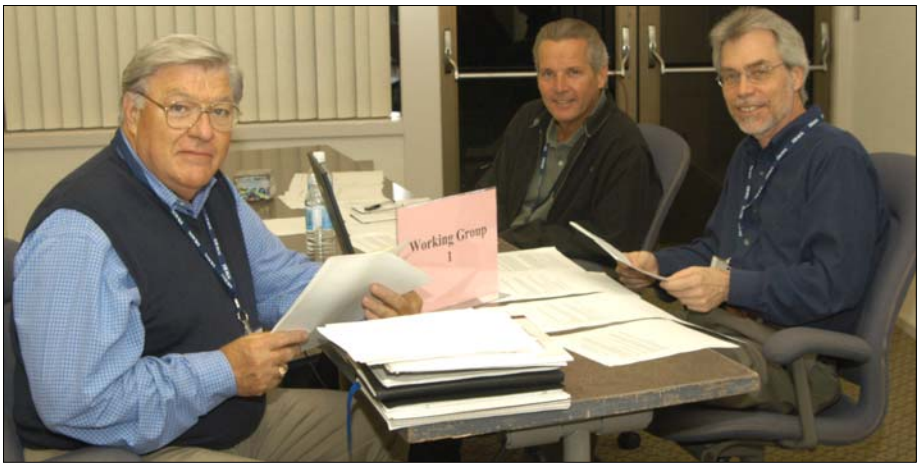
PART 1

WORKING GROUP REPORTS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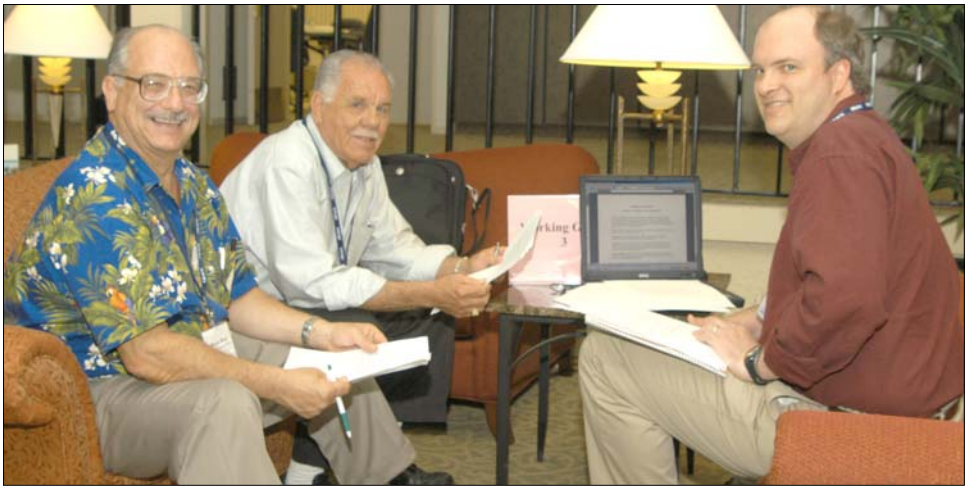


PRIORITY 1

Make the Value of a Diverse Portfolio and Regional Approach to Project Formulation the Principal Consideration in Evaluating the Costs and Benefits of Water Reuse

WORKING GROUP MEMBERS:

Cromwell, King, and Martin

Rational:

The days of planning and constructing single-purpose water projects are over. No longer do local communities situated in highly urban environments have the luxury of planning in a vacuum without regard to the looming "tragedy of the commons." Moreover, significant net benefits can be realized from planning in partnership with neighboring communities.

Project optimization is critical, and this can best be approached in a regional context. Water reuse projects must be included as a strategic component of the regional portfolio to maximize the benefits of reuse projects – and of water supply planning in general! The larger the system boundary, the greater the number of opportunities to optimize project benefits in terms of cost effectiveness, reliability, and environmental and water supply sustainability.

The benefits of reuse projects typically "spill over" jurisdictional boundaries and accrue to everyone in a region, making clear the basis for win-win cost-sharing arrangements as the best means of defeating fragmentation. In addition, projects that deliver "win-win" benefits to multiple jurisdictions are more likely to generate support, including funding from outside sources.

Approach:

- *Why a portfolio approach?* Diversification of investment portfolios has been shown to enhance and protect return on investments. The approach reduces risks by averaging across a collection of different risk characteristics. Managing a community's water supply options follows the same principles. In the classic least-cost planning process, water managers focused on building the cheapest alternatives first and looked only within their jurisdictional boundaries. By instead broadening the choices and respecting the fact that it is better to have

projects with varying characteristics, there is less risk and more benefit in the overall water-supply portfolio. This benefit spills over to everyone in the region.

- *Regional approaches can be more cost-effective.* Conceived at a regional level, projects can be developed at larger scales with reduced unit costs to be shared by all participants. In addition, there are trading opportunities involving potential win-win relationships that may exist between watershed partners. For example, the ownership of water rights may suggest trading strategies that complement the mix of possible projects that may exist in one jurisdiction versus another. One jurisdiction may be in better position to develop a reuse project that produces greater flexibility in resources available to others in the region.

- *Regional approaches can enhance supply reliability.* Having the larger portfolio of projects with varying performance characteristics during drought scenarios, coupled with flexible transmission options for drought emergencies, can result in benefits from greater supply reliability. This could provide the justification for a high-cost reuse project as a strategic part of a regional drought management plan that might not otherwise be a first choice for a single agency. Although all reuse projects inherently enhance supply reliability due to drought resistance, the benefits are greater if shared at a regional level, and the costs can be shared by all who benefit.

- *Regional approaches are more environmentally sustainable.* Because there are more water-supply options to choose from at the regional level, reliance on the options that have the most deleterious environmental effects can be minimized. This includes seasonal or drought adaptations to minimize environmental pressures through such means as sustaining critical instream flow levels to preserve key habitats. Groundwater replenishment can also be promoted and excessive draw downs avoided by operating the regional system as a system.

Potential Conflicts:

- *Regional collaboration is intended to reduce conflicts.* Once collaborating jurisdictions can see that there is win-win potential in collaboration, the prospects for conflict resolution are greatly enhanced. In addition, environmental concerns are addressed in two ways. First, supply optimization demonstrates a good faith effort to develop a mix of resources in the most sustainable way. Second, the environmental issues, such as instream flows, are introduced into the projects at the inception and carried all the way through.

- *Consideration of benefits and costs may lead the way to regional collaboration.* To build the support needed to mobilize multiple jurisdictions to adopt formal collaboration mechanisms, such as joint powers agreements, it is extremely helpful to be able to demonstrate the win-win rationale in terms of benefits and costs. Win-win is the antidote to fragmentation. This foundation, in the benefits case, may also help to obtain outside funding and build political support**.**

PRIORITY 2

Accounting for Stakeholder Perceptions in Conducting and Reviewing an Economic Analysis of Water Reuse Projects

WORKING GROUP MEMBERS:

Mosher, Raucher, and Rossi

Rationale:

People with varying backgrounds, belief systems, and interests value water reuse in different ways. Stakeholder perceptions of benefits may be the deciding factor in the success of water reuse projects. It is critical that the process of informing stakeholders and the public involves a discussion of benefits.

Engaging stakeholders in the discussion of benefits may help to reach a consensus on the range of benefits in qualitative and quantitative terms. Utilities need to communicate the benefits that matter most to stakeholders and other key audiences. Utilities also need to focus on the most important benefits to ensure broad application and support.

Approach:

Creating advocates among stakeholders can be addressed through a multi-faceted approach that:

- *Demonstrates that reclaimed water is a resource and not a waste product to be disposed of.* Illustrate the value of this source in maintaining and enhancing the community's quality of life.

- *Uses terminology that better communicates the value of the water*. Avoid terminology that distinguishes "reclaimed water" as something inferior to "water." Develop terminology that better communicates the various qualities of water, based on suitability of use rather than origin. This terminology must be inherently defined and understood by the public and leaders, and it should apply to *all* water sources and at *all* stages.

- *Emphasizes aesthetic features, such as public urban fountains, streams, and lakes, as highly visible and valuable applications of water reuse*. Qualitatively assess and communicate the role of water-based aesthetic amenities in maintaining or enhancing civic pride, personal enjoyment, and property values.

- *Clearly conveys the message to stakeholders that the current situation is being improved through water reuse rather than being degraded.* Identify the added value qualitatively and/or quantitatively.

- *Recognizes the importance of partnering with commercial/industrial/institutional entities*. Identify current or proposed large-scale operations, such as zoos, parks, and industries, and engage them in building a larger base of advocacy.

- *Acknowledges the public's negative perceptions and provides factual and balanced feedback.*

- *Identifies individuals or organizations trusted by the public who can be enlisted to provide testimonials for the project*. Cultivate relationships early on in a process.

- *Emphasizes the benefits of the local control of reclaimed water as a value in seeking stakeholder support*.

- *Refers to the 25 best practices identified in the WateReuse Foundation (WRF) report "Understanding Public Concerns of Indirect Potable Reuse."*

- *Works with the community to define the problem (and define the right "without project" baseline), as well as to develop solution options*.

***Potential Conflicts*:**

Potential conflicts can occur due to perceptions that cannot always be addressed through these processes. The conflicts can develop in the form of:

- Recalcitrant and influential opponents.

- Not doing enough, or not taking early action to involve stakeholders.

- Attempting to defend a chosen project or initiative that may not be appropriate at this time or at all.

PRIORITY 3

Dealing with Risk, Reliability, and Uncertain Values When Analyzing Water Reuse Projects

WORKING GROUP MEMBERS:

Henderson, West, and Wilson

Rationale:

- Benefit and cost values are often imprecise but are often represented using a single value. Picking one number could cause policy stakeholders to believe the analysis is tilted toward a desired outcome.

- Water reuse projects provide benefits to system reliability that are often not fully recognized.

- The range of possible outcomes needs to be understood before major investments are made. This includes demands, capital costs, operating costs, technical performance, and secondary impacts.

- Even though risk and uncertainties exist, they should not stop the evaluation or implementation of projects.

Approach:

The following items need to be considered when dealing with risk, reliability, and uncertain values as part of analyzing water reuse projects:

Risk and Reliability

- *Recognize the value of reliability.* Reliability provides the public with assurances that often drive project acceptance.

- *Fully value the higher risk.* Conservation and reuse projects that blunt the negative impact of drought will not be assigned their true worth unless risks are valued more highly. The avoided cost of drought impacts can be estimated to put a value on reliability. Surveys of customer willingness to pay to avoid drought impact through the implementation of recycling projects can also be a good indicator of the value of reliability. We recommend that water utilities survey their customers on a regular basis with regard to willingness to pay for

changes in reliability and related water-management decisions to both estimate values and build understanding of these issues in the community.

- *Incorporate risk factors.* Risk factors and uncertainties must be incorporated into the economic framework for analyzing any reclaimed water project.

- *Recognize climate change.* The importance of increased reliability from water recycling projects in the face of climate change must be recognized. Estimate the benefits of reliability from climate change conditions by including climate change scenarios. Also, water recycling projects are expandable, allowing for easier adaptation to changing need.

- *Include adequate storage.* In a reclaimed water program, adequate storage must be included in project planning to ensure a reliable and constant supply.

- *Recognize drought impact.* Drought helps a community fully appreciate the value of increased reliability due to reclaimed water projects.

Uncertainty

- *Identify and anticipate impacts.* As many impacts as possible must be anticipated, recognizing that there will be unknowns. Build public awareness and trust by being proactive in resolving issues.

- *Use full range value.* The full range of an estimated value should be used instead of a point estimate, when available, in the economic evaluation, recognizing that many values will be imprecise, either due to natural variability in values or uncertain knowledge of the true value.

- *Use sensitivity analysis.* Explore ranges of values with stakeholders and affected community groups by using sensitivity analysis to build a shared understanding. We endorse establishing focus groups to test assumptions and estimated values against perceptions held by stakeholders. “Breakeven analysis” is another useful analysis method for uncovering uncertain values.

Potential Conflicts:

- *Regulatory issues.* Regulatory requirements may need to be changed and/or be expedited in certain instances to allow for the proposed complete evaluation of economic factors.

- *Desirable levels of risk or reliability.* There will be differing opinions in regard to desirable levels and/or risk or reliability. Some studies have shown that in already reliable systems, the public may be willing to accept less reliability in return for lower water bills.

- *Climate change.* There are differing opinions on the likelihood and impacts of climate change. There also are differing model projections of climate change impacts.

PRIORITY 4

View Recycled Water Fees as a Function of the Worth of Water to the User and the Community-at-Large

WORKING GROUP MEMBERS:

Carruthers, Mariscal, and Riley

Rationale:

- The assignment of fees for the highest and best use of recycled water will more properly align the resource.
- The fee structure should capture all the societal benefits that recycled water provides to the community. Costs should be shared by all beneficiaries and not just the water recycling purveyor.
- The fee components can be displayed to illustrate equity among all parties.

Approach:

The product, recycled water, comprises several components, including:

- Water quality.
- Timing of delivery.
- Reliability.
- Public health assurance.
- Aesthetic needs.

These components define the willingness of the end user to pay for recycled water. This can help to define a proper treatment system so as to optimize the capital system and reduce overall costs. However, there are major capital costs to an end user who switches to the new water source. End users sometimes require financial assistance from water purveyors to accept

recycled water into their systems (e.g., infrastructure costs including meters, piping, etc.). Water purveyors may also require non-potable storage for recycled water.

Others who gain from the new system can be asked to bear these early capital costs in proportion to their gain. For example, potable water suppliers may be able to postpone obtaining new water sources if recycled water use offsets the need to obtain additional supplies. These avoided costs to potable water suppliers may include:

- The cost of acquiring a new source of water.
- Replacement pipe downsizing.
- Treatment.
- Mitigation for water taken out of a surface water source.
- Drilling deeper wells.
- Reduced more costly potable storage requirements.
- Avoiding salt water intrusion.

Surrounding communities may also gain from an improved environment in that nutrients from secondary treated water will not be delivered to surface waters.

Potential Conflicts:

Rate payers who do not receive recycled water may balk at covering some of the costs of producing recycled water. A resolution to this dilemma may include educating users regarding the cost of obtaining new potable water. This may help them understand the importance of supporting recycled water use as it relates to their water rate fees by avoiding additional costs they may be incurred by obtaining the next increment of water.

The ability to obtain funds from outside the local jurisdiction may be enhanced. Downstream water users and state institutions may also be persuaded that the reduced National Pollution Discharge Elimination System (NPDES) load to surface waters creates a value that could be appropriately shared.

PRIORITY 5

Satisfy Social Obligations and Improve Living Conditions by Maintaining Community Assets and Supporting Community Values

WORKING GROUP MEMBERS:

Good, Kasower, and O'Brien

Rationale:

Water managers have the responsibility to create projects and programs that are responsive to the sentiments of the customers they serve. There are also unwritten social obligations for agencies to meet the overall water supply needs of communities. Although not necessarily required from a legal standpoint, understanding these sentiments can lead to successful project implementation. For example, during times of drought, areas of large irrigation, such as public parks and recreational fields, are often the target of potable water restrictions because of the large volumes of water they use or perceive to use. The community may desire a locally controlled project that can sustain those assets during drought (e.g., conservation, water reclamation/reuse, landscape alterations). Moreover, this self-reliance has the potential of serving the community as a whole, regardless of economic status.

In addition, other large water users, including power plants and oil refineries, provide products that virtually all citizens rely upon for daily living. If water is scarce or unavailable, these key industries may be forced to limit operation or increase the price of their product, thereby negatively impacting the local/regional economy. Water agencies must work to ensure continuous water supply and appropriate water quality to these economy-driving businesses.

To quantify these social obligations, an economic evaluation framework is required. The full array of economic benefits cannot be realized without appropriate analytical tools that estimate the values of:

- Self-reliance and local control.
- Urban aesthetics.
- Health and quality of life.

- Various sources of accessible water.

- The ability to reflect community sensibilities.

These tools, if properly developed and utilized, capture the full community values of their water resources.

Approach:

The key to implementing this economic framework is assessing community sentiments, values, and desires. This requires direct interaction with the public in the form of surveys, focus groups, stakeholder meetings, and collaboration with existing community-based organizations. These analytical processes are designed to methodologically derive an organized sense of community values which, when matched with utility alternatives, will result in greater acceptance and success of projects.

Potential Conflicts:

- Ability to translate economic theory to applied community valuation activities. This may require the services of an economic research firm.

- Inability to adequately understand the diversity of community sentiment or the universal application of economic tools (i.e., one size may or may not fit all). One strategy to minimize this potential problem is to engage agency staff in long-term outreach and dialog with local communities, not specific to a given project.

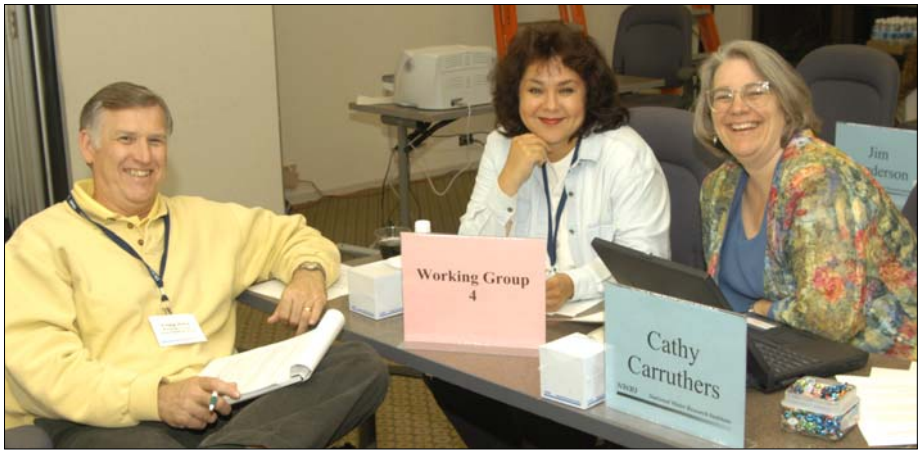
- The internal agency culture may resist community outreach methods. A possible solution is to develop internal community and cultural sensitivity training and to introduce new and diverse methods of supply planning to technical staff. Such educational programs could include successful case studies from other agencies.

- Initial or continuing resistance from communities to engage in dialog with the agency. Establish the agency as the trusted experts who are willing to work with communities to resolve water issues.

- Agency budget for new approaches may be limited, unavailable, or unmarketable to utility managers. This can be circumvented by expanding cultural sensitivity training to upper management/governing boards and by making clear, powerful cases for innovative projects.

- Community priorities and agency scheduling needs are out of sync. Use the information acquired in the second bulleted item listed above to either better communicate the scheduling needs of the agency or to adjust the scheduling needs of the agency to meet the more

immediate needs of the community. A community will not support an agency's project if there is another legitimate project which they deem more valuable.




Working Group
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PRIORITY 6

Strategies to Promote Long-Term Sustainability of Water Resources through Water Reuse

WORKING GROUP MEMBERS:

Castor, Grinnell, and Sheikh

Rationale:

The long-term sustainability of water resources is critical to ensure their availability for future generations. One way to ensure long-term sustainability is through water reuse, also known as reclaimed water or recycled water. This requires that certain strategies are employed during the development of water reuse systems. The first strategy is the use of reclaimed water to defer the needs to expand existing potable water treatment capacities and/or new potable-quality resources. The second strategy is to effectively evaluate and price the costs of reclaimed water to the customer base. Finally, the utility planning horizon needs to be extended to encompass at least the next 20 years for defined project planning and at least the next 50 years to address overall community growth and preservation of water resources for future generations.

Approach:

To defer the expansion of water treatment capacities and new potable-quality water resources, water reuse savings (e.g., potable-quality offsets) must be identified and quantified. This can be accomplished through potable water use records prior to the installation of water reuse systems, coupled with similar records obtained following access to reclaimed water. A standard measure of water-quality offsets must be consistently applied throughout the service areas. It is essential that water reuse customer bases (e.g., single family residential, multi-family residential, commercial, environmental, recreational, and industrial) be identified and appropriate offsets be quantified for each.

Pricing of the reclaimed water system and the water supplied must include the cost to design, construct, and deliver the reclaimed water to the customers. This cost estimation can be accomplished by determining the present worth of each water reuse project using the cost of each water reuse project, the volume of potable-quality water saved in million gallons per day, and amortizing the project over 30 years. This provides a cost benefit identified by the cost per 1,000 gallons of reclaimed water provided. Successful projects are those that have cost benefits less than the current cost per 1,000 gallons of potable-quality water. The value of water reuse projects designed for long-term sustainability should be calculated by means of an economic method that goes beyond traditional discounting methods so that the projects and their long-term benefits are appropriately valued. Efficiency and preservation for future generations also can be

accomplished by charging the customers at a rate equal to or greater than the cost derived from the cost-benefit analysis.

Effective long-term planning and water reuse management can be accomplished through the long-range forecasting of various criteria associated with demand increases to the utility and water resources currently in use, as well as those identified for future development. These criteria include, but are not limited to:

- Estimated population growth.
- Changes in recreational facilities.
- Changes in agricultural practices.
- Industrial development.
- Tourist attractions.

It is imperative that the most accurate and representative data, positive or negative, be used for this planning effort. The uncertainties associated with the data and data-gathering projects require that this planning effort be repeated and adjusted on a regular basis, such as once every 5 years but not longer than once every 10 years. Each planning cycle must include the review of the most recent data and the active involvement of all stakeholders. The new projects provide the justification for the utility to adjust, adapt, or otherwise change the direction to ensure the long-term preservation of the water reuse and water resources.

***Potential Conflicts*:**

Potential conflicts include:

- Existing inertia to change in “the ways things have always been done.”
- Conflicting goals of residential and commercial development versus the need to conserve water for future use.
- Untrue or incorrect accusations from individuals or groups opposed to water reuse.
- Lower prioritization of water reuse than less effective water preservation alternatives.
- Political opposition to costs associated with the success of the water reuse program.

***Resolution of Conflicts*:**

The following procedures may be effective in resolving the conflicts identified above:

- Take advantage of natural cycles that encourage innovative thinking, such as drought mitigation strategies, maximum drought probability, water storage options for drought management, and related activities.

- Promote and educate all consumers in water conservation.

- Distribute the most current factual information regarding water supply, values of water reuse, and the role of the individual customer in accomplishing the goals of water reuse.

- Establish an in-depth bilingual public outreach program using all forms of available media (e.g., press, in-bill mailings, radio, television) to reach the maximum population in the utility's service area.

- Generate and distribute frequent media packages addressing specific water issues, such as long-term sustainability, global warming, drought contingencies, and individual responsibility for water conservation.

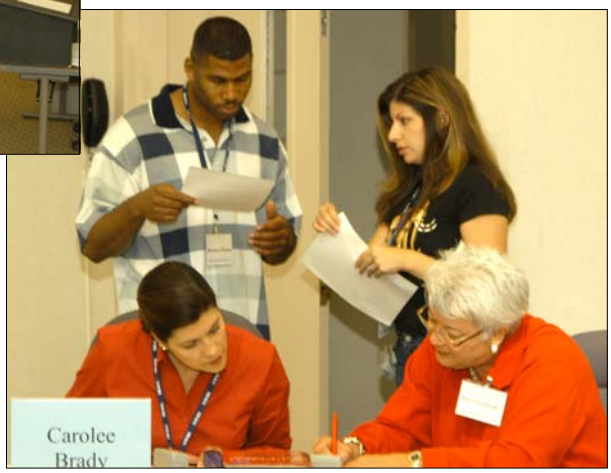
- Meet negative and/or unfounded claims with established facts or defined plans using credible spokespersons.

- Maintain an active and up to date risk management program including public programs to accurately convey the documented risks in terms the customers can understand.

- Provide clear, factual assessments of the failure(s) to implement the plans developed for long-term sustainability.

- Conduct recurring workshops involving all stakeholders to ensure their understanding and "buy-in" to the plans and goals of the utility and overall community.


Brian Brady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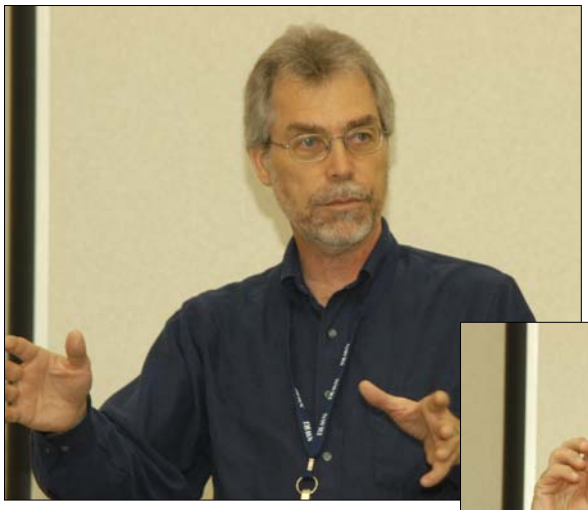
7
ACCOUNT FOR NON-QUANTIFIABLE
BENEFITS AND COSTS
QUALITATIVELY
8

PART 2

NGT WORKSHOP



PRIORITY 1

Baseline Scenario Should Forecast the Default Status Quo Scenario

Originators:

Cromwell on behalf of himself, Castor, Haddad, Kasower, King, Mariscal, Martin, Raucher, Rossi, and Sheikh

The following issues were consolidated under the above title:

Title: **Baseline Scenario Should Forecast the Default Status Quo Scenario**

Originator: Cromwell

Issue Description:

The "No Action" option – deferring action to increase water supply capacity – is an action. It is an action that has costs and benefits the same as any other supply scenario. We should not compare the "with project" case against a "without project" case that is empty. It is not true that deciding not to act is just waiting. There are direct costs stemming from bypassed opportunities for regional collaboration that result in less efficient project options and less environmentally preferable project options.

Especially in multi-jurisdictional/regional settings, time gets away from you, and sooner or later each jurisdiction has to fend for itself rather than waiting for regional collaboration to gel. Once one jurisdiction makes a financial commitment to a less-than-optimal strategy; it cannot pull its money back. Once the pieces start to crumble, deals fall apart and opportunities are lost – forever. The larger the system boundary, the greater the number of opportunities to optimize water resources in ways that are cost effective, reliable, and environmentally sustainable. Inaction kills these options.

Importance:

Frequently, a project that has been stuck finally gets moving when things have mounted to crisis proportions (i.e., nothing like a good drought). Implicitly, somehow, the perceived benefits and costs have changed at that point and things get moving. If enough attention can be placed on

forecasting the costs and benefits of the default status quo scenario, then maybe it will be easier for people to see what is coming and act sooner to take advantage of better options.

How Do You Propose Meeting or Complying with This Issue?

We should define an array of typical baseline scenario types that would serve as a catalogue to shop from when putting together a benefit cost analysis for reuse projects. This should be drawn from experiences in battle in different regions that can be broadened to suit our generic needs.

Title: **Quantify the Derived Value of Maintaining/Restoring Natural Systems through Water Reuse**

Originator: Castor

Issue Description:

Natural systems provide a significant value to the quality of life, tourist industries, and ability to grow a utility's customer base. Implementing efficient water reuse can help maintain minimum flows and levels and/or improve (rehydrate) water-dependant ecosystems.

Importance:

The presence and preservation of natural systems are critical to the environmental health of all communities. Primary and secondary contact water recreation serves as a basis for tourist industries in various states/regions. Additionally, natural systems help reduce surface runoff and improve groundwater recharge. Natural systems also help remove anthropomorphic contaminants, thereby improving water quality as well as quantity. Loss of natural systems can reduce property values; reduce the desire to relocate/retire to a certain areas; and increase costs of storm water management and water quality programs. Additionally, water reuse provides an efficient use of reclaimed water when irrigation demands do not consume the available reclaimed water supply and can improve potable-quality groundwater supplies, thus postponing the identification and development of new sources.

How Do You Propose Meeting or Complying with This Issue?

It may be possible to achieve this issue by:

- Constructing wetlands, as a permitted facility, using reclaimed water to generate and manage the hydro-periods needed to establish a functional ecosystem as an alternative to conventional mitigation banking.

- Extending existing or planned reclaimed water transmission/distribution systems, where possible, to natural systems that can benefit from rehydration.

- Enacting state or local ordinances that encourage or require surplus reclaimed water to be used in natural systems (surface or subsurface) restoration.

Title: **Regional Surface Water Environmental Benefits through Water Reuse**

Originator: Haddad

Issue Description:

Economic growth and population growth continue to put pressure on open space and natural resources. As natural conveyors of water, rivers are regularly utilized as sources of fresh water for cities. The American public is particularly interested in preserving the ecological services and aesthetic qualities of surface waters.

Importance:

Urban water reuse reduces the amount of water that must be withdrawn from rivers and other surface waters. It also replenishes surface waters in places where it is held or sent prior to reuse.

How Do You Propose Meeting or Complying with This Issue?

- A survey of the literature on the value of surface water and instream flows will be performed.

- An estimate of the proportion of surface water foregone (i.e., not take by the city) per acre-foot of reclaimed water will be made (e.g., 60 percent).

- Multiply water value times quantity foregone to get benefit.

Title: **Future Non-Local Water Acquisition Benefits of Water Reuse**

Originator: Haddad

Issue Description:

Water reclamation and reuse are urban best management practices that signal a thorough, good-faith effort on the part of cities to provide for growing water needs. This helps set the stage for future negotiations with agricultural regions over rural-to-urban water transfers.

Importance:

Even substantial water reuse systems may not satisfy all future demand for growing urban regions. These regions will need to acquire additional non-local supplies some time in the future. The new supplies are likely to come from current agricultural users.

How Do You Propose Meeting or Complying with This Issue?

Compare the costs of pre- and post-best management practices efforts by cities to secure new non-local water supplies.

Title: **The Value of a Diverse Water Supply or the "Portfolio Approach" to Water Supply Planning**

Originator: Kasower

Issue Description:

Diversification of investment portfolios has been shown to enhance and protect return on investment. This is a result of managing risks, as well as concerning the investment with maximized returns. Like financial investments, each water supply has its own risk/reliability characteristics. Managing a community's water supplies for risk/benefit optimization would do a better job of supporting the community's economic activities than the traditional cost-benefit approach to water-supply planning.

Importance:

In the classic "least-cost planning process," water managers focus on building out the cheapest alternatives first. This development strategy actually places the local economy at undue risk. By including the risk and uncertainty characteristics of each alternative supply, planners can actually optimize the overall community water-supply portfolio.

How Do You Propose Meeting or Complying with This Issue?

The risk and uncertainty characteristics of each supply need to be described and evaluated. Essentially, the probability of delivering the potential project benefits would be some proportional value.

Title: **Address Economic Efficiencies through the Creation of Common Pool Resources**

Originator: King

Issue Description:

- Identify watershed resources with common local ownership.
- Provide replenishment and non-potable water supplies.
- Provide equities in the watershed, maximum benefit efficiencies.
- Develop more efficient investment strategies to drought proof the watershed.
- Identify potential private sector investment partners.
- Address the importance of habitat values that are water dependent.

Importance:

- Treats the watershed as a system.
- Flattens peaking demands and price swings.
- Provides efficiencies in financing projects when money is in short supply.

- Provides collaborative planning opportunities.

- Consolidates political support regionally, as opposed to local advocacy.

How Do You Propose Meeting or Complying with This Issue?

Form common pool resources that involve the public as well as private interest. No market exists in the long run without some underlying public institution of support.

Title: **Identify Opportunities and Constraints for Water Reuse Projects**

Originator: King

Issue Description:

- Develop a Global Imaging System (GIS) inventory of usable publicly held properties suitable for reclaim water projects.

- Develop a regulatory framework that recognizes stormwater benefits in reclamation and reuse.

- Initiate regulatory guidelines that bring the environmental community into the created wetlands planning process supporting reuse programs.

Importance:

- Reclaim stranded assets, fallowed acreage, and surplus right-of-ways that can be converted to the collection and treatment of both dry weather and high-flow storm flows.

- Provides opportunities for community-based projects that offer:
  - treatment
  - visual amenity
  - habitat
  - resource reuse
  - irrigation basins

How Do You Propose Meeting or Complying with This Issue?

Consolidate the existing inventories of public agency GIS documents so that a resource center could be established for developing local projects that combine regional resources.

Title: **Contribute Appropriate Water Recycling Funding Levels Commensurate with Regional Benefits**

Originator: Mariscal

Issue Description:

Absent a drought situation, it is getting more difficult to convince local water purveyors to develop water recycling/groundwater projects (the low hanging fruit has been picked). Although there is a regional benefit for an entire service area, the water agency that initiates the project is straddled with all the project costs and regulatory headaches, with minimum benefit in relation to their effort. Regional water wholesalers and other agencies (e.g., waste treatment plants) that benefit from this recycling effort must step up to the plate and provide additional incentives and financial support. State and federal support must also continue to grow. Why? Because instead of pursuing and developing local recycling/desalination projects, pressures to pursue water supplies outside one's region will continue (i.e., increase imported water supplies). The benefits of recycling derived by a community must be paid by the other regional agencies benefiting from this recycling effort. If not, recycling efforts will slow down, and other sources of water (e.g., imported water) will continue to be pursued (the path of least resistance).

Importance:

It is important to continue to make water recycling attractive to local agencies in order to encourage more, or better yet, continued and sustained water recycling efforts. Regional benefits include:

- Water Supply Reliability: By obtaining/producing a local supply of uninterruptible water, local control of water resources is secured.

- Economic Benefits: Economic prosperity can be achieved by attracting and keeping businesses in our respective service territories by ensuring water supply reliability. A potential cost savings can also result if the next increment of water supply is more expensive to obtain than producing an additional increment of recycled water.

- Environmental Benefits: Reduced imported water demand will allow more water to be allocated for environmental purposes and enhancements.

- Increased System Capacity: By encouraging and increasing recycled water use, potable water system capacity is increased.

How Do You Propose Meeting or Complying with This Issue?

Regional, state, and federal agencies must provide adequate funding levels in order to not just develop new recycling projects but also to keep existing recycled projects operating. Benefits must be quantified based on regional benefits, not just the benefits derived by any one individual agency.

Title: **If Federal Funding Is Sought, the Economic Evaluation Needs to Demonstrate That the Project Has National Benefits**

Originator: Martin

Issue Description:

There is a seemingly endless demand for federal dollars to implement water reuse projects. If a project is small, only serves a few customers, and is of interest to only the local community, it is less likely to be viewed as having a need or justification for financial support at the federal level. The economic framework needs to be able to demonstrate that the project is of benefit to the nation, not just to a local community.

Importance:

The federal budget is highly constrained at this time, and there are many other pressing needs for taxpayer dollars to fund other types of public works projects. With so many water reuse projects already federally authorized for construction, competition for scarce federal resources will get more intense.

How Do You Propose Meeting or Complying with This Issue?

If possible, the economic framework should demonstrate a connection between the proposed project and an existing federal project. It needs to emphasize how the nation will benefit from the project (e.g., the project will proved an environmental enhancement benefit).

Title: **Project Formulation in a Regional or Watershed Context and Incremental Costing Versus Average Unit Cost Considerations**

Originator: Martin

Issue Description:

The days of planning and constructing single-purpose water projects are over. No longer do local communities situated in a highly urban environment have the luxury of planning in a vacuum with no regard to the impacts and benefits that can be realized from planning in partnership with neighboring communities. Project optimization is critical to achieving financial support from outside sources. This can be better achieved if the project is planned in a regional context. The public and funding agencies need to know a project is optimal in terms of getting the most "bang for the buck." The average per unit cost of an acre-foot of water delivered for beneficial use is an important indicator of how the project will perform in meeting the needs of a community and the impact the project will have on ratepayers. However, the incremental cost of meeting the various demands is also important for evaluating project effectiveness. The economic framework needs to be able to demonstrate that meeting each individual demand will be done in a cost-effective manner.

Importance:

Public concern for the environmental quality of entire watersheds is growing. To be accepted, the project needs to be shown to have low or no impact on the watershed, or better yet that the project benefits the watershed. In addition, ratepayers will be more inclined to support an entire project concept if it is shown that marginally economic deliveries have been identified and considered in the analysis, and that all water demands will be met in the most economically optimal way.

How Do You Propose Meeting or Complying with This Issue?

Partnerships between neighboring water agencies should be pursued to enable all demands within and across jurisdictional boundaries to be considered for service and met at a minimal cost. In addition to evaluating the merits of a project based on average units costs, the framework should allow for a determination of the incremental unit costs of meeting the next available demand in a potential network. Outlying demands that disproportionately raise the total average unit cost of the project and bring into question the overall merits of the project should be dropped from further consideration. All efforts should be taken to maximize the optimality of the project economics.

Title: **Cost Savings of Expanding Reuse as Part of a Broader Buried Infrastructure Renewal Program for Water Supply**

Originator: Raucher

Issue Description:

Potable water infrastructure renewal is a large cost item emerging for many water suppliers. If reuse is promoted in concert with supply pipeline replacement, utilities may realize significant cost savings and other benefits. For example, if reuse is used for fire protection, new supply lines for potable water can be downsized and be less costly to buy, install, and maintain.

Importance:

Reuse can be valuable for fire protection, outdoor irrigation, and other peak uses that currently dictate water supply main over sizing. By using upcoming infrastructure renewal as an opportunity to make reuse available for such uses, a more efficient piping system can be developed overall.

How Do You Propose Meeting or Complying with This Issue?

A case study would be a good way to illustrate the concept and develop comparative cost estimates.

Title: **Exchanging Supplies to Avoid Geographic and Regulatory Obstacles**

Originator: Rossi

Issue Description:

Often, reclaimed water is available in sufficient quantities to serve urban needs, though it may not be geographically convenient. Even if reclaimed water is easily accessible and highly treated, regulatory constraints limit the flexibility to meet a broad range of needs. In many cases, nearby farms, industries, and other entities may have rights to sources that are acceptable for potable use and are more geographically convenient to urban systems.

Importance:

Overcoming geographic and "match-suitability" obstacles are critical for broadening the opportunities to expand – and thus increase – the real value of reclaimed water.

How Do You Propose Meeting or Complying with This Issue?

Identify exchange opportunities with farms, industries or other entities that currently use potable water but are geographically suited to receive non-potable water. Municipalities physically taking the "potable" water will benefit in the form of avoided infrastructure and water acquisition costs (which are easily quantifiable).

Title: **Fragmentation of Benefits; Concentration of Costs**

Originator: Sheikh

Issue Description:

The costs of implementing a water reuse project are concentrated in two ways:

- They are almost entirely concentrated in the initial phase of project implementation. All facilities must be built (and paid for) before the first acre-foot of water is reclaimed and reused.

- Usually one agency bears all the costs, even though the benefits may accrue to several agencies.

In the past, this highly concentrated nature of costs has hindered implementation of many a project, which otherwise would have been economically sound to the community as a whole.

Benefits of water reuse, on the other hand, are fragmented among disparate entities that may not even realize they are beneficiaries of the project. Commonly, the water supply benefit accrues in part to the water retailer and in part to the wholesaler; improvement of reliability of the water supply, another benefit, accrues to the community; energy conservation, if any, accrues to the energy generators and the consumers of energy and the public at large; environmental benefits to the receiving waters accrue to the region, the state, and the nation; any habitat and ecological improvement benefits that might be involved (if recognized) belong to the nation, etc.

Importance:

This issue is important because the institutions charged with water supply, wastewater management, watershed protection, environmental stewardship, etc. are totally independent of one another and generally do not communicate with one another. In the relatively rare instances where these diverse interests have come together to see a water reuse project come to life, the difficulties involved, the complications of forming partnerships, and the near impossibility of paying for the benefits toward the costs involved illustrate the importance to the issue.

How Do You Propose Meeting or Complying with This Issue?

- Consolidation of water, wastewater, watershed agencies into single water-cycle entities.
- Formation of joint-powers agreements.
- Agreements among disparate agencies to cost share in recognition of the shared benefits.
- Regionalization of tiny entities serving water and sewerage to small localized areas.

PRIORITY 2

Do Stakeholder Perceptions Play a Role in Conducting and/or Reviewing Economic Analyses of Water Reuse Projects?

Originators:

Mosher on behalf of himself, Good, Haddad, King, Raucher, Riley, Rossi, and Wilson

The following issues were consolidated under the above title:

Title: **Do Stakeholder Perceptions Play a Role in Conducting and/or Reviewing Economic Analyses of Water Reuse Projects?**

Originator: Mosher

Issue Description:

Stakeholder perceptions of benefits may be the deciding factor in the success of a water reuse project. The process of informing stakeholders and the public should include a discussion of benefits.

Importance:

Engaging stakeholders in the discussion of benefits may help to reach a consensus on the true range of benefits in qualitative and quantitative terms. Utilities need to communicate the benefits that matter most to the stakeholders and other key audiences. Utilities also need to focus on specific elements of the most important benefits to ensure broad appreciation and support of the project's benefits.

How Do You Propose Meeting or Complying with This Issue?

- Develop the tools to market the benefits of water reuse projects.
- Utilities should engage stakeholders and key audiences early and often.

Title: **Water Recycling Is a Win-Win-Win Solution for Utilities, Direct Customers, and Indirect Customers When Direct Customers Help to Identify Community Values**

Originator: Good

Issue Description:

Water recycling is often billed as being environmentally friendly and "the right thing to do" for utilities looking to minimize environmental impacts of wastewater discharge or additional potable water facilities (e.g., dams). It is also sold as a benefit to the local/regional population who benefit from a cleaner environment and "newly available" potable supply. Use of recycled water can also be an opportunity for direct customers to showcase their environmental programs and stewardship.

Importance:

In some cases, the direct cost (rate) of recycled water is enough to convince customers to use it rather than potable or raw water. However, as demand for recycled water increases, so may its price. If properly educated, customers (e.g., zoos, parks, industry) can benefit not only from the generally lower cost of recycled water but also from the positive environmental image it portrays of their business to their customers. If done properly, these direct customers will help sell/endorse the recycled water project.

How Do You Propose Meeting or Complying with This Issue?

Institute a program to educate direct customers of the multiple benefits of reclaimed water use during the earliest planning stages for the system or customer connection.

Title: **Urban Aesthetic Benefits of Water Reuse**

Originator: Haddad

***Issue Description*:**

Public urban fountains, streams, and lakes provide aesthetic values to cities. Ponds and waterfalls on private land provide aesthetic value as well. Irrigation of urban open space also provides aesthetic benefits.

Importance:

Aesthetic uses of water are not considered "essential" and are at risk during droughts or when cities outgrow their water supply. However, they are valued by urban residents and private landowners. Water reuse projects can provide a reliable source of water for urban aesthetic uses.

How Do You Propose Meeting or Complying With This?

- Perform hedonic analysis of property values in aesthetically water-rich and water-poor areas of cities or between cities.
- Scale this value to a given city.
- Multiply by the reduced risk that these uses will be lost due to the presence of recycled water.

Title: **Translate Public Acceptance into Public Commitment**

Originator: King

Issue Description:

- Develop information that incorporates all aspects of the proposed project.
- Establish stakeholder groups that acknowledge the negatives perceived by the public (e.g., health community, environmental groups, school groups, recreation groups, homeowner associations, services and business development proponents, etc.).
- Establish an information/feedback program that provides elected officials with support positions related to the project.

Importance:

Local projects gain acceptance when constituency support, elected officials, and special interest groups agree that the outcomes are beneficial.

How Do You Propose Meeting or Complying with This Issue?

- Solicit local buy-in early in the project.
- Provide an input system for informing agency management and boards for local support.
- Offer regional partnering in agency projects that addresses conservation of traditional resources by participation in reuse projects.

Title: **Manage Globally; Build Support Locally**

Originator: Raucher

Issue Description:

Water reuse needs to be seen as part of a broader, regional effort to manage water resources. However, the backing and success of reuse projects often depend on local buy-in and support. Therefore, benefits to the local community need to be identified and communicated.

Importance:

Absent local support, reuse projects may be doomed (even if they provide significant widespread benefits).

How Do You Propose Meeting or Complying with This Issue?

Research, such as focus groups and conjoint analysis, to better articulate what "local control" and related benefits mean to people, and how much value (or preference ranking) to assign to locally oriented benefits.

Title: **Recognize the Difference between Reuse and Disposal**

Originator: Riley

Issue Description:

The basic premise of the workshop requires that reclaimed water be seen as an asset that provides services that are valuable. Water resource management programs need to be based on knowledge of options and alternatives at the outset so that historic management is forced to fit changing customer and environmental demands. Many industry practitioners do not realize the difference – especially engineers and water resource planners, who generally establish the baseline for project planning. As an example, I have seen proposals that describe turf or lawn irrigation as "evaporation" to get rid of water and not find any benefit from the resource.

Importance:

Understanding the difference establishes reclaimed/recycled water as an asset, not a liability and drives planning from project initiation based on market development.

How Do You Propose Meeting or Complying with This Issue?

Begin with convincing engineers and planners that wastewater can be turned into an asset as the first option, and disposal is a last resort.

Title: **Change the Name to Protect the Innocent (Terminology Reform)**

Originator: Rossi

Issue Description:

Acceptance of the "full range of benefits" by the public and leaders is inextricably tied to perception. In the absence of rational well-balanced information, perceptions will be based on common rhetoric. Promoters use rhetoric to sell, and opponents use it to denounce. A major obstacle in gaining greater acceptance has been the rhetorically based terminology used within the industry. We plead for acceptance and recognition of the great value of the source, but continue to call it reclaimed water, effluent, treated wastewater, recycled water, re-used water, repurified water, and so on. Because these terms overtly tie the source to its origin, even those in the profession are challenged in making the separation.

Importance:

The value of reclaimed/recycled water is linked to the actual and perceived purity of the source. If the perception is not changed, recognition cannot be broadened.

How Do You Propose Meeting or Complying with This Issue?

Water quality terminology needs to be reformed throughout the industry. We need to develop terminology that better communicates the various qualities of water based on suitability of use, rather than origin. This terminology must be inherently defined and understood by the public and leaders. This will also call for defining how various treatment technologies can upgrade the water to a higher level, again defined in basic terms. The terminology should apply to *all* water sources and at all stages.

Title: **Cultivate Project Champions and Bullet-Proof Them**

Originator: Rossi

Issue Description:

Water professionals, though acknowledging the importance of (and often being constrained by) sociopolitical factors, often promote new water projects without the cover they need from political and community leaders. This has led to significant impediments in implementing "new water" programs in some communities.

Importance:

Strategic leadership development must be a key component of "new water" programs. Leaders must fully understand, embrace and defend actions – which mean forcing cultural shifts to support and even enhance perception of value.

How Do You Propose Meeting or Complying with This Issue?

Identify and engage selected leaders from a variety of community and governmental entities and give them the tools and support to speak confidently. This can be done by integrating them fully into the process and arming them with a comprehensive understanding of the relative pitfalls as well as the benefits. This may require bringing these folks into the process long before their leadership positions will be needed.

Title: **Communicating Water Reuse as a Step Forward for a Community**

Originator: Wilson

Issue Description:

Must clearly convey the message that water reuse is an overall community improvement and not an effort to replace water of superior quality (e.g., potable water) with an inferior quality (e.g., recycled water).

Importance:

It is difficult to ask people to accept a product of any type that is of inferior quality to what they already receive. The purification process needs to be clearly conveyed.

How Do You Propose Meeting or Complying with This Issue?

Continue to pursue advanced treatment and public outreach.

PRIORITY 3

Sound Business Decisions Require That Risk Factors and Uncertainties Be Explicitly Incorporated in the Economic Framework of Any Project

Originators:

Wilson on behalf of himself, Cromwell, Grinnell, Good, Haddad, Henderson, Riley, Sheikh, and West

The following issues were consolidated under the above title:

Title: **Sound Business Decisions Require That Risk Factors and Uncertainties Be Explicitly Incorporated in the Economic Framework of Any Project**

Originator: Wilson

Issue Description:

Single-point projections of the future mask the many assumptions made in economic models of future events.

Importance:

The range of possible outcomes needs to be understood before major investments are made. This includes demands, capital cost, operating cost, technical performance, and secondary impacts.

How Do You Propose Meeting or Complying with This Issue?

There are numerous academic institutions and consulting firms that are active in the field of decision analysis and risk analysis.

Title: **On the One Hand, On the Other Hand – the Need for Sensitivity Analysis**

Originator: Cromwell

Issue Description:

There are loads of assumptions that go into a benefit cost analysis. Many of them are well grounded (e.g., some cost estimates), but many must be evaluated across a plausible range of values.

The one-handed economist approach of just picking a number somewhere in the middle may cause some stakeholders to regard the analysis as tilted toward a desired answer.

Yet, too much of the "on the one hand, on the other hand stuff" really gets on the nerves of people and leaves a sense that benefit cost analysis is pretty silly.

Importance:

Sensitivity analysis is critical to the proper use of benefit cost analysis. So, how do you engage stakeholders in understanding what are probably very important areas of uncertainty and engaged in helping to work on those critical uncertainties? That is what the need for sensitivity analysis is really telling you about an assumption – it is a priority for a deeper, shared understanding among stakeholders.

How Do You Propose Meeting or Complying with This Issue?

A group of folks with front-line experience should sit down and brainstorm the ways in which stakeholders can be reached on this issue and the ways in which our toolkit can help:

- Establish focus groups to test assumptions against perceptions.
- Use the spreadsheet tool for sensitivity analysis and "breakeven analysis."
- Use sensitivity analysis to identify research priorities that can help move a project along (i.e., a value of information application – how much does it mean to us to get better data on "x"?).

Title: **Responding to the Issue When the Imbalance of Demand Is Greater Than Supply**

Originator: Grinnell

Issue Description:

Drought creates critical decisions to be transferred from a future planning mode to the present. Define the value of recycled water with a priority as to where it fits in the drought priority list.

Importance:
This is when push comes to shove – high stakes for all involved, elected and appointed. Very emotional.

How Do You Propose Meeting or Complying with This Issue?

- Hire NWRI to solve the problem with Stratus.
- Need local consensus groups with agency and citizen groups represented.

Title: **Water Recycling Projects Have both Direct and Indirect Costs but Need Not Be Derailed by What-Ifs**

Originator: Good

Issue Description:

Just like direct benefits, direct costs of water recycling projects are easy to quantify: plant, distribution, storage, operations and maintenance, impact of reduced flows downstream of wastewater plants (if they were beneficial). However, like indirect benefits, indirect costs can also be difficult to identify. In some cases, opponents of water recycling projects try to interfere with their implementation by developing numerous what-if scenarios in an attempt to scare (terrorize) the general public in hopes of defeating the project.

Importance:

While it is crucial to identify and anticipate as many potential impacts of water recycling as possible, it is equally important to recognize and convey that there are unknowns. This is no different than the development of potable water supplies except that the general public is conditioned to the fact that new constituents have been or will be found in drinking water and that the local utilities will act responsibly to address them.

How Do You Propose Meeting or Complying with This Issue?

Work to build trust with the public during the planning stages of water recycling projects and do not break it – ever. When new issues arise, allocate sufficient resources to handle them swiftly and to the satisfaction of customers.

Title: **Climate Change Benefits of Water Reuse**

Originator: Haddad

Issue Description:

Climate change due to the increasing levels of greenhouse gases in the atmosphere may increase the length and severity of droughts and heat waves. More major storm events are also predicted which temporarily increase the turbidity of surface source waters. Climate change poses numerous potential problems for urban water systems, including increasing demand for urban garden irrigation water when droughts or heat waves occur during spring planting, as well as increasing fluctuations of supply due to increased storm intensity and turbidity. Water reuse provides a reliable source of water during extended droughts and heat waves, and when storms reduce the availability of surface source water.

Importance:

Climate change is a world-wide phenomenon with the potential to affect every water agency. While some impacts may be felt in the medium-to-long term, others, including these, may be felt in the short term or immediately.

How Do You Propose Meeting or Complying with This Issue?

Use normal analysis of water reliability benefits during droughts, heat waves, and high turbidity periods but increase over time the average expected size of the drought, heat wave, or turbidity event. Then estimate the extent to which additional water reliability benefits are due to water reuse.

Title: **Provide Information on Variability and Uncertainty Involved in Benefit or Cost Estimates**

Originator: Henderson

Issue Description:

Estimates of benefits or costs are frequently presented as one value, often an average value. However, benefits or cost estimates will be uncertain or imprecise to varying degrees. This results from both uncertainty and variability. Estimates could be uncertain because the exact state of the world is unknown to the analyst. Is the value of improved delivery reliability to a customer $25 per acre-foot, or is it $100 per acre-foot? Some values are imprecise because they are changing with time or other factors, and this variability is a natural characteristic. For example, water use can vary by day or by season.

Importance:

The recognition of variability or uncertainty conveys the confidence the analyst has in the estimate and gives information on the full range of value that the true value could be in reality. The impact of a value on overall net benefits can be explored using sensitivity analysis, where values for one variable in the analysis are systematically increased or decreased in steps to observe the impact on the total net benefits of the project. Confidence is built by using the full range of values in the analysis.

How Do You Propose Meeting or Complying with This Issue?

Provide a range of values for an estimate, not just the average. If confidence intervals have been estimated, retain the information on what percent confidence interval was estimated (e.g., 95 percent confidence interval).

Title: **Include the Increased Product Reliability to Reclaimed Water Projects**

Originator: Riley

Issue Description:

Additional costs due to public health requirements for additional reliability appear onerous. On the other hand, reliability provides a basic sales point to the public. However, there is a point of diminishing returns.

Importance:

Reliability provides the public with additional assurances that often drive project acceptance.

How Do You Propose Meeting or Complying with This Issue?

Ensure separate hedonic assessment.

Title: **Monetize Risk**

Originator: Shiekh

Issue Description:

One clear benefit that pertains to most all water reuse projects is an increase in reliability of the supply. While often recognized, the real value of water supply reliability is rarely accounted for fully, especially in view of the drastic consequences attendant on extended drought. Inclusion of even a fraction of this value (along the lines of the value of an insurance policy) might be sufficient to justify an otherwise marginal project.

Importance:

Unless risk is valued more highly, projects like conversation and reuse which blunt the negative impact of drought will not be given their truer worth.

How Do You Propose Meeting or Complying with This Issue?

A rigorous actuarial approach to calculating the cost of drought and regulatory shortages should provide additional recognition of the value of this risk.

Title: **Managing an Interruptible Reclaimed Water Supply against Seasonal Demands**

Originator: West

Issue Description:

In Florida, the wet season is in the summer, and the dry season is in the winter. During the wet period, the wet-weather flow excess goes to golf courses, more for disposal rather than beneficial use.

During the dry period, reclaimed water supply is in much more demand and is increasing in demand as reclaimed water systems are expended.

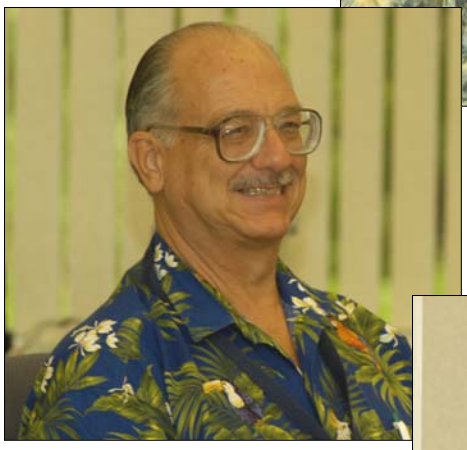
Importance:

Realize the situations of excess reclaimed water during the wet weather and getting rid of it and not having sufficient amount of reclaimed water when it is needed during the dry season.

How Do You Propose Meeting or Complying with This Issue?

- Storage is needed on a very large scale, which would not be feasible. Aquifer storage is possible (e.g., underground storage) and groundwater recharge – perhaps some sort of energy conversion.
- Finding beneficial uses for excess water is not needed for irrigation.
- During the dry season, establish logical and acceptable rationing of reclaimed water.


Jerry King



PRIORITY 4

The Default Approach in the Benefit Cost Framework Should Be Based on Rational Cost Allocation among Beneficiaries

Originators:

Cromwell on behalf of himself, Carruthers, Grinnell, Haddad, Mariscal, Raucher, Riley, and West

The following issues were consolidated under the above title:

Title: **The Default Approach in the Benefit Cost Framework Should Be Based on Rational Cost Allocation among Beneficiaries**

Originator: Cromwell

Issue Description:

Various political, inter-jurisdictional, and historical issues interfere with cost allocation. Discounts for reclaimed water also distort the cost allocation.

Importance:

There is an underlying rational basis for cost allocation that should be the first view provided in project planning. Anything else – while it may be the reality – is ad hoc in terms of economics. We need to find a solid starting point.

How Do You Propose Meeting or Complying with This Issue?

Set up the framework so that the default view of the answer is the one based on rational cost allocation.

Title: **Define the Baseline and New State of Being to Avoid Double Counting or Counting of Secondary Benefits**

Originator: Carruthers

Issue Description:

- Case A: If the new reclaimed water allows existing potable water to go to new homes that would otherwise have been precluded (because new water from the river is unavailable and water cannot be taken away from an existing user) then the value of the change is the gain to the potable water users. It is appropriate to charge the potable water user.
- Case B: If, on the other hand, the water that would have been taken out of the river is allowed to stay in the river, then the value is the public use values created by the river.
- You have to be careful not to add to these values.

Importance:

Double counting would be an issue for all governmental actions.

How Do You Propose Meeting or Complying with This Issue?

Carefully define the shift that occurs.

Title: **Treatment Process Must Be Suitable to Meet the Objectives of the End Use Quality**

Originator: Grinnell

Issue Description:

The quality of the reuse water needs to fit the criteria of the users. By defining the quality of the effluent of the process, the proper treatment system can be designed and constructed to optimize the system capital costs. This can provide a usable product at a minimum cost. Unnecessary

treatment that removes harmless constituents can be avoided, and critical ones can be dealt with by eliminating them or minimizing their presence.

Importance:

If cost of product is too high, it will price the product out of the market. If product quality is too low, the product will not be able to be used for the intended market.

How Do You Propose Meeting or Complying with This Issue?

Disposal of effluent with permit limitations (e.g., total maximum daily load [TMDL] limits) sometimes forces decisions that lower the value of recycled water in order to achieve a beneficial use where negotiation of supply and demand are not controlled by pre-established laws or ordinances.

- The Monterey Peninsula golf courses have decided that paying for reverse osmosis (RO) to reduce the high total dissolved solids (TDS) for irrigating the greens and tees is necessary to maintain the quality of the golf experience. A trial and error method was used and found to be quite expensive in getting to the final conclusions.

- The effluent from a main treatment plant in the Las Vegas Valley, where the flows make up return flow credits to the consumptive potable water supply, have been priced at a cost that is 10 percent of the price of potable water.

Title: **Urban Aesthetic Benefits of Water Reuse**

Originator: Haddad

***Issue Description*:**

Public urban fountains, streams, and lakes provide aesthetic values to cities. Ponds and waterfalls on private land provide aesthetic value as well. Irrigation of urban open space also provides aesthetic benefits.

Importance:

Aesthetic uses of water are not considered "essential" and are at risk during droughts or when cities outgrow their water supply. However, they are valued by urban residents and private landowners. Water reuse projects can provide a reliable source of water for urban aesthetic uses.
How Do You Propose Meeting or Complying With This?

- Perform hedonic analysis of property values in aesthetically water-rich and water-poor areas of cities or between cities.
- Scale this value to a given city.
- Multiply by the reduced risk that these uses will be lost due to the presence of recycled water.

Title: **Establish Recycled Water Rates That Reflect the True Value of Providing Recycled Water While Providing the Right Incentives to Entice Potential End Users**

Originator: Mariscal

Issue Description:

Establish rate schedules for recycled water that reflect the true value of supplying recycled water without discouraging potential end users. Although typically most water purveyors charge less for recycled water in order to entice new customers, offering price discounts for recycled water is not always the complete answer. For example, a large city in southern California offered recycled water at approximately half the rate of potable water. Less than half a dozen customers signed up to receive recycled water through this program. Offering recycled water at a steep discount may also somewhat "cheapen" recycled water – since it is offered at a lower rate than potable water, its value is somewhat diminished.

Potential end users must perceive a real value in obtaining and using recycled water. One "carrot" can include offering retrofit assistance to potential end users to minimize initial out-of-pocket expense. Another incentive might include providing some type of guarantee that if and when a water shortage is ever declared, any active recycled water user will not be required to cut back on potable water use at the same level required by other customers. In effect, by using recycled water, one now becomes a member of a very select, exclusive group (again emphasizing the benefits of recycled water use).

Importance:

Offering recycled water at its true cost will force recycled water purveyors to provide a better quality product.

The benefits of using recycled water (i.e., potentially lower cost/retrofit assistance; guaranteed minimum reductions during times of shortages), will help to market and sell recycled water as a valuable commodity.

How Do You Propose Meeting or Complying with This Issue?

Time and again, customers are asking for recycling retrofit assistance. They are looking at payback periods of less than 5 years to make it worth their while to invest capital on retrofitting their facilities to accept recycled water. Without some type of assistance, via a revolving loan or grant program, the initial expense cannot be justified to upper management.

As for pricing, although it is understood that the commodity charge for recycled water should never be higher than the potable water rate due to valid concerns regarding potentially higher maintenance costs associated with recycled water use (i.e., due to high TDS levels), care should be taken to not establish commodity charges for recycled water that are too artificially low and which diminish the perceived value of recycled water.

Title: **Cost Savings of Expanding Reuse as Part of a Broader Buried Infrastructure Renewal Program for Water Supply**

Originator: Raucher

Issue Description:

Potable water infrastructure renewal is a large cost item emerging for many water suppliers. If reuse is promoted in concert with supply pipeline replacement, utilities may realize significant cost savings and other benefits. For example, if reuse is used for fire protection, new supply lines for potable water can be downsized and be less costly to buy, install, and maintain.

Importance:

Reuse can be valuable for fire protection, outdoor irrigation, and other peak uses that currently dictate water supply main over sizing. By using upcoming infrastructure renewal as an opportunity to make reuse available for such uses, a more efficient piping system can be developed overall.

How Do You Propose Meeting or Complying with This Issue?

A case study would be a good way to illustrate the concept and develop comparative cost estimates.

Title: **Ensure Public Health Benefits Are Included in Economic Valuation**

Originator: Riley

Issue Description:

The workshop, so far, and most proposals that begin with wastewater and move to reclaimed water are based on the benefits accrued to the environment, not the impacts on public health. Reclaimed water enhances, supplements, or augments potable water supplies, and potable water is the cornerstone of a public health program. The difficulty is that public health benefits are based on proving the negative and are often forgotten or foregone due to difficulty with the assessment.

It is apparent that those active in the industry know that reclaimed water affects municipal water supply, but the general public and other stakeholders do not share this knowledge. Specific, essential public health benefits need to be included in all value determinations.

Importance:

Public health benefits are a presumed, yet many times forgotten, benefit. These are benefits that are necessary to a community and need to be specifically identified and developed.

Marketing a reclaimed water project requires positive spins. Public health arrives with a white hat, so emphasizing public health protections and values need to be key component of project valuation.

How Do You Propose Meeting or Complying with This Issue?

Ensure that public health is included in hedonic economic assessments.

Title: **Cost Benefits of Recycling Value-Added Reclaimed Water**

Originator: West

Issue Description:

Replacing potable water with reclaimed water has reduced the water supply income, resulting in a raise in the rates of drinking water.

As for the cost of potable water increasing when reclaim water is used, the short answer is that this may be the apparent effect (i.e., increase costs for potable water); in fact, our revenues last year were down $6 million. However, when considering the decreased need for capital expansion of new works and the attendant cost, the reclaimed water becomes an economic offset as well as a potable water offset. Also, in Florida, discharge into waterways will not be allowed in the future, or that which is discharged will have to be very highly treated. Reclaimed water is a more cost effective, environmentally safe, and acceptable alternative to highly treated effluent into waterways.

Importance:

All cost benefits and added value, including cost avoidances, have to be considered for reclaimed water when compared to what may be seen as reduced revenues by not selling more potable water or requiring increased costs due to capital expansion and operation of reclaimed water works and distribution systems.

How Do You Propose Meeting or Complying with This Issue?

The water conservation benefits for irrigation process water, cooling towers, etc. are being better understood and accepted in a wide scale by water suppliers and users. These benefits are generally easily seen and understood. What is less understood is the total economic advantage that water reuse provides, particularly the cost avoidance and value added reclaimed water to the supplier.

The cost avoidance and total cost benefits need to be better determined, articulated, and agreed and then entered into the economic equation for more comprehensive and accurate representation of cost benefits of water reuse and value added reclaimed water.

Title: **Determine the Most Effective Utility Business Model to Provide Reclaimed Water as a Synergistic Commodity**

Originator: West

Issue Description:

Should the reclaimed water be part of the wastewater side of the utility, the water distribution side, or a separate utility (e.g., a semi-autonomous corporation as an enterprise fund)? Depending on the business model, capital and operations costs are realistically defined and accounted.

Importance:

Treating reclaimed water as a commodity applies market principles of supply and demand and cost benefit allocations. Ideally, reclaimed water should be self-supporting at a minimum, with no tax money required, and no reclaimed water revenues going into the general tax fund.

How Do You Propose Meeting or Complying with This Issue?

Water, wastewater, and reclaimed water must all be operated and managed as semi-autonomous enterprise funds (with no government subversions) in a synergistic relationship. The cost benefits will be optimized and better realized. (Privatization may be a possibility.)

PRIORITY 5

Satisfy Social Obligations and Improve Living Conditions by Maintaining Community Assets and Key Utilities

Originators:

Good on behalf of himself, Haddad, Kasower, Martin, and O'Brien

The following issues were consolidated under the above title:

Title: **Satisfy Social Obligations and Improve Living Conditions by Maintaining Community Assets and Key Utilities**

Originator: Good

Issue Description:

During times of drought, areas of large irrigation, such as public parks and recreational fields, are often the target of potable water restrictions because of the large volumes of water they use or are perceived to use. For example, during the summer of 2002, four public golf courses in Denver were closed due to the combined effect of watering restrictions and damage to turf through heavy use. Numerous sports fields were also closed, limiting individual and league play of both youth and adults.

Other large water users include utilities, such as power plants and oil refineries, which provide products that virtually all citizens rely upon for daily living. If water is scarce or unavailable, these key industries may be forced to limit operation or increase the price of their product, thereby negatively impacting the local/regional economy.

Importance:

The citizens of a community (i.e., taxpayers) own and benefit from city parks and recreation facilities. Although not a requirement for survival, there is a social obligation for public and private utilities to maintain these public areas, thereby improving morale and quality of life even during water shortages.

Likewise, water and wastewater utilities have a social obligation to work with key utilities and industries to ensure continuous delivery of economy-driving services and goods to consumers at reasonable cost (e.g., power and fuel).

How Do You Propose Meeting or Complying with This Issue?

- Meet with local parks/recreation leadership to determine and prioritize which public areas should be considered for conversion to reclaimed water.
- Identify and meet with key utilities and industries and determine their interest in using a more drought-resistant supply of water.

Title: **Urban Aesthetic Benefits of Water Reuse**

Originator: Haddad

***Issue Description*:**

Public urban fountains, streams, and lakes provide aesthetic values to cities. Ponds and waterfalls on private land provide aesthetic value as well. Irrigation of urban open space also provides aesthetic benefits.

Importance:

Aesthetic uses of water are not considered "essential" and are at risk during droughts or when cities outgrow their water supply. However, they are valued by urban residents and private landowners. Water reuse projects can provide a reliable source of water for urban aesthetic uses.

How Do You Propose Meeting or Complying with This Issue?

- Perform hedonic analysis of property values in aesthetically water-rich and water-poor areas of cities or between cities.
- Scale this value to a given city.
- Multiply by the reduced risk that these uses will be lost due to the presence of recycled water.

Title: **Health and Quality-of-Life Benefits of Water Reuse for Poor and Marginalized Communities**

Originator: Haddad

Issue Description:

As water scarcity grows in cities, essential uses are protected while non-essential uses are scaled back, including water for public areas. Residents of lower-income, immigrant, and otherwise-disadvantaged communities are more likely to utilize public resources, such as parks and public pools than are higher income residents.

Importance:

These recreational venues provide health and quality-of-life benefits to their users. Since urban water reuse provides additional protection for non-essential uses, it thereby provides additional protection for the health and quality of life of disadvantaged residents.

How Do You Propose Meeting or Complying with This Issue?

- Identify health and quality-of-life benefits from use of public recreation facilities and open space.
- Estimate cost of lost benefits from the closing of existing public facilities or the choice not to build additional facilities in the absence of water reuse.

Title: **Value of Self Reliance/Local Control in a Community Water Supply**

Originator: Kasower

Issue Description:

Locally controlled water supplies have unique characteristics that are not shared by large-scale regional, state, or federal imported water projects. Recognizing the economic values that water underwrites in a community, supplies imported from distant watersheds, other regions, and other states have less certainty (thus potentially less value) than locally supplied sources.

Importance:

Self reliance/local control is a unique value of reclaimed water. Without quantifying this value, recycled water is undervalued relative to imported alternatives.

How Do You Propose Meeting or Complying with This Issue?

Self reliance/local control is conceptually a function of each specific community's perspectives. At a minimum, some generalized "value" should be estimated, perhaps based on surveys and as a function of economic activity within the community.

Title: **The Value of Doing the "Right Thing" as Existing in the Community**

Originator: Kasower

Issue Description:

In most communities there is an interest in environmental quality. In particular, for communities where there is a strong "green" political consciousness, the value of a sustainable, reliable, environmentally benign water supply would be prominent. Even in communities where environmentalism is not prominent, these values may still exist. There are many examples of community "good" that is underwritten by a reuse project. Yet, these values are not illuminated in the planning process.

Importance:

Where this value exists, it should be part of the project evaluation in order to realistically cast the project in a beneficial light. Such an approach would also provide an opportunity for good public relations.

How Do You Propose Meeting or Complying with This Issue?

Careful assessment of community values and benefits of the project is the first step. Descriptions of these values must be integrated into the project evaluation.

Title: **Economic Analysis of a Water Reuse Project in the Urban Environment Needs to Consider All Types of Impaired Water**

Originator: Martin

Issue Description:

Typical water recycling projects have been analyzed on the merits of reusing municipal and industrial wastewater. Other types of impaired water (e.g., brackish groundwater, storm water runoff, agricultural wastewater, and sea water) need to be included in the evaluation of water recycling opportunities.

Importance:

Many communities, where water demand could be met with recycled water, do not have large quantities of municipal and industrial effluent. These areas may have other types of impaired water that could be reclaimed and reused. Rather than limit your project development to effluent, these other options should be considered in evaluating the merits of a municipal and industrial wastewater project.

How Do You Propose Meeting or Complying with This Issue?

When planning and evaluating water recycling opportunities, broaden the potential options under consideration and think outside of the box.

Title: **Water Reuse Can Be a Step Forward for a Community by Using the Full Values of This Resource**

Originator: O'Brien

Issue Description:

Recycled water is a source whose fluctuations are dampened compared to other alternative sources of supply (i.e., its inclusion in a water supply portfolio reduces volatility).

Importance:

This issue is important because it addresses the cost objections to investing in recycled water and makes the issue of supply reliability concrete.

How Do You Propose Meeting or Complying with This Issue?

The economic value associated with the reduction of volatility should be captured and credited against costs using the theories and guidelines established for investment portfolio analysis.

PRIORITY 6

Water Reuse Needs to Look Beyond the Normal Planning Horizon to Long-Term Sustainability

Originators:

Grinnell on behalf of himself, Castor, and Sheikh

The following issues were consolidated under the above title:

Title: **Water Reuse Needs to Look Beyond the Normal Planning Horizon to Long-Term Sustainability**

Originator: Grinnell

Issue Description:

Recent experience may have generated a history of poor performance of the costs of recycled projects (i.e., stops new projects). By expanding the timeframe for benefits (i.e., maybe to life cycle style analysis), we establish a permanent value of the water reuse.

Importance:

A short-term focus can stop a project but long-term sustainability is necessary for a community's future (e.g., Arizona's 100-year water source for developers).

How Do You Propose Meeting or Complying with This Issue?

Groundwater resources in the state of Nevada for southern Nevada can provide a new source of water that, if not totally consumed, would result as a resource loss, (i.e., would not be eligible for return flow credits). Recycling the domestic consumption portion to achieve 100 percent usage will guarantee the use of all of the water brought into the Valley for a sustainable future.

Title: **Quantify the Demand Value from Delay in Developing New Water Sources**

Originator: Castor

Issue Description:

Water reuse can be used to defer developing new water sources to meet developing potable demands. Often, new water sources (e.g., groundwater and surface water) are limited, non-existent, or capital-intensive (e.g., desalination). Water reuse can be used as an alternate source to meet needs with the *lowest* quality water. Water reuse then replaces (i.e., provides an offset of a given quantity of potable quality water) potable quality water supplies allowing drinking water and related demands to be mitigated, if not fully met. Additionally, water reuse can augment surface water flows to maintain minimum flows and levels while allowing for increased wet season potable-quality withdrawals.

Importance:

New water supplies for drinking water demands are becoming scarcer each day and have a finite limit. Alternate supplies, such as desalination, are capital-intensive projects; and aquifer storage and recovery for potable-quality water have limited areas for application.

How Do You Propose Meeting or Complying with This Issue?

This issue can be met by:

- Require through state or local laws or ordinances that all water utility customers use water of the *lowest* quality sufficient to meet the demand.
- Standardize quantification of the volume of offsets for areas of water reuse.
- Use reclaimed water for downstream augmentation so that similar volumes can be withdrawn for storage and treatment.

Title: **Use of Standard Discount Rates to Calculate the Present Worth of a Project's Undervalued Investments That Provide Sustainable Water Resource Benefits**

Originator: Sheikh

Issue Description:

Just as the spatial framework for evaluating reuse projects must be expanded to include the entire watershed, the temporal framework for valuing water must be enlarged to include future generations. However, unlike the current manner of discounting the value of benefits to future generations according to the time value of money, a countervailing credit should be accounted recognizing the fundamental value of sustainable supplies as compared with more limited alternatives.

By the same token, there are no penalties in the market for wasting under-priced water, or for building projects with a limited span of service.

Importance:

At a standard discount rate of only 6 percent, a project that provides $1 million in benefits 40 years from now would not merit investment of $100,000 today. This routinely prejudices us against investing in projects whose major benefits are to stabilize resource use, leaving an adequate base to sustain the choices of future generations.

How Do You Propose Meeting or Complying with This Issue?

There are a number of current economic theories addressing this problem that could be practically applied to our industry. Such application would help both the development of economic theory itself, and would address our own problem of resource valuation.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AND IMPROVE LIVING
CONDITIONS BY MAINTAIN
COMMUNITY ASSETS AND
KEY UTILITIES
J. CROMWELL

PRIORITY 7

Develop a User-Friendly Benefit-Cost Spreadsheet Model

Originators:

Mosher on behalf of himself, Carruthers, Castor, Cromwell, Henderson, and O'Brien

The following issues were consolidated under the above title:

Title: **Develop a User-Friendly Benefit-Cost Spreadsheet Model**

Originator: Mosher

Issue Description:

Once an economic framework has been developed and accounts for the benefits and costs of water reuse projects, the results have to be translated into a form that enables water/wastewater utilities to use the approach to evaluate reuse projects and to communicate the results to the public. The tool needs to be user friendly; include modeling and results that are transparent, defensible, and understandable; and contain appropriate guidance.

Importance:

Simple and easy-to-use tools are required to meet the needs of water/wastewater agencies to appropriately evaluate water reuse projects and the alternatives and for communication to the public. The goal should be to put these tools in the hands of agencies. The agencies would use the tools to screen project ideas and validate the perceived benefits at an early stage of the project.

How Do You Propose Meeting or Complying with This Issue?

- Develop an economical framework (WRF project).
- Develop a spreadsheet tool (WRF project).
- Market and promote the tools (WateReuse Association).

Title: **Define the Baseline and New State of Being to Avoid Double Counting or Counting of Secondary Benefits**

Originator: Carruthers

Issue Description:

- Case A: If the new reclaimed water allows existing potable water to go to new homes that would otherwise have been precluded (because new water from the river is unavailable and water cannot be taken away from an existing user) then the value of the change is the gain to the potable water users. It is appropriate to charge the potable water user.
- Case B: If, on the other hand, the water that would have been taken out of the river is allowed to stay in the river, then the value is the public use values created by the river.
- You have to be careful not to add to these values.

Importance:

Double counting would be an issue for all governmental actions.

How Do You Propose Meeting or Complying with This Issue?

Carefully define the shift that occurs.

Title: **Define Preferences Regarding Scientific and Economic Data and How They Can Be Used in Economic Analysis**

Originator: Carruthers

Issue Description:

For Economic Data Only:

- Market data: Prices for water, prices of net product of water, revealed preference (e.g., hedonic travel cost for recreation), adjusting market data for market failure, market power, technological externalities, and problems for extrapolation.
- Non-market data: Survey data and public decision-making record.

Importance:

The literature sometimes presents a range of values, and one should select the measure of the central tendency carefully.

How Do You Propose Meeting or Complying with This Issue?

- Describe the literature and how the value to be used was selected.
- Use existing literature reviews.

Title: **Value of Postponing Wastewater Treatment Plant (WWTP) Upgrades to Meet New TMDL Permit Conditions**

Originator: Castor

Issue Description:

WWTPs are going to be required to meet new stricter permit conditions for normal discharge components, such as heavy metals and nutrients, if they are to continue their existing surface discharge practice. Developing water reuse systems to supply alternative irrigation supplies for

residential, multi-family, and commercial developments can significantly reduce or eliminate the need for WWTP surface discharges except under emergency conditions.

Importance:

Proposed U.S. Environmental Protection Agency (USEPA) requirements for improving the quality of WWTP discharges permitted under the NPDES program are going to become more stringent, thus requiring significant upgrades to existing treatment processes with concomitant requirements for influxes of new capital funding to achieve the upgrades. By investing some or all of this required funding in the development of water reuse transmission and distribution systems, WWTP capital investment can be postponed or eliminated with the those monies going to improve and increase water reuse.

How Do You Propose Meeting or Complying with This Issue?

Several mechanisms can be employed to implement this issue:

- Local ordinances and/or impact fees requiring dual system installations in all new residential development can be enacted.
- State water improvement grant programs for county and municipal utilities can be made available for water reuse projects.
- Portions of federal water quality improvement monies (e.g., grants, state funding, etc.) can be designated for application to water reuse development programs.
- Capital funds from the county and/or municipal budgets originally estimated for TMDL compliance can be used for water reuse.

Title: **Framework Needs Rules and Communication Methods on Inflation and Discounting**

Originator: Cromwell

Issue Description:

Often the finance manager from a utility that you are trying to interest in joining a regional collaboration will turn off instantly at the sight of an analysis that does not use their favorite assumptions on inflation and the market cost of new capital. Unfortunately, inflation has no

place in benefit cost analysis, and we also need to choose a discount rate to apply in the analysis that is unlikely to match the market cost of capital.

Importance:

These assumptions have a big effect on the numerical comparisons that result from benefit cost analysis. But if finance managers (or board members or other stakeholders) perceive that benefit cost analysis has drifted far away from the true "business case," then benefit cost analysis may be quickly shelved and forgotten.

How Do You Propose Meeting or Complying with This Issue?

There is some flex in the economics handbook. Analyses can be run at different discount rates, for example, although this begins to look equivocal. Otherwise, we just need to agree on certain rules and identify ways of talking about it effectively. A group of people who recognize these symptoms and have had such discussions with finance people should sit down with economists to list the key talking points for this issue.

Title: **Make the Framework and Tool Informative (with Regard to Technical Concepts) and User Friendly**

Originator: Henderson

Issue Description:

Values for some water uses are difficult to quantify, partially because there are not markets available to observe prices for uses. For instance, there are usually not directly observable markets for the value of whitewater rafting. The preferred method for valuing such uses is the surveying of the willingness to pay for users to have access to the resource. However, these surveys and studies are often relatively expensive to conduct. Instead, a method of estimating values known as benefits transfer is commonly used. With this method, values derived for a benefit in one location and time are applied with care to different instances of the same value. There are several rules to guide appropriate application of benefits transfer. These methods, and rules guiding their application, should be explained and embedded as an explanation in the economic framework.

Importance:

Credible application of resource economics techniques is critical to building confidence in the framework and acceptance.

How Do You Propose Meeting or Complying with This Issue?

Explicitly and extensively document in the framework, and tool the types of valuation techniques available and the characteristics of those techniques. Guidance should be given for which tools should be used in which situations.

Title: **The Framework Should Facilitate the Stakeholder Process by Aiding in the Identification and Prioritization of Applicable Values**

Originator: O'Brien

Issue Description:

Value does not necessarily have to be expressed in an absolute sense. Focus should be on identifying and prioritizing the values based on selective weighting, as well as on the trade-offs that stakeholders are willing to make.

Importance:

- People value benefits differently, and the qualitative component will be difficult to get away from.
- How are decisions made? Decisions are emotional and based on gut reactions; they are not always based on facts and economics.
- This task is required in order to get project support.

How Do You Propose Meeting or Complying with This Issue?

Introducing the framework to the stakeholders and allowing them to customize it for a particular application will be a useful tool throughout the prioritization process.

PRIORITY 8

Provide Information on Variability and Uncertainty Involved in Benefit or Cost Estimates

Originators:

Henderson on behalf of himself, Carruthers, Cromwell, and Grinnell

The following issues were consolidated under the above title:

Title: **Provide Information on Variability and Uncertainty Involved in Benefit or Cost Estimates**

Originator: Henderson

Issue Description:

Estimates of benefits or costs are frequently presented as one value, often an average value. However, benefits or cost estimates will be uncertain or imprecise to varying degrees. This results from both uncertainty and variability. Estimates could be uncertain because the exact state of the world is unknown to the analyst. Is the value of improved delivery reliability to a customer $25 per acre-foot, or is it $100 per acre-foot? Some values are imprecise because they are changing with time or other factors, and this variability is a natural characteristic. For example, water use can vary by day or by season.

Importance:

The recognition of variability or uncertainty conveys the confidence the analyst has in the estimate and gives information on the full range of value that the true value could be in reality. The impact of a value on overall net benefits can be explored using sensitivity analysis, where values for one variable in the analysis are systematically increased or decreased in steps to observe the impact on the total net benefits of the project. Confidence is built by using the full range of values in the analysis.

How Do You Propose Meeting or Complying with This Issue?

Provide a range of values for an estimate, not just the average. If confidence intervals have been estimated, retain the information on what percent confidence interval was estimated (e.g., 95 percent confidence interval).

Title: **Account for Non-quantifiable Benefits and Costs Qualitatively**

Originator: Henderson

Issue Description:

Simplistic benefit-cost analyses only account for those benefits and costs that can be quantified. However, there are benefits and costs that are often not quantifiable due to the technical difficulty of estimating value, or cost and time involved in obtaining information. Estimating the value of local control over water resources or public relations value of pursuing water recycling is very difficult. However, just because these values cannot be readily quantified does not mean they are not important. Benefits and costs that cannot be quantified should nonetheless be recognized and carried forward in the economic framework.

Importance:

For analyses from the societal perspective, inclusion of the non-quantifiable benefits and costs in a qualitative way ensures that those values are not overlooked and can indicate whether the final estimate from the analysis could be considered an over- or under-estimate. Explicit handling of all values helps build confidence in the thoroughness of the analysis with stakeholders.

How Do You Propose Meeting or Complying with This Issue?

In the framework and spreadsheet tool, explicitly account for non-quantifiable values by describing the benefit or cost and indicating the possible impact on net benefits (e.g., positive, strongly positive, negative, strongly negative, or uncertain). Benefits or costs that are so small as to be insignificant, or that have been mitigated, can still be noted in the accounting as such, thereby providing a record that the benefit or cost category was considered.

Title: **Need for Concrete Values**

Originator: Carruthers

Issue Description:

We lack data for some uses:

- Water as a product – sometimes these values are easier to get but some are harder:
  - *easier*: water purchased for use
  - *harder*: water used aesthetically without payment

- Water as an input to production – values are more removed:
  - derived demand depends on the value of the change created by the water
  - private sector use, based on market values, is easier (e.g., agricultural budgets and net value)
  - public sector use is harder

Importance:

If you have some values and not others, there is the potential for a lack of balance.

How Do You Propose Meeting or Complying with This Issue?

We are doing the following but need suggestions and better data:

- Literature reviews.

- Linking with scientists.

- Probabilistic models.

Title: **On the One Hand, On the Other Hand – the Need for Sensitivity Analysis**

Originator: Cromwell

Issue Description:

There are loads of assumptions that go into a benefit cost analysis. Many of them are well grounded (e.g., some cost estimates), but many must be evaluated across a plausible range of values.

The one-handed economist approach of just picking a number somewhere in the middle may cause some stakeholders to regard the analysis as tilted toward a desired answer.

Yet, too much of the "on the one hand, on the other hand stuff" really gets on the nerves of people and leaves a sense that benefit cost analysis is pretty silly.

Importance:

Sensitivity analysis is critical to the proper use of benefit cost analysis. So, how do you engage stakeholders in understanding what are probably very important areas of uncertainty and engaged in helping to work on those critical uncertainties? That is what the need for sensitivity analysis is really telling you about an assumption – it is a priority for a deeper, shared understanding among stakeholders.

How Do You Propose Meeting or Complying with This Issue?

A group of folks with front-line experience should sit down and brainstorm the ways in which stakeholders can be reached on this issue and the ways in which our toolkit can help:

- Establish focus groups to test assumptions against perceptions.
- Use the spreadsheet tool for sensitivity analysis and "breakeven analysis."
- Use sensitivity analysis to identify research priorities that can help move a project along (i.e., a value of information application – how much does it mean to us to get better data on "x"?).

Title: **Responding to the Issue When the Imbalance of Demand Is Greater Than Supply**

Originator: Grinnell

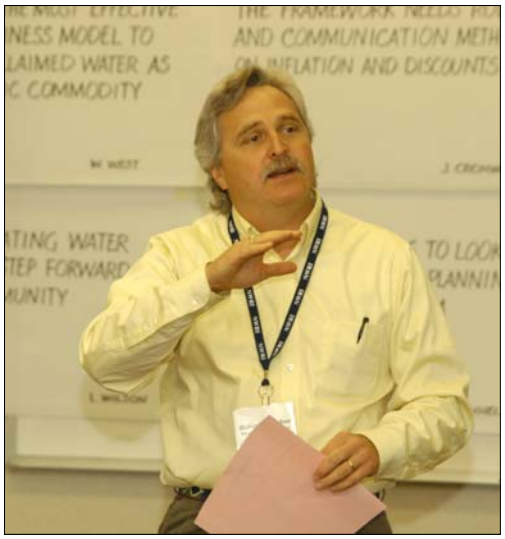
Issue Description:

Drought creates critical decisions to be transferred from a future planning mode to the present. Define the value of recycled water with a priority as to where it fits in the drought priority list.

Importance:
This is when push comes to shove – high stakes for all involved, elected and appointed. Very emotional.

How Do You Propose Meeting or Complying with This Issue?

- Hire NWRI to solve the problem with Stratus.
- Need local consensus groups with agency and citizen groups represented.


NESS MODEL TO
AIMED WATER AS
C COMMODITY
AND COMMUNICATION METH
ON INFLATION AND DISCOUNTS
TING WATER
TEP FORWARD
UNITY


Mark Tettemer


Richard

PRIORITY 9

Case Studies to Quantify the Benefits of Water Reuse Projects

Originators:

Mosher on behalf of himself, Castor, Raucher, and Tettemer

The following issues were consolidated under the above title:

Title: **Case Studies to Quantify the Benefits of Water Reuse Projects**

Originator: Mosher

Issue Description:

Conduct a retrospective analysis of the benefits of water reuse projects to develop "lessons learned" and to plan for future projects. Identify, quantify, and value the full range of benefits.

Importance:

This effort could provide a better understanding of reuse project planning. Since the work would be based on case studies, the results would be more defensible, less theoretical, and possibly more accurate.

How Do You Propose Meeting or Complying with This Issue?

- Identify a list of projects representing all reuse applications.
- Develop case studies and identify the full complement of benefits.
- Develop how the results could be translated into planning tools to more accurately evaluate the costs and benefits of reuse projects.

Title: **Quantify the Added Value to Property with Water Reuse Availability**

Originator: Castor

Issue Description:

Water reuse is a valued resource; however, the value to a developer or homeowner has not been defined. The fact that a value for water reuse exists is validated by the current demand for reclaimed water for irrigation in mid- to up-scale residential developments. Homeowners and developers need to have a basis for offering reclaimed water system access in their property offerings.

Importance:

A quantified value for access to water reuse systems can increase local tax bases thereby increasing available funds for utility capital projects. This has been demonstrated by the reluctance of some local utilities in Florida to meter and charge conservation rates for reclaimed water service based on previous (ca. 1990) agreements to allow *unlimited* use and no metering of reclaimed water use coupled with property tax reductions. A quantified value can be an inducement for developers to install dual systems during the initial development phase of new subdivisions.

How Do You Propose Meeting or Complying with This Issue?

The value can be obtained from the tax incentives used initially in the 1990s to promote reclaimed water use coupled with the calculated saving derived from using reclaimed water versus potable water amortized over the life the mortgage (15 or 30 years).

Title: **Conduct an In-Depth, Illustrative Case Study Application of a Stakeholder-Compatible Benefit-Cost Analysis of a Reuse Project**

Originator: Raucher

Issue Description:

- Work with a real water reuse project being planned and develop a comprehensive benefit-cost analysis in concert with water agency staff, associated stakeholders, and governing officials.

- Identify and suitably label and describe all relevant benefits and costs.

- Quantify and monetize to extent feasible.

- Portray, document and communicate results via useful templates and reports.

Importance:

While it is easy to discuss the economic framework in the abstract, it may be more valuable to the reuse community to have a high-quality demonstration of the economic framework developed as a case study. This could serve as a:

- Learning process to fine tune the economic framework.

- Benchmark for how a suitable benefit-cost analysis can and should be done by reuse agencies.

- Tool to help future practitioners envision what and how they need to accomplish in terms of benefit-cost analysis.

How Do You Propose Meeting or Complying with This Issue?

- Find a reuse project in the initial stages of conception.

- Get water agency buy-in to be a partner in the study.

- Get supplemental funding and technical review/oversight from research-supporting entities (e.g., WRF, NWRI, U.S. Department of the Interior, Bureau of Reclamation [USBR]).

- Conduct and help communicate benefit-cost analysis to agency, stakeholders and governing officials.

- Do a case study of a completed reuse project to document benefits and costs realized by an active reuse program.

Title: **The Value of Recycled Water for Business Retention, Attraction, or Expansion**

Originator: Tettemer

Issue Description:

Some businesses (e.g., dye houses) operate on a very slim margin and are vulnerable to going out of business or relocating. Some businesses will consider the availability of recycled water in locating its business and will base their decision on reliability and/or lower costs of supply.

Importance:

Businesses provide jobs and needed tax revenues to fund local projects and services. The retention, attraction, and expansion of businesses are very important to the economy.

How Do You Propose Meeting or Complying with This Issue?

Work with Chambers of Commerce or other entities to assess the local, regional, statewide, and federal benefits.

PRIORITY 10

Economic Impact of Hesitant Regulatory Attitudes toward Water Recycling

Originators:

Sheikh on behalf of himself, Riley, and Tettemer

The following issues were consolidated under the above title:

Title: **Economic Impact of Hesitant Regulatory Attitudes toward Water Recycling**

Originator: Sheikh

Issue Description:

Regulators tend to err on the side in conservatism in establishing ground rules for utilization of recycled water. "Belts and suspenders", "multiple-barrier treatment requirements", cross-connection shut-down testing requirements, signage that scares the public and causes resistance and outright opposition – these are examples of ways in which regulators increase the cost of water recycling without adding significantly to the safety and benefits of water reuse.

A realistic and economically sound regulatory framework is needed to:

- Ensure science-based restrictions as opposed to ultra-conservatism, based on over-protectiveness.
- Require safe reuse practices.
- Reduce costs of compliance.
- Maintain and increase public confidence in safety of water recycling.

Importance:

It is important because its recognition and compliance can narrow the gap currently perceived to exist between the monetized benefits and costs of water recycling projects. This issue is far more important than is currently recognized by the regulatory community.

How Do You Propose Meeting or Complying With This?

The regulatory agencies (in California, the Department of Health Services, the State Water Resources Control Board, and the nine Regional Water Quality Control Boards) should work more closely with the water reuse industry to streamline regulations and to step back from any unnecessary and overly protective and restrictive provisions in existing requirements and permit conditions.

A comparison of Florida and California regulatory attitudes, by me and co-authors, was presented at a recent conference: "Impact of Institutional Requirements on Implementation of Water Recycling/Reclamation Projects", presented at the 2004 Water Sources Conference in Austin, Texas, January 11-14, 2004.

Title: **Define the "Ownership" of the Reclaimed Water**

Originator: Riley

Issue Description:

The determination of who owns and controls the raw resource (sewage) and the final product (reclaimed water) defines responsibility for investment and who reaps benefits.

Importance:

The value or benefit of the raw resource or a final product is in question if the ownership or control is in question. One does not invest in someone else's valuables and cannot sell someone else's assets. This issue represents an essential attribute of the product. Appropriative water law states, which recognize beneficial uses of water, base legislative fixes on other states' legislative and legal decisions. What one does affects another.

How Do You Propose Meeting or Complying with This Issue?

Resolution will require state-by-state legislative changes based on a common resource goal, which requires national and regionally accepted goals.

Title: **Reduce or Eliminate Challenges to the California Environmental Quality Act (CEQA) Process**

Originator: Tettemer

Issue Description:

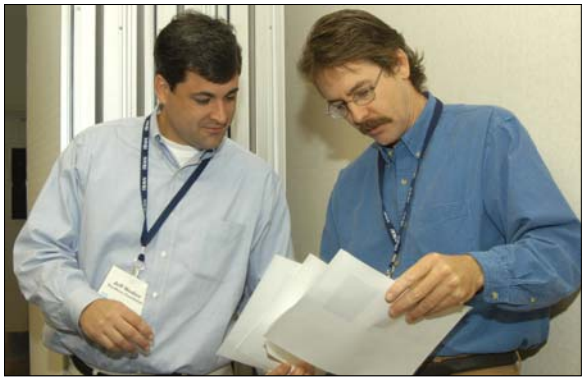
The CEQA process discloses a project's impacts to resources, including water. In some instances, opponents to a project may cite the use of potable water to challenge the project, thereby causing project delays and increased project costs. The State's requirement that recycled water be used also has regulatory agencies urging its use.

Importance:

Embracing recycled water as a viable alternative to potable water for non-potable application may reduce or eliminate challenges; may garner support from environmental groups; and may aid in compliance with State requirements for its use.

How Do You Propose Meeting or Complying with This Issue?

- Strongly encourage the use of recycled water to increase support, reduce, or eliminate opposition.
- Try to value the avoided costs to reduce or eliminate project opposition.



STRENGTH OF FEELING ANALYSIS

The Strength of Feeling Analysis is a method that gives quantitative sense of the degree of agreement, or disagreement, among the participants regarding the importance of each identified issues.

Table 1 is organized according to the priority ranking by all 20 participants of all 10 major issues on which they voted. Also shown are the rankings and relative levels of agreement among the three categories of participants: economists, utilities, and others.

TABLE 1: STRENGTH OF FEELING

Rank	Title	Overall (20)*	Economists (6)*	Utilities (9)*	Others (5)*
1.	Baseline Scenario Should Forecast the Default Status Quo Scenario	79.0%	78.3%	77.8%	82.0%
2.	Do Stakeholder Perceptions Play a Role in Conducting and/or Reviewing Economic Analyses of Water Reuse Projects?	73.5%	66.7%	78.9%	72.0%
3.	Sound Business Decisions Require That Risk Factors and Uncertainties Be Explicitly Incorporated in the Economic Framework of Any Project	68.0%	71.7%	67.8%	64.0%
4.	The Default Approach in the Benefit Cost Framework Should Be Based on Rational Cost Allocation among Beneficiaries	56.5%	60.0%	44.4%	74.0%
5.	Satisfy Social Obligations and Improve Living Conditions by Maintaining Community Assets and Key Utilities	53.5%	53.3%	65.6%	32.0%
6.	Water Reuse Needs to Look Beyond the Normal Planning Horizon to Long-Term Sustainability	51.0%	55.0%	52.2%	44.0%
7.	Develop a User-Friendly Benefit-Cost Spreadsheet Model	50.0%	45.0%	43.3%	68.0%
8.	Provide Information on Variability and Uncertainty Involved in Benefit or Cost Estimates	43.0%	55.0%	36.7%	40.0%
9.	Case Studies to Quantify the Benefits of Water Reuse Projects	43.0%	41.7%	50.0%	32.0%
10.	Economic Impact of Hesitant Regulatory Attitudes toward Water Recycling	32.5%	23.3%	33.3%	42.0%

*Number of participants in each category

APPENDICES

A P P E N D I X A

ACRONYMS

AWWA	American Water Works Association
CEQA	California Environmental Quality Act
GIS	Global Imaging System
JPA	joint powers agreement
LVVWD	Las Vegas Valley Water District
NPDES	National Pollution Discharge Elimination System
NWRI	National Water Research Institute
OPPS	Office of Program and Policy Services
RO	reverse osmosis
SWFWMD	Southwest Florida Water Management District
TDS	total dissolved solids
TMDL	total maximum daily load
USBR	U.S. Department of the Interior, Bureau of Reclamation
USEPA	U.S. Environmental Protection Agency
WRF	WateReuse Foundation
WWTP	wastewater treatment plant

APPENDIX B

WORKING GROUPS' VISUAL PRESENTATIONS

Working Group 1

PRIORITY 1:
The Value of A Diverse Portfolio and Regional Approach to Project Formulation Should Be the Principal Consideration in Evaluating Costs and Benefits of Water Reuse Projects

John Cromwell, Richard Martin, Jerry King

Rationale

- The days of planning and constructing single-purpose water projects are over. No longer do local communities situated in highly urban environments have the luxury of planning in a vacuum without regard to the looming "tragedy of the commons."
- Moreover, significant net benefits can be realized from planning in partnership with neighboring communities.

Rationale

- Project optimization is critical and this can best be approached in a regional context. Water reuse projects must be included as a strategic component of the regional portfolio in order to maximize the benefits of reuse projects – and of water supply planning, generally!
- The larger the system boundary, the greater the number of opportunities to optimize project benefits in terms of cost-effectiveness, reliability and environmental and water supply sustainability.

Rationale

- The benefits of reuse projects typically "spillover" jurisdictional boundaries and accrue to everyone in a region, making clear the basis for "win-win" cost sharing arrangements as the best means of defeating ***fragmentation***.
- In addition, projects that deliver "win-win" benefits to multiple jurisdictions are more likely to generate support, including funding from outside sources.

Approach

Why a portfolio approach?

- Diversification of investment portfolios has been shown to enhance and protect return on investment. The approach reduces risks by averaging across a collection of different risk characteristics. Managing a community's water supply options follows the same principles.

Approach

Why a portfolio approach?

- In the classic least-cost planning process, water managers focused on building the cheapest alternatives first and looked only within their jurisdictional boundaries.
- By instead broadening the choices and respecting the fact that it is better to have projects with varying characteristics, there is less risk and more benefit in the overall water supply portfolio.
- This benefit "spills-over" to everyone in the region.

Approach

Regional approaches can be more cost-effective.

Conceived at a regional level, projects can be developed at larger scale with reduced unit costs to be shared by all participants.

In addition, there are trading opportunities involving potential "win-win" relationships that may exist between watershed partners. For example, ownership of water rights may suggest trading strategies that complement the mix of possible projects that exist in one jurisdiction versus another.

One jurisdiction may be in better position to develop a reuse project that produces offsets resulting in greater flexibility and/or environmental benefits elsewhere in the region.

Approach

Regional Approaches Can Enhance Supply Reliability

Having the larger portfolio of projects with varying performance characteristics during drought scenarios coupled with flexible transmission options for drought emergencies can result in benefits from greater supply reliability.

This could provide the justification for a high-cost reuse project as a strategic part of a regional drought management plan that might not otherwise be a first choice for a single agency.

Although all reuse projects inherently enhance supply reliability due to drought resistance, the benefits are greater if shared at a regional level and the costs can be shared by all who benefit.

Approach

Regional Approaches Are More Environmentally Sustainable

Because there are more water supply options to choose from at the regional level, reliance on the options that have the most deleterious environmental effects can be minimized.

This includes seasonal or drought operating adaptations to minimize environmental pressures through such means as sustaining critical in-stream flow levels to preserve key habitats.

Groundwater replenishment can also be promoted and excessive drawdowns avoided by operating the regional system as a system.

Potential Conflicts

Regional Collaboration is Intended to Reduce Conflicts

Once collaborating jurisdictions can see that there is "win-win" potential in collaboration, the prospects for conflict resolution are greatly enhanced.

In addition, environmental concerns are addressed in two ways. First, supply optimization demonstrates a good faith effort to develop a mix of resources in the most sustainable way. Second, the environmental issues, such as in-stream flows, are introduced into the projects at the inception and carried all the way through.

Potential Conflicts

Consideration of Benefits and Costs May Lead the Way to Regional Collaboration

In order to build the support needed to mobilize multiple jurisdictions to adopt formal collaboration mechanisms such as Joint Powers Authorities, it is extremely helpful to be able to demonstrate the "win-win" rationale in terms of benefits and costs.

"Win-win" is the antidote to ***fragmentation***. This foundation in the benefits case may also help to obtain outside funding and build political support.

Working Group 2

ACCOUNTING FOR STAKEHOLDER PERCEPTIONS IN CONDUCTING AND REVIEWING ECONOMIC ANALYSES OF WATER REUSE PROJECTS

Group #2

Jeff Mosher
Bob Raucher
Steve Rossi

In a Nutshell…

- ***Rationale:***
- People with varying backgrounds, belief systems, and interests value water reuse in different ways. Stakeholder perceptions of benefits may be the deciding factor in the success of water reuse projects. It is critical that the process of informing stakeholders and the public involves a discussion of benefits.
- Engaging stakeholders in the discussion of benefits may help to reach a consensus on the range of benefits in qualitative and quantitative terms. Utilities need to communicate the benefits that matter most to stakeholders and other key audiences. Utilities also need to focus on the most important benefits to ensure broad application and support.

- ***Approach***
- Creating advocates among stakeholders can be addressed through a multi-faceted approach including:
- Demonstrating that reclaimed water is a resource and not a waste product to be disposed of;
  - Illustrate the value of this source in maintaining and enhancing the community's quality of life
- Using terminology that better communicates the value of the water
  - Avoid terminology that distinguishes "reclaimed water" as something inferior to "water"
  - Develop terminology that better communicates the various qualities of water based on suitability of use rather than origin. This terminology must be inherently defined and understood by the public and leaders. The terminology should apply to ALL water sources and at all stages.
- Emphasizing aesthetic features such as public urban fountains, streams and lakes as highly visible and valuable applications of water reuse
  - Qualitatively assess and communicate the role of water-based aesthetic amenities in maintaining or enhancing civic pride, personal enjoyment and property values

- Clearly conveying the message to stakeholders that the current situation is being improved through water reuse rather than being degraded:
  - Identify the added value qualitatively and/or quantitatively;
- Recognizing the importance of partnering with commercial/industrial/institutional entities:
  - Identify current or proposed large-scale operations such as zoos, parks and industries, and engage them in building a larger base of advocacy
- Acknowledging the public's negative perceptions, and providing factual and balanced feedback
- Identifying individuals or organizations trusted by the public who can be enlisted to provide testimonials for the project
  - Cultivate relationships early on in a process
- Emphasizing the benefits of local control of reclaimed water as a value in seeking stakeholder support
- Refer to the 25 best practices identified in the WRF's report "Understanding Public Concerns of Indirect Potable Reuse"
- Work with the community to define the problem (and define the right "without project" baseline), as well as to develop solution options.

- **Potential Conflicts**
- Potential conflicts can occur due to perceptions that cannot always be addressed through these processes. The conflicts can develop in the form of:
- Recalcitrant and influential opponents;
- Not doing enough, or not taking early action to involve stakeholders;
- Attempting to defend a chosen project or initiative that may not be appropriate at this time or at all.

Rationale

- Stakeholder perceptions of benefits may be the deciding factor in the success (or failure) of water reuse projects
- Critical Point: Utilities need to communicate the benefits that matter most to stakeholders and other key audiences
- Engaging stakeholders in the discussion of benefits may help to reach a consensus on the range of benefits in qualitative and quantitative terms

Approach

Create advocates among stakeholders through:

- Demonstrating that reclaimed water is a resource and not a waste product to be disposed of
  - Illustrate the value of this source in maintaining and enhancing the community's quality of life (home yards, gardens, public green spaces, "water independence")

Approach

- Using terminology that better communicates the value of the water:
  - Avoid terminology that distinguishes "reclaimed water" as something inferior to "water"
  - Develop terminology that better communicates the various qualities of water based on suitability of use rather than origin. This terminology must be inherently defined and understood by the public and leaders. The terminology should apply to ALL water sources and at all stages

Approach

- Emphasizing aesthetic features such as public urban fountains, streams and lakes as highly visible and valuable applications of water reuse:
  - Qualitatively assess and communicate the role of water-based aesthetic amenities in maintaining or enhancing civic pride, personal enjoyment, and property values

Approach

- Clearly conveying the message to stakeholders that the current situation is being improved through water reuse rather than being degraded:
  - Identify the added value qualitatively and/or quantitatively

Approach

- Recognizing the importance of partnering with commercial/industrial/institutional entities:
  - Identify current or potential large-scale customers such as zoos, parks and industries, and engage them in building a larger base of advocacy

Approach

- Acknowledging the public's negative perceptions, and providing factual and balanced feedback

Approach

- Identifying individuals or organizations trusted by the public who can be enlisted to provide testimonials for the project:
  - Cultivate relationships and share information early on in a process

Approach

- Emphasizing the benefits of "local control" of reclaimed water as a value in seeking stakeholder support

Approach

- Work with the community to define the problem (and define the right "without project" baseline), and to develop solution options

Approach

- Refer to the 25 best practices identified in WRF's report "Understanding Public Concerns of Indirect Potable Reuse" for guidance on working with stakeholders

Potential Conflicts

- Recalcitrant and influential opponents
- Not doing enough, or not taking early action to involve stakeholders
- Attempting to defend a chosen project or initiative that may not be appropriate at this time (or at all)
- Working with the media and local politicians

"T_2C"


Preparing for
the Challenge.....

Working Group 3

Dealing with Risk, Reliability and Uncertain Values When Analyzing Water Reuse Projects

Priority Issue Working Group 3

Jim Henderson, Larry Wilson and Wayne West

Rationale

- Benefit and cost values are often imprecise, but are often represented using a single value. Picking one number could cause policy stakeholders to believe the analysis is tilted towards a desired outcome.
- Water reuse projects provide benefits to system reliability that are often not fully recognized.

Rationale (continued)

- The range of possible outcomes needs to be understood before major investments are made. This includes demands, capital costs, operating costs, technical performance, and secondary impacts.
- Even though risk and uncertainties exist, they should not stop the evaluation or implementation of projects.

Approach – Risk and Reliability

- **Recognize value of reliability**
- **Fully value the higher risk**.
- **Incorporate risk factors**.
- **Recognize climate change.**
- **Include adequate storage**
- **Recognize drought impact**

Approach - Uncertainty

- **Identify and anticipate impacts**
- **Use full range value.**
- **Use sensitivity analysis.**

Potential Conflicts

- **Regulatory issues.**
- **Desirable levels of risk or reliability**.
- **Climate change**

Working Group 4

Fees Should be a Function of the worth of the water to the user

Team Members
Cathy Carruthers
Maria Mariscal
Craig Riley

Rationale

The Rationale for this Statement is Based on the Premise that this will allocate Recycled Water to its Highest and Best Uses.

Approach

- Direct & indirect beneficiaries
- Beneficiaries require a standardized approach to assure consideration of fee components
  - Define Components of Reclaimed Water
  - Components define the willingness of end use to pay for recycled water
  - Helps to define treatment system that optimizes capital investment & reduce overall costs
  - Acknowledge major capital costs to end use who switch to recycled water who need financial assistance with infrastructure

Product Components

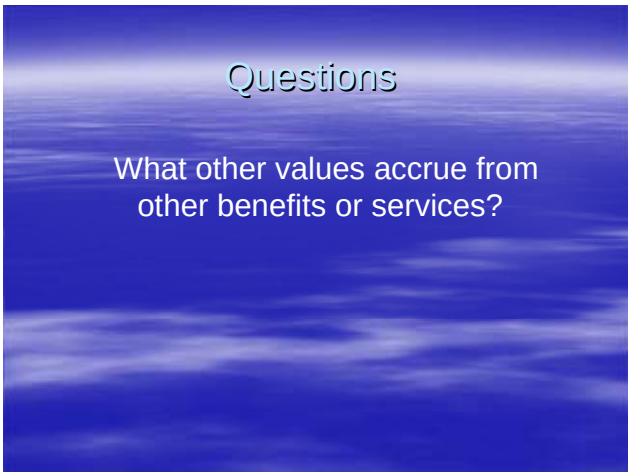
- Water quality
- Timing of delivery
- Reliability
- Public health needs
- Aesthetic needs

Indirect Beneficiaries & Benefits

- Others who gain from the new system can be asked to bear these early capital costs in proportion to their gain. For example potable water buyers may be able to postpone buying new water sources if recycled water frees up some existing water supply to allow growth. These avoided costs to potable water buyers may include
  - the cost of acquiring a new source of water
  - replacement pipe downsizing
  - providing treatment for the water
  - providing mitigation for water taken out of a surface water source
  - drilling deeper wells
  - reduced more costly potable storage requirements
  - avoiding salt water intrusion
- Some may gain from an improved environment in that nutrients from secondary treated water will not be delivered to surface waters.

Potential Conflicts & Resolution

- A potential conflict regarding the cost-sharing approach may include an initial unwillingness of rate payers who do not directly receive recycled water to help subsidize the costs of producing recycled water for those who do.
- Resolution to this dilemma may include educating non-recycled water users on the importance of supporting recycled water use as it relates to their water rate fees by avoiding additional costs they may incur with obtaining the next increment of water.


Questions
What other values accrue from other benefits or services?

Working Group 5

Priority #5 Prospectus

Satisfy Social Obligations and Improve Living Conditions by Maintaining Community Assets and Supporting Community Values

Steven Kasower
James O'Brien, P.E.
Brian Good

Rationale

- Create projects/programs responsive to community sentiments
- Projects may be locally controlled
- Serve entire community, regardless of economic status (i.e. parks, recreational facilities)
- Provide a reliable source for utilities and key industries

Rationale

- Need a economic evaluation framework
- Estimate the value of:
  - Self-reliance and local control
  - Urban aesthetics
  - Health and quality of life
  - Various sources of accessible water
  - Ability to reflect community sensibilities

Approach

- Assess community sentiments, values, and desires
  - Surveys
  - Focus groups
  - Stakeholder meetings
  - Collaboration with existing organizations

Potential Conflicts

1. Translating economic theory to applied community valuation activities

   Engage the services of an intelligent, economic research firm which has a research grant

Potential Conflicts

2. Inability to understand diversity of community sentiment and properly apply economic tools

   Long-term outreach and dialog

Potential Conflicts

3. Agency culture may resist outreach

Community specific and cultural sensitivity training

Use case studies

Potential Conflicts

4. Resistance from communities to engage in dialog

Establish agency as THE trusted water experts

Potential Conflicts

5. Limited budget (or ability to market it)

Training for agency executives and decision makers

Make clear, powerful cases for innovative projects

Potential Conflicts

6. Community priorities / agency schedule out of sync

Communicate agency needs or be flexible

Clarifications?

Working Group 6

LONG TERM SUSTAINABILITY OF WATER REUSE

Strategies to promote water resource preservation for future generations

RATIONALE

Efficient application of water reuse (aka reclaimed or recycled water) can accomplish the following:

- Defer capital expenses associated with new water resource development
- Assure that water reuse is appropriately priced to assure efficient use
- Allow water supply officials to develop specific plans for the next 20 years and long range plans for the next 50 years

DEFERRING CAPITAL EXPANSION

- Use reclaimed water (RW) to replace potable quality water where appropriate
- Quantify the offset (amount of potable saved by using RW
- Standardize offsets, by customer type, across the service area
- Project time delay in future capital investments

PRICING WATER REUSE

- Assure that all costs are included in the water reuse project
- Determine the volume of potable water offset by the project
- Amortize the costs over the expected project life (usually 30 years)
- Meter and price the RW to assure efficient use
- More appropriate economic method than current discount to accurately value long-term projects

PRESERVATION THROUGH WATER REUSE

- Collect the most accurate data projections available
- Examine all relevant factors (e.g. population growth, agricultural changes, industrial development, etc.)
- Include estimates for at least a 1-10 year drought
- Plan specific for 25 and general for 50 years
- Repeat process at regular intervals.

POTENTIAL CONFLICTS

- Inertia in existing infrastructure
- Conflicting goals among stakeholders
- Not viewing water reuse as a revenue generating element
- Untrue or incorrect assertions by vocal “concerned” individuals or groups
- Inappropriate priorities usurping water reuse’s importance
- Political opposition to funding requirements

POTENTIAL CONFLICT RESOLUTIONS

- Take advantage of natural event (droughts) that require innovation
- Promote reuse and conservation and educate consumers
- Stress individual responsibility for reuse and conservation
- Establish in-depth bi-lingual public outreach programs

POTENTIAL CONFLICT RESOLUTIONS (cont'd)

- Distribute frequent media packages on water reuse subjects
- Meet negative/unfounded claims with facts & credible spokespersons
- Maintain an accurate, up-to-date risk communication program in lay person terms
- Conduct recurring workshops for all stakeholders to gain "buy-in"

A P P E N D I X C

BIOGRAPHICAL SKETCHES AND CONTACT LISTS

Catherine A. Carruthers

Cathy Carruthers has over 23 years experience as an environmental economist. Since 2002, she has worked for the Washington State Department of Ecology under Economic and Regulatory Research, conducting economic analysis for regulations, including Surface Water Quality Amendments. Prior to this position, she worked for the Washington State Department of Natural Resources, where she was responsible for the economic analyses for negotiations, legislations, and policy, and for writing guidance for the valuation of easements and rights of way. She also held positions at the University of Washington, Washington State Puget Sound Water Quality Authority, Mexico State University, and New Mexico Natural Resources Department. Carruthers received a B.A. in Economics from the University of California, Santa Barbara, and an M.A. in Economics from the University of Washington.

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Since 2001, Malcolm Castor has managed reclaimed water and water conservation projects funded by the Southwest Florida Water Management District (SWFWMD), which manages the water and water-related resources within its boundaries. Prior to joining SWFWMD, he conducted regulatory inspections and initiated regulatory actions based on Florida Petroleum Storage Tank regulations for the Florida Department of Health, served 12 years as site manager and field environmental enforcement investigator for the USEPA, and managed environmental projects as a private consultant for private-and public-sector clients. Castor received a B.S. in Chemistry from Newberry College and completed graduate studies in Environmental Management from the University of Colorado in Denver.

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John Cromwell is an environmental economist with over 30 years consulting experience. He specializes in benefit-cost analysis of national drinking water quality regulations, utility competitiveness and reliability, infrastructure rehabilitation and replacement, regional water resources planning, and risk management. He has been centrally involved in national policy issues affecting the water supply industry as an advisor to Congress, federal agencies, state regulators, and water industry associations. Some projects he worked on include analyzing the impacts of the Safe Drinking Water Act for the USEPA, developing a Water Industry Data Base for the American Water Works Association, assessing infrastructure issues in the water supply field for the National Council on Public Works Improvement, and studying the environmental impacts of water supply augmentation strategies for the U.S. Army Corps of Engineers. Cromwell received a B.S. in both Biology and Economics, as well as an M.S. in Policy Sciences from the University of Maryland.

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Gary Grinnell joined the Las Vegas Valley Water District (LVVWD) after working as a consultant for over 40 years on hydroelectric and water resource projects in the Western Hemisphere. At LVVWD, he is the recycled water representative, responsible for developing the two-satellite water resource projects to provide recycled water to 17 golf courses. Parks and schools along the pipeline routes will be supplied as the treatment capacity of the two plants mature to their 10-mgd ultimate capacities. Wastewater agencies, the City of Las Vegas, and the Clark County Water Reclamation District designed, operate, and provide the tertiary treated water to LVVWD, who then distributes the water to users. All but one of the golf courses has involved a process of converting the potable supply to recycled water after the courses were designed and constructed. Currently, Grinnell is Vice-Chair of the Water Reuse Committee of the American Water Works Association (AWWA), past Chair of the Recycled Water Committee of the CA/NV AWWA Section, and member of the Nevada Section of the WateReuse Association. He received a B.S. in Civil Engineering from Northeastern University.

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Brent Haddad is an Associate Professor of Environmental Studies at the University of California, Santa Cruz, and a consultant on water reclamation policy and water marketing. He studies urban water management, climate change and water management, and water reallocation among agricultural, environmental, and urban uses. He also serves on the Advisory Board of the University of California Center for Water Research and on the Project Advisory Committee for the WateReuse Foundation project on public perception of water reuse projects. Haddad received both an M.B.A. in Business and Public Policy and a Ph.D. in Energy and Resources (freshwater focus) from the University of California, Berkeley.

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Jim Henderson, a Senior Associate at Stratus Consulting Inc., is an economist who specializes in environmental economics, water-resource planning, river basin modeling, and water conservation analysis. He has analyzed many aspects of sustainable water-supply development and management and is experienced in analyzing the cost-effectiveness of water-supply options. He co-authored a study of the sustainability of water resource use in Tucson, Arizona, and has worked on several projects analyzing the water savings, cost-effectiveness, and patterns of participation in water conservation programs. He also managed a planning process for the recharge and recovery of surface water supplies using local aquifers in Tucson. Henderson also developed a computer model of the Colorado River basin for use in a drought-game exercise for the Severe Sustained Drought Project — an interdisciplinary analysis of the functioning of water management institutions under severe drought conditions. He received a B.A. in Economics from Colorado College and an M.S. in Natural Resource Economics from the University of Arizona.

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Steven Kasower

Steven Kasower has worked in the water and wastewater field for over 26 years. An economist, Kasower has focused on the interdisciplinary characteristics of resource issues. Presently, he serves as Desalination Planning Manager of the Water Treatment Engineering and Research Group for the U.S. Department of Interior, Bureau of Reclamation (USBR), where he is involved in planning and identifying the appropriate role for advanced treatment technologies in creating new water supplies in the West. In addition, he is responsible for bringing alternative and interdisciplinary perspectives to USBR's applied water treatment technology research. Prior to this position, Kasower worked for the California Department of Water Resources, where he was the water recycling spokesperson and manager of water recycling activities. He also worked for the USBR, Mid-Pacific Region, where he was a member of the Federal-State San Joaquin Valley Drainage Program, serving as liaison to the National Academy of Sciences Economics and Policy Sub-Committee of the Committee on Irrigation Induced Water Quality Problems. Kasower is a graduate of the University of California, Davis, where he studied Economics.

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Jerry King has over 24 years experience in areas related to water resources planning, management, and regulation, with an emphasis in urban runoff management and regulation. Currently, he serves as Vice President of Planning & Development for McGuire Environmental Consultants, Inc., which provides services to the municipal and private water utility market, especially in the areas of water quality and water treatment. Prior to this position, King served as a board member of the Regional Water Quality Control Board for over 15 years, where he provided oversight for the research, planning, and implementation of Orange County's first TMDL for the Upper Newport Bay. He also has consulted as a water specialist in drafting guidelines for stormwater prevention plans. King received a B.A. in Social Science/Economics from the University of California, Irvine, and an M.S. in Urban Regional Planning from the University of California, Los Angeles.

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Maria Mariscal is a Senior Water Resources Specialist with the San Diego County Water Authority, a regional water agency that provides about 90 percent of the water used in San Diego County. Her responsibilities include developing and funding water-recycling projects implemented by the Water Authority's member agencies. She developed the Water Authority's first regional water conservation program and has developed and implemented conservation projects, such as toilet rebate, commercial, industrial and institutional surveys, and plumbing retrofit programs. Currently, Mariscal serves as the WateReuse Liaison for the WateReuse Association, San Diego Regional Chapter, and is a member of the Public Relations Committee. She is also a member of the Executive Management Team for the Southern California Comprehensive Reclamation and Reuse Study. Mariscal received a B.A. and an M.A. in Public Administration from San Diego State University.

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Richard A. Martin

Richard Martin has worked for the Bureau of Reclamation for over 25 years. He is currently the Manager of the Title XVI Water Reclamation and Reuse Program, a $30-million per year effort involving 28 specifically authorized water recycling projects in eight states in the West, as well as more than a dozen planning studies and research projects. He also is the Office of Program and Policy Services (OPPS) lead on water resource planning and rural water development. Currently, he manages the multimillion dollar research partnership with the WateReuse Foundation and serves as the OPPS representative on the Science and Technology Steering Committee, Strategic Planning and Performance Council, Multi-State Salinity Coalition, and Water Reuse Task Force. He also serves on the Rural Water Team and helped write draft legislation to authorize Reclamation to develop a formal Rural Water Development Program. Martin received a B.A. in Geology from Southern Illinois University and an M.S. in both Geophysics and Mineral Economics from the Colorado School of Mines.

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Jeff Mosher is Director of Research Programs for the WateReuse Foundation, an educational, nonprofit public-benefit corporation that serves to increase public awareness and understanding of recycled water and to facilitate the development of technology to improve water recycling. As Director of Research Programs, Mosher is responsible for directing the Foundation's research program. He also supports several WateReuse Association initiatives. In his previous water agency association experience, he provided support on regulatory and legislative issues on a variety of water-related issues. He also worked for 10 years as an environmental consultant in the areas of water quality, regulation, and policy. Mosher received a B.S. in Chemistry from the College of William and Mary and an M.S. in Environmental Engineering from George Washington University.

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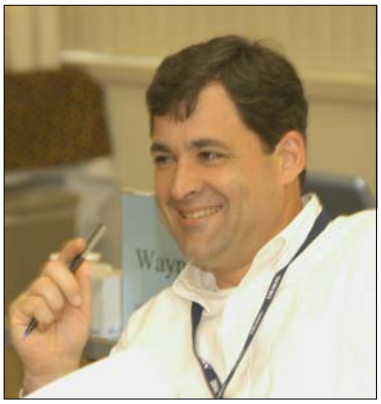

James J. O'Brien, P.E.

James O'Brien has over 12 years of experience in the planning, design, and construction management of water resources projects. He has worked in both the public and private sectors and has been with the District for over 5 years. The District is the primary water resources management agency for Santa Clara County. Currently, he is in the water use efficiency unit of the water supply management division and is focused on water recycling, specifically in the areas of master planning, public outreach, grant funding, and advanced recycled water treatment. O'Brien received a B.S. in Mechanical Engineering from the University of California at Santa Barbara and an M.S. in Water Resources Engineering, with a minor in Environmental Engineering, from San Jose State University. He is a Registered Professional Engineer in the State of California.

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Bob Raucher, Executive Vice President at Stratus Consulting Inc., specializes in environmental economics and natural resource valuation methods and has extensive experience applying economic and management tools to public water supply and wastewater utility issues and water resources management. He has considerable experience in regulatory and legislative issues affecting water utilities and water use and has recently led efforts by three national water supply associations to assess water system security and anti-terrorism needs and solutions. Currently, he is Principal Investigator on an American Water Works Association Research Foundation project investigating various decentralized and other "unconventional" approaches to water supply provision as a blueprint for understanding how water delivery and use may change through the twenty-first century. Raucher received a B.A. in Economics and Anthropology from the State University of New York, Albany and both an M.S. in Econometrics and a Ph.D. in Natural Resource Economics and Public Finance from the University of Wisconsin-Madison.

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Craig Riley has worked for the Washington State Department of Health since 1989. For the past 5 years, he has served as the Program Lead for the Water Reclamation and Reuse Program, which is part of the Division of Drinking Water at the Department of Health. Among his responsibilities, Riley reviews reclamation efforts, promotes water reclamation, provides regulatory review and approval for planning and construction documents, and provides basic management. Prior to joining the Department of Health, he was in consulting for 16 years. Riley received both a B.S. and an M.S. in Civil Engineering from Montana State University. He is a registered professional engineer in the state of Washington.

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Since 2001, Steve Rossi has been the City of Phoenix's Principal Water Resources Planner, where he is responsible for ensuring that sufficient high-quality water supplies are available to meet the needs of current and future customers of the Phoenix water system. He is also responsible for overseeing a diverse range of projects involving water rights and water policy, research, salinity management, and infrastructure planning. Rossi previously directed the State of Arizona's Assured Water Supply Program with the Arizona Department of Water Resources. There, his responsibilities included policy and regulatory development, program implementation, management of groundwater recharge and water rights programs, conservation planning, and technical assistance. Rossi received a B.A. in Geography and Regional Planning from California State University, Chico, and completed graduate studies in Water Resources Administration and the University of Arizona.

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Bahman Sheikh, Ph.D., P.E.

Bahman Sheikh is involved in research, planning, and implementing water reclamation and reuse projects. His research has focused on the treatment and agricultural use of recycled water and its impacts on public health, crops, soil properties, and farmer/public acceptance. He is an independent consultant, serving public and private clients primarily in California and in the Middle East. Recent clients include The World Bank, U.S. Agency for International Aid, Metropolitan Water District of Southern California, Marin Municipal Water District, City of San Jose, Monterey Regional Water Pollution Control Agency, Parsons, ARD, Inc., and Bechtel International. He is the author or co-author of numerous publications, including the NWRI report, *The Value of Water*. His current projects include a collaborative research program in Monterey, California, whose main objective is to evaluate filter loading rates for the production of disinfected tertiary recycled water. Sheikh received a B.Sc. in Agriculture from the American University of Beirut, Lebanon, and both an M.S. in Irrigation (Water Science and Engineering) and a Ph.D. in Soil Physics from the University of California, Davis.

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Mark Tettemer

Mark Tettemer began his career as a consultant working on a wide range of projects, including the San Joaquin Marsh. He then joined West and Central Basin Municipal Water Districts as a Recycled Water Project Manager. In this role, he developed a partnership with recycled water customers to ensure seamless transition to recycled water use. Currently, he is Manager of Customer Development, where he develops policy to support the District's goals and leads the Customer Development Staff. In addition to his professional activities, he is active in his community as a member of Kiwanis and is a Planning Commissioner for the City of Lake Forest, California. Tettemer received a Bachelors Degree in Business Administration at the University of Phoenix.

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Wayne West's professional experience in water, wastewater, and water reuse facility operation and utility management spans 35 years, including 15 years of residential experience on international projects in the Middle East, Africa, and Asia. He has worked on several development projects involving urban and regional water use, funded by the United States Agency for International Development, World Bank, The African Development Bank, and United Nations. Currently, he is the Program Manager for Pinellas County Utilities Commercial/Industrial Water Use Program, where he is responsible for developing and managing water conservation and alternative water source programs for the non-residential customers for Pinellas County Utilities. West received both a B.A. in Geography and Political Science and an MPA in Public Administration, specializing in Public Utility Management, from Edinboro University of Pennsylvania. He is a State Certified Water Treatment Plant Operator and a Certified Wastewater Treatment Plant Operator.

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Larry Wilson has been an elected member of the Board of Directors of the Santa Clara Valley Water District for over 9 years. In that capacity, he has served both as Vice Chair and Chair of the Board. In addition, he represents the District as a Director of the San Luis Delta Mendota Water Authority and also serves on the Association of California Agencies, Region 5 Board of Directors. Prior to serving on the board, Wilson worked in surface water and groundwater operation at the District, retiring after 33 years of service.

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A P P E N D I X D

PREVIOUS NGT WORKSHOPS CONDUCTED BY NWRI

Value of Water Roundtable Report. Report of a roundtable sponsored by NWRI in cooperation with American Water Works Association Research Foundation. Kellogg West Conference Center/Hotel, California State Polytechnic University, Pomona, CA, September 23-25, 2003. 160p.

CALFED-Bay Delta Drinking Water Quality. Report of a workshop sponsored by NWRI in cooperation with CALFED Bay-Delta Drinking Water Quality Program and USEPA Region IX. Kellogg West Conference Center/Hotel, California State Polytechnic University, Pomona, CA, July 29-31, 2003. 239p.

Water Reuse Planning for the State of Washington. Report of a workshop sponsored by NWRI in cooperation with Washington State Department of Ecology. DoubleTree Hotel Seattle Airport, Seattle, WA, May 30-June 1, 2003. 221p.

Seawater Desalination: Opportunities and Challenges. Report of a workshop sponsored by NWRI in cooperation with Metropolitan Water District of Southern California and Member Agencies. Kellogg West Conference Center/Hotel, California State Polytechnic University, Pomona, CA, March 28-30, 2003. 213p.

Decision Support System. Report of a workshop sponsored by NWRI in cooperation with Tellus Institute. Kellogg West Conference Center/Hotel, California State Polytechnic University, Pomona, CA, February 4-6, 2003. 161p.

Water Quality and Resource Management Issues. Report of a workshop sponsored by NWRI in cooperation with Lawrence Livermore National Laboratory and University of California. Wente Vineyards, Livermore, CA, January 28-30, 2003. 252p.

Life Cycle Environmental Impacts Associated with Different Fuel Options. Report of a workshop sponsored by NWRI in cooperation with Clarkson University, Lawrence Livermore National Laboratory, and USEPA – Office of Research and Development. Kellogg West Conference Center/Hotel, California State Polytechnic University, Pomona, CA, February 15-17, 2002. 202p.

Issues in Methanol Research. Report of a workshop sponsored by NWRI in cooperation with the American Methanol Institute. Hilton Hotel, Costa Mesa, CA, October 5-7, 2001. 173p.

Chino Basin Organics Management. Report of a workshop sponsored by NWRI in cooperation with the Inland Empire Utilities Agency, and the Southern California Alliance of Publicly Owned Treatment Plants. Kellogg West Conference Center/Hotel, California State Polytechnic University, Pomona, CA, April 18-20, 2001. NWRI Report No. NWRI-01-03, 205p.

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Oxygenate Contamination. Report of a workshop sponsored by NWRI in cooperation with the United States Bureau of Reclamation. Kellogg West Conference Center/Hotel, California State Polytechnic University, Pomona, CA, September 15-17, 2001: 258p.

Utility Leadership. Report of a workshop sponsored by NWRI in cooperation with Malcolm Pirnie, Inc., the University of Southern California, and the University of South Florida. Kellogg West Conference Center/Hotel, California State Polytechnic University, Pomona, CA, October 24-26, 1999: 154p.

Non-potable Water Recycling. Report of a workshop sponsored by NWRI in cooperation with Irvine Ranch Water District and the Orange County Water District. Kellogg West Conference Center/Hotel, California State Polytechnic University, Pomona, CA, May 23-25, 1999: 174p.

Conjunctive Use Water Management Program. Report of a workshop jointly sponsored by NWRI, Association of Ground Water Agencies, and the Metropolitan Water District of Southern California. Kellogg West Conference Center/Hotel, California State Polytechnic University, Pomona, CA, May 27-29, 1998: 157p.

Barriers to Providing Safe Drinking Water Through Small Systems. Report of a workshop jointly sponsored by NWRI, Pan American Health Organization, and NSF International/WHO Collaborative Center. Pan American Health Organization Headquarters, Washington, D.C., May 13-15, 1998: English report: 175p., Spanish report: 188p. (Bound in a single volume.)

Barriers to Harvesting Stormwater. Report of a workshop jointly sponsored by NWRI, Los Angeles County Department of Public Works, County of Orange Public Facilities & Resources Department, Southern California Coastal Water Project, and the American Oceans Campaign. Kellogg West Conference Center/Hotel, California State Polytechnic University, Pomona, CA, September 22-24, 1997: 159p.

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