CALIFORNIA **URBAN WATER** AGENCIES

August 2, 2004

Lester Snow, Director
Department of Water Resources
1416 Ninth Street, Room 1102
Sacramento, CA 95814
lsnow@water.ca.gov

Patrick Wright, Executive Director
California Bay-Delta Authority
650 Capitol Mall, 5th Floor
Sacramento, CA 95814
patrick@calwater.ca.gov

Attached for your information is a brief evaluation of the November 2003 Pacific Institute report, "Waste Not, Want Not." We undertook this review since this report has received much attention as a valuable addition to water conservation research, and since it relates to activities underway by both the Department of Water Resources (DWR) and the California Bay-Delta Authority (BDA). The Pacific Institute report was funded in part by DWR and the BDA.

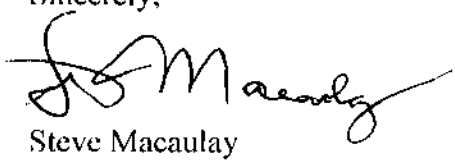
Our evaluation does not go into great detail. We believe the report has been a valuable contribution to a higher level of interest by policymakers regarding the potential savings resulting from urban water conservation. The report was designed to be a theoretical evaluation of maximum water conservation savings potential using existing technology, constrained only by cost-effectiveness at the consumer level. It is a solid piece of technical work, with clearly displayed assumptions, data and analyses.

Our principal concern – with some of the report's conclusions, as well as the general public dialogue regarding conservation savings – has to do with the significant challenges of implementing urban water conservation programs. Unlike other water resource management options, urban conservation savings rely on broadly distributed implementation and maintenance: each consumer has to decide whether to accept a financial incentive, install or agree to have someone else install a water conservation device, and agree to maintain savings measures and replace them as needed. Unfortunately not every consumer knows what his/her cost-effective options are, nor are they willing necessarily to make such choices even knowing that they will save money. In many cases (the Pacific Institute report is clear on this point), homeowner savings may result from savings on water, energy and sewer bills. This brings up important issues of how an agency conservation program is funded and managed. Historically it has been difficult to develop programs that include funding from all utilities that benefit from the water, energy and wastewater savings.

455 CAPITOL MALL, #705, SACRAMENTO, CA 95814 916•552•2929 FAX 916•552•2931

It is just as important to accept the Pacific Institute report for what it does do, as well as what it does not. The report, as well as the work of others (including the California Urban Water Conservation Council and several recent CUWA studies), opens the door to dialogue and future work in the area of implementation. CUWA and our member agencies expect to be a significant part of such discussions.

Sincerely,



Steve Macaulay
Executive Director

Attachment

Cc w/attachment:

Mary Ann Dickinson
Executive Director
California Urban Water Conservation Council
455 Capitol Mall, Suite 702
Sacramento, CA 95814
MADinLA@aol.com

Peter Gleick, President
Pacific Institute for Studies in Development, Environment and Security
654 13th Street, Preservation Park
Oakland, CA 946112
pgleick@pipeline.com

CUWA Board of Representatives

A & N Technical Services, Inc.

Memorandum

To: CUWA Conservation Committee

From: Thomas W. Chesnutt, Ph.D
David M. Pekelney, Ph.D

Date: August 2, 2004

Re: Review of Pacific Institute report *Waste Not, Want Not*

The Pacific Institute report on urban water conservation potential in California—*Waste Not, Want Not*—is broad in scope. The report constitutes a comprehensive approach to-one of the most important challenges faced in California. It contains useful discussions of water planning, planning constructs, and the economics of water conservation. This brief review was commissioned by the California Urban Water Agencies (CUWA) to provide some insight on what this report does and does not accomplish.

The Pacific Institute (PI) report focuses on constructing one estimate of water conservation savings potential, and does not focus on the practical steps need to implement programs to achieve that potential. This we see as the most important limitation of the study, and we offer some comments regarding the links between potential and implementation. We believe strongly that any estimate of conservation savings potential (or estimates of water resulting from any water management tool) should include or be followed-up by a thorough discussion of the realistic implementation challenges. Otherwise, the hard work represented by thorough technical analyses is likely to be either misinterpreted or discounted.

839 Second Street, Suite 5 • Encinitas, CA 92024-4452 • Voice: 760.942.5149 • Fax: 760.942.6853
11808 Stanwood Dr. • Los Angeles, CA 90066 • Voice: 310.439.1883 • Fax: 310.439.1884

Synopsis

The report constructs a definition of technically possible water conservation—the difference between current levels of water use and levels of water use that are technically possible with a select number of existing, working, and currently available technologies. The study did not attempt to include a comprehensive list of all feasible efficient technologies, but focused on known and widely accepted water efficient technologies. It parallels prior state planning work by dividing water use into different sectors: indoor residential, outdoor residential, and commercial, industrial, institutional sectors. Water use within sectors is further divided up into its constituent "end" uses. The report notes the many places where good information on end uses is lacking and makes explicit assumptions about both current levels of water use efficiency and technically possible levels of water use efficiency. The report examines the economics of water use efficiency from a retail water customer point of view and concludes that the amount of water conservation potential is little diminished by a requirement of customer cost-effectiveness.

The report can be categorized as secondary empirical research since it undertakes no new measurement of either water use or water use efficiency. It is better understood as policy research that explicitly documents an alternative vision of urban water conservation potential for the State of California. By organizing its thoughts by end use, the report documents a detailed vision of water conservation potential and notes the many inadequacies of existing information at this level. The report compiled a considerable amount of information on estimates of water use efficiency. The report is to be commended for its comprehensive approach and transparent presentation.

Review

While the report presents a range of useful data and informative discussion, readers should be aware of some key limitations to the analysis, as follows.

1. While the report offers a comprehensive review of how much water Californians could potentially save in homes, on landscapes, and in business, not all of the report's conclusions are supported by the data and analysis presented.
2. By cataloging water savings potential by end use category, the report usefully identifies where the greatest reservoirs of savings in the urban sector may lie. But the report does not address what changes in current laws, regulations, or institutions would be needed to effectively tap into these reservoirs.
3. Some estimates of end use savings potential could be improved by using available empirical evidence from field studies.
4. The economic analysis, while suggesting that investment in water use-efficiency may be cost-effective from a total resource, or societal perspective, does not consider the institutional constraints and transactional costs that guide utility investment decisions. The analysis of water conservation cost-effectiveness is only taken from the point-of-view of the water customer. The report concludes the amount of water conservation potential is little diminished by a customer cost-effectiveness test of 600 $/acre-foot. Ignoring technical accounting issues with the cost-effectiveness analysis we would like to point out that an economic analysis from only the customer point-of-view cannot inform discussions of who ought to pay for water conservation programs, or how these changes should or can be implemented.

Point 1 -- Not all of the report's conclusions can be supported by the data and analysis.

There are conclusions in the report that do not follow from the analyses contained in the report. Specifically we cite the following conclusion:

> *This report, "Waste Not, Want Not," strongly indicates that California's urban water needs can be met into the foreseeable future by reducing water waste through cost-effective water-savings technologies, revised economic policies, appropriate state and local regulations, and public education. (Page 1)*

The first reason that we believe this conclusion does not flow from the analyses of the report lies in the scope of water resources examined. It is standard practice in water supply sufficiency analysis to examine all sources of water supply because one cannot conclude one alternative is the most cost-effective without understanding the other alternatives. The analyses in the report do not examine any water resource other than water efficiency. Hence, the conclusion listed above cannot be derived from the analyses contained in the report. (Existing sources of water supply cannot be assumed to remain constant through the foreseeable future. Some water supplies may diminish in the future and others may be developed. Supply costs may vary widely and change substantially over time.)

The second reason that we believe the conclusion does not flow from the analyses of the report lies in its implicit definition of "California urban water needs." California's urban water needs are not limited to water quantity requirements, but also include requirements for water quality and reliable delivery. Though water use efficiency can be a complementary strategy for reducing the cost of water quality and reliability improvements, it is certainly not a complete substitute for them. Meeting water needs involves an evaluation of the complete water system: diversion, storage, treatment, distribution, demand reduction, reuse, etc. It needs to consider the "time value" of water as well – demand reduction in wet years will not help meet needs in dry years

unless such reductions can be saved to storage (directly or by exchange.) There are also changing water quality requirements. The complete picture of meeting water demands is very complex, and varies from one urban water system to another based on the particular mix of supplies, demands and system configuration.

More generally we take issue with the characterization of water use efficiency as an "either/or" choice that precludes the need for other water resource investments. Many other water management tools have proven to be complementary and can increase the value of investments in water use efficiency (e.g., reclamation, storage, treatment, and transportation). Pursuing only one future water management tool to add to existing tools involves a degree of risk that urban water utilities are not likely to take. This does not diminish the value or importance of water conservation, but emphasizes the need to carefully evaluate the integration of all available tools.

Point 2: Changes to existing laws, regulations, and institutions not considered.

The analysis focuses on deriving one definition of a physically possible state of water efficiency. The difference between current water demand and technically possible water demand constitutes the definition of conservation potential. We ignore for the moment any technical issues on the implicit water demand models for current water demand or the technically possible water demand. The report provides little detail on how one effectively moves from current levels of water demand to the level of technical potential. For example, while the report suggests that toilet water use constitutes a significant reservoir of water savings, it doesn't provide information that would allow one to answer the following sorts of questions:

- Which water conservation programs are most effective at achieving ULF toilet retrofit?
- Does toilet replacement in multiple family dwellings save the same amount of water as toilet replacement in single family dwellings?

- Do low-income families save the same amount of water per toilet from ULF toilet retrofit?
- Are customers satisfied with ULF toilets?
- Do water savings diminish over time?
- What factors other than water savings drive household decisions to replace toilets?
- What is the impact of current toilet efficiency standards on the cost-effectiveness of utility-sponsored toilet replacement programs?

All these questions are important for designing effective programs to achieve real water savings in toilet end-uses. Although the report does not claim to answer all the above questions, some of the report's conclusions cannot be reached without their consideration.

Point 3: Some estimates of end use savings potential could be improved by using available empirical evidence from field studies.

While we agree with the report's focus on end uses, the methods of the report choose not to use available information from existing water conservation programs, field studies of existing end uses, and achieved water savings. Field studies and impact evaluations differ from the mechanical/engineering estimates used in the Waste Not, Want Not in that field studies measure conservation savings in actual use rather than in the lab or on the design table. Field studies can be designed to account for variable human behavior (removal of efficient fixtures or longer showers), physical performance decay (mineralization of showerheads or leaking toilet flappers), and other factors encountered in the field.

To illustrate the importance of these issues we examine one slice of the water use pie—Ultra Low Flow (ULF) toilets—high efficiency toilets designed to flush at 1.6 gallons per flush (gpf). The Pacific Institute report divides the world of toilets into three categories—those that flush 6 gpf, 3.5 gpf, and 1.6 gpf (referred to as nonconserving,

conserving, and ultra-low-flow). All homes built before 1980 are assumed to have toilets flushing 6 gallons per flush. The method of assigning differing flush volumes according to home age originated with work by the California Urban Water Conservation Council (CUWCC) on quantifying the reliable water savings from ULF toilet programs. Housing construction dates are public information and serve as a justifiable basis for developing water use efficiency estimates. The use of 6 gpf for nonconserving toilets—presumably the mid-point between the nominal values of 5 gpf and 7 gpf—does not match existing field studies of nonconserving flush volume. It yields the following estimate of water savings from replacing nonconserving toilets with ULF toilets: 6 gpf * 4.9 flushes/person – 1.6 gpf * 5.1 flushes/person = 29.4 gpp – 8.16 gpp = 21.24 gl. per person per day. The PI estimated level of water savings from nonconserving toilet replacement is about 25% greater than the level of water savings observed in field studies of actual ULF toilet replacement[1].

There are well documented reasons why engineering estimates and empirical measurements in the field may differ—notably the role of human behavior and the persistence of savings over time due to human and mechanical factors. The sum of end uses in the PI report constitute an implicit water demand model, albeit a rather detailed static depiction of water using technologies[2]. We believe that this static model is not well suited to answering the dynamic question of how one moves from current levels of water use to future levels of water use.

[1] For example, a four year study of the post-retrofit consumption of approximately 26,000 dwelling units in Southern California found per capita effects in single family dwelling units closer to 16 gpd and 18 gpd in multi-family dwelling units. See Chesnutt, et al., *Ultra Low Flush Toilet Programs: Evaluation of Program Outcomes and Water Savings,* July 1995.

[2] Successful implementations of end use models require solid estimates of the existing saturation of efficient technologies; the report correctly notes the absence of reliable and consistent information on this "baseline" data statewide.

The report appears to emphasize simplicity over concrete field data in its choices of conservation estimates; this is an important distinction that may limit the document's usefulness to statewide policy discussions on how to make water conservation real.

Point 4: The economic analysis does not consider the institutional constraints and transactional costs that guide utility investment decisions.

The analysis of water conservation cost-effectiveness is taken from the point-of-view of the water customer. The report concludes the amount of water conservation potential is little diminished by a customer cost-effectiveness test of 600 $/acre-foot. The costs and benefits experienced by water customers do not reflect the costs and benefits experienced by the water utility. Since water utilities are the major drivers for implemented water conservation programs, an understanding of the incentives faced by water utilities is critical to understand the willingness of water utilities to making WUE investments, or the likelihood of the success of such investments.

The report's assessment of customer cost-effectiveness also presents a quandary—if water conservation is cost-effective to customers, why have customers not implemented water conservation? The report concludes that customers have difficulties perceiving the cost-effectiveness. There is another possibility to flawed customer perceptions, namely that the cost-effectiveness analysis may be too narrow (a common flaw of many cost-benefit analyses.[3]) Though we understand that an analysis of customer acceptance of WUE programs is not the intended focus of this report, we also believe that the cost-effectiveness of WUE cannot be properly addressed without consideration of customer acceptance.

[3] The cost assumptions in the report, in particular the unit cost assumptions for conserved water, are too simple to apply over the full scope of technical conservation potential. It is very unlikely that moving from 95 to 100 percent penetration of a water efficient device will cost the same as the first step that moves to 5 percent penetration. Further, good information on the likely full costs and benefits of conservation devices is itself costly for the consumer to acquire—in terms of both time and money. Also, cost-effectiveness is different than the question of ability to pay. Though the cost assumptions are easy to communicate when they are simple, we do not expect this analysis to convince many skeptics.

Ignoring technical accounting issues with the cost-effectiveness analysis we would like to point out that an economic analysis from a customer point-of-view cannot fully inform discussions of who ought to pay for water conservation programs. Water agencies are right to focus on questions of net conservation—the additional increment of conservation produced by conservation programs. This incremental conservation—net of ongoing conservation—is the correct benefit to weigh with incremental investment decisions in water use efficiency. For those interested in working out the institutional arrangements to implement and achieve cost-effective water use efficiency programs, these questions are paramount.

Conclusion

The Pacific Institute report *Waste Not, Want Not* does succeed in many things. It calculates a vision of technical water efficiency that is (1) consistent, (2) transparent, and (3) state-wide. This vision of conservation possibilities is useful for getting a handle on the magnitude of the stakes involved. The report's discussions of terminology and policy issues are thought provoking and insightful. Many of the information deficiencies and data shortcomings noted in the report are both valid and useful for pointing to needed future improvements. The report's imposition of economic, institutional, and practical constraints is less than completely successful, though these are admittedly difficult topics.

We believe most readers will find some level of agreement with the following aspiration of the report's authors: "We hope that this analysis is the beginning, not the end, of a real debate over water conservation in California (page 35)." We believe that there is considerable debate over conservation in California now. We advocate for more and more thorough analyses of conservation measures in terms of cost, savings, quality, and

reliability. Although the report provides a vision, concrete progress toward conservation requires addressing many of the practical questions of how to cost-effectively implement WUE programs.

There are opportunities to advance the understanding of water conservation, including its implementation as well as integration with other water management tools. It is essential that all water management tools be evaluated with enough rigor to draw sound conclusions regarding potential contributions to reliable provision of safe potable water.