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3-31-2009

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Statement of Mary Ann Dickinson

Executive Director

Alliance for Water Efficiency

EPA's Role in Promoting Water Efficiency

Hearing of March 31, 2009

Subcommittee on Water and Wildlife

Senate Committee on Environment and Public Works

The Alliance for Water Efficiency is pleased to appear before you today to offer views on activities and programs to improve water efficiency throughout the United States. We are a North American non-profit organization, composed of diverse stakeholders with significant experience in water conservation programs and policies. Our mission is to promote the efficient and sustainable use of water, to promote cost-effective water efficiency measures that will reduce wasteful consumption, reduce the need for additional drinking water and waste water capacity, and provide multiple energy, economic, and environmental benefits. And in that mission, we work closely with staff at the Environmental Protection Agency (EPA).

As the nation's steward of ambient water quality as well as safe drinking water, EPA has promoted water efficiency's many benefits. Programs have existed for over 20 years in EPA's Office of Water and Wastewater, albeit modestly funded and staffed.

WaterSense

This limited focus began to grow with the launching of the WaterSense program in 2006. Like its Energy Star cousin, WaterSense is aimed at product efficiency, product labeling, and consumer messaging. Unlike its Energy Star cousin, however, WaterSense is funded at a very paltry level of $2.4 million annually, compared with over $44 million annually for Energy Star.

WaterSense is EPA's most important flagship water efficiency program, with visible links to the water utilities, private sector, and the public. Despite low levels of funding, WaterSense has made extraordinary strides in the past three years, launching a nation-wide program, and testing and labeling hundreds of products such as high-efficiency toilets and faucets. EPA's effort in rolling out the program quickly has been truly remarkable and commendable. However, it must be acknowledged that quick success was possible primarily because the water efficiency community had already paved the way with preliminary testing and product specifications, for high-efficiency toilets in particular. Now that other product specifications need to be fully researched and tested, it is critical that WaterSense be provided sufficient funds to carry out its mission and to continue to keep its partners engaged. The private sector strongly supports the WaterSense program, has demonstrated its desire to be participating partners, and is anxious to see faster progress, and the labeling of more product categories.

WaterSense has some important differences from its Energy Star cousin. No product receives a label without a performance test by a third party certifier. No product receives a label unless it is 20% more efficient than the national efficiency standard for that product. And product specifications are based on field as well as laboratory analyses. Thus, a WaterSense labeled product provides the consumer with a guarantee of not only water efficiency, but superior performance. The double-flushing toilet of the past will not be returning.

But to continue this great work, WaterSense needs to be authorized by Congress, not only to ensure its longevity, but also to signal important policy approval from the current Administration. We recommend that its funding be increased to at least $10 million annually. If left at the current annual funding level of $2.4 million, only 1-2 product categories per year – at the most – could be launched. This would be unacceptable. There are literally dozens of products waiting to be considered, in both the commercial as well as residential sectors. And addressing the largest growing water use – urban irrigation – is a critical need that must be adequately funded to ensure that product specifications are effective and reasonable.

We have a number of further detailed recommendations for development of the WaterSense program which are included in our full testimony.

Funding and Policy for Water Efficiency Programs

EPA's funding of State Revolving Funds (SRF) is an important policy opportunity. Until the American Recovery and Reinvestment Act of 2009 (ARRA), green infrastructure projects did not receive much official recognition in clean water and drinking water programs. The ARRA changed all that by designating a mandatory 20% set-aside for green projects such as energy efficiency, water efficiency, or innovative environmental projects. This was an important step, a step which should be continued in the future and codified in federal SRF requirements, in order to ensure that adequate consideration is given to funding infrastructure projects that include efficiency as an important part of project goals.

Further, EPA should require that states examine ways to require water efficiency as part of its own implementation of SRF awards. EPA recommended this strategy – albeit on a voluntary basis – in its Water Conservation Plan Guidelines to States, published in 1998. And some states have adopted it. California requires that all Clean Water SRF applicants commit to implementing the state's Water Conservation Best Management Practices before state SRF funds can be awarded. A similar requirement exists on the Drinking Water SRF side. Requiring this kind of commitment of all states will ensure that federal funding will be spent on

sustainable, efficient projects which are appropriately-sized with less environmental and energy impact.

Water Efficiency Research

With drought gripping much of the country and with water supplies in shortage conditions in many locations, the time is right for the federal government to carefully assess water efficiency as a beneficial strategy, and to do so in a manner carefully structured to ensure measurable results. The Alliance prefers that a well-grounded and well-organized Research and Development program get firmly established, rather than for any particular research program to get funded. And we also believe that the criteria for a water efficiency research program should be carefully vetted with stakeholders. One important stakeholder group is the Plumbing Efficiency Research Coalition, launched earlier this year and comprised of six major plumbing and water efficiency organizations nationwide.

Successfully reducing water consumption requires careful examination of products, programs, and practices. Unlike the theoretical research that is often conducted in other environmental programs, water efficiency research must be applied research, testing programs and products in real world situations. How low can fixture flow go without potentially impacting the flow in drain lines? How can water, once used for potable purposes, best be kept on site to re-use for landscape irrigation? What are the direct reductions of greenhouse gas emissions that are possible with water efficiency programs?

This type of applied research can benefit EPA's overall sustainability approach, not just water efficiency. Of particular concern is gray water. Gray water is an on-site source of water that embodies no energy for pumping and transport from some remote location. It does require a level of treatment dependent upon public health and safety, and one which corresponds to its ultimate end use. But gray water holds significant promise in helping US consumers to reduce their need for potable water for landscape irrigation. To enable this to happen, however, a

universal Federal definition of gray water and its requirements must be set by EPA and the States to enable moving forward with actions to capture and use this resource.

Finally, although many water-efficient products, technologies, and programs already exist, more research and development is needed. Funding to date has been limited and woefully insufficient given the chronic need. Many of the projects undertaken in the past ten years have been funded by utility dollars. In our full testimony we offer the subcommittee an illustrative list developed by the Alliance's Water Efficiency Research Committee, which includes potential high-value research topics to advance our water efficiency knowledge and to help speed the commercialization of water-efficient products and practices.

In summary, we urge the Committee to consider making water efficiency a program worthy of continued Congressional review:

1. **WaterSense authorization and funding;**
2. **Setting requirements for water efficiency project funding with State Revolving Fund programs; and**
3. **Comprehensive water efficiency research programs that will yield important findings about appropriate standards and specifications and measurable savings for future sustainability.**

Thank you for the opportunity to testify.

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FURTHER DETAILED RECOMMENDATIONS: WATERSENSE

1. Create a "road map" for labeling in the non-residential sector

WaterSense needs to address the non-residential sectors, particularly those that are known high water users. There are many items of equipment, as well as practices both indoor and outdoor, that are prime candidates for evaluation, stakeholder input, specification development and, eventually, labeling. In doing this, WaterSense needs to meet with water utility conservation practitioners to identify the key elements of and general path for the road map. This includes early identification of the specific sectors in the non-residential category to be given the highest priority.

2. Develop outreach and implementation through new business sectors

At this time, candidate non-residential sectors that should be considered by WaterSense in the road map are Hospitality (Lodging, Food Service, Entertainment), Medical Services (Hospitals, Diagnostic and Treatment Centers, Medical and Dental Offices), and Public Facilities (Municipal Facilities, Courts and Penal Institutions, Education, etc.). In each of these categories, stakeholder organizations already exist that are concerned with "green" construction and operating efficiencies (water and energy). Therefore, these three (and perhaps others) constitute a ready and available vehicle for dialog with WaterSense on promotion of further water use reductions. (Many have already achieved significant efficiencies.)

Whether through a formal partnership or an informal relationship, stakeholder organizations in these three areas can be used for both outreach and implementation, something that is not being done on the residential side with the plumbing installers. These organizations can give guidance to WaterSense on how to most effectively communicate with their constituents as well as be useful to WaterSense in offering programs and opportunities that actually yield product installations.

3. Certify plumbers

As the WaterSense Program is currently being implemented, the lack of a direct "connection" to the plumbing trades is somewhat inhibiting take up of labeled product. It is critical to the indoor portions of the program (plumbing, appliances, and equipment) that the installations be performed by plumbing professionals formally trained and certified in water use efficiency and WaterSense. The current "gap" between outreach and promotion and the actual selection and installation of products is easily addressed.

Rather than the WaterSense developing and maintaining a costly individual certification program for plumbers, WaterSense should instead ally itself (either formally or informally) with GreenPlumbersUSA and other organizations that already have training and certification processes in place. This would be a far more cost-effective and user-friendly approach to

involving this important trade. Furthermore, it would assure that new construction seeking a WaterSense "label" would be fully supportive of the program, the products, and the systems. This, then, leads to including a requirement for WaterSense "certified" (or "recognized", "qualified", or "credentialed" if the term "certified" is unacceptable) plumbers to install systems and products in new WaterSense homes.

4. Enact parallel activities

In general, without a clear road map, WaterSense developments (except for New Homes) seem to move forward in a serial process, rather than parallel, if at all. For example, product candidates are evaluated and specifications developed before any outreach to the sectors using those products takes place. In our view, the development of new WaterSense product specifications (medical equipment, on-premise laundry equipment, food service equipment, water treatment devices, etc.) should move forward along with a parallel track as noted above. That is, developing relationships with the hospitality sector ought to be taking place concurrently with the evaluation of products for that sector; likewise, for the medical services sector. In this way, product evaluation will be enhanced and, to some extent, simplified, as the end-users are involved in WaterSense decisions about water-using products.

5. Represent WaterSense on all national green building guidelines and standards activity

As WaterSense gains traction in the marketplace, WaterSense specifications and labeled products are being called out in national and regional green building programs, guidelines, and ANSI standards across the U.S. Yet, the "connection" between these efforts and the WaterSense staff is limited, largely due to budget and staffing constraints at the agency. It is critical to the future of the green building movement and to the success of WaterSense that this "sector" be recognized. The dominant programs, guidelines, and ANSI standards of national scope need to have WaterSense representation and participation on their committees. This includes the USGBC (LEED), ASHRAE (S189.1 and S191), National Association of Home Builders, and Green Building Initiative.

6. Develop product research

Currently, WaterSense's evaluation, specification development, and labeling in product areas are being delayed because of a lack of meaningful data on the product and/or the marketplace. WaterSense needs to be authorized to commission the laboratory and field research that is necessary to get their product evaluation process moving forward. In many cases, relying instead upon others to provide data usually results in product categories being shelved, when, in reality, they represent very large areas of potential water use reduction. See further detailed recommendations on water efficiency research later on in this testimony.

FURTHER DETAILED RECOMMENDATIONS: GRAY WATER

1. Recognize gray water as a legitimate source of "new" water

Graywater is an on-site source of water that embodies no energy for pumping and transport from some remote location. It requires a level of treatment dependent upon public health and safety and also upon its ultimate end use. However, a universal federal definition of graywater would aid the EPA and states to move forward with actions to capture and use this resource.

2. Research gray water applications and long-term effects of graywater diversion

Gray water diversion, treatment, and reuse -- while certainly providing some significant benefits -- also creates some potential issues that need to be investigated. Apart from public health and safety, research is needed in the following areas:

a) Treatment requirements for individual end uses (see 3. below). Each water-using appliance or fixture within a building demands a certain quality of water to function properly and maintain the warranty provisions. Graywater (untreated and treated) distribution within a building, including piping sizes and colors, cross-connections, and related issues. Necessary separate conveyance systems for collected raw and treated graywater can increase building costs. The need to physically distinguish between blackwater, raw graywater, treated graywater, and potable water piping in the plumbing system is crucial.

b) Effects of diverting large amounts of graywater that would otherwise be directed to the building drainlines and, ultimately, to the municipal sewer. As less and less liquids are available to transport the solids in the drainlines and sewers, the potential for serious blockages increases. In Australia, advance indications of such problems have been found in some municipal sewer systems.

3. Set national definitions of water quality as they relate to graywater treatment and reuse

Plumbing manufacturers are concerned that treated gray water meet their specifications for water quality in order for that water to be used to flush their toilets and urinals. Yet, no one has clearly defined what water quality levels will suffice. Appliance manufacturers are reticent to guarantee the cleaning performance of their clothes washers without the use of high quality water. Again, that requested quality level has not been defined. The successful reuse of treated graywater depends upon a full investigation and definition of expected quality metrics.

FURTHER DETAILED RECOMMENDATIONS: RESEARCH

A national water efficiency research program could be structured as follows:

1. There should be a clear definition of conservation and/or water use efficiency. With states, communities, and EPA itself all facing enormous exposure to the rising costs of water and wastewater infrastructure over the coming decades, an appropriate focal point for research would seem to be the measures and practices that have the greatest potential to make significant reductions in the volumes of treated drinking water deliveries and the associated volumes of wastewater requiring treatment. A quantitative goal of water savings and/or infrastructure dollars avoided may also be useful as an organizing tool for the program. In any event, definitions of end use efficiency, efficiency of potable water distribution systems, and on-site capture and re-use would be most helpful. It is essential that this research program have a focus, and that focus should be articulated in the authorizing legislation.

2. As the Department of Energy has learned from years of experience with its energy efficiency R&D programs, road-mapping with industry partners is quite crucial for identifying research agendas that are well-grounded in the real world and focused upon overcoming specific barriers to more efficient technologies and practices. Partners will tend to bring a range of concerns – beyond simply reducing water consumption – to the table, and help identify research directions that have multiple benefits for stakeholders. We recommend that a water efficiency research program contain explicit delineation of stakeholder coordination.

3. The issue of cost-sharing should be carefully considered. It may be appropriate for governments to fully fund basic research in fundamental sciences, but a useful water conservation and efficiency R&D program must also consist of applied research. Cost-sharing can help identify research partners who are serious and capable, as well as technologies that have been validated by non-federal financial support. The closer that such technologies are to being market-ready, the greater the non-federal contribution for should be for the remaining research.

4. The research program should build in an assessment function that can document measurable results. A research portfolio must include a range of measures, some of which may pay off big and some pay off little if at all. We should not shy away from frank assessment of results; indeed, we should build it into the program from the beginning. The Department of Energy's entire energy efficiency research program was in serious jeopardy in the mid 1990's until the General Accounting Office identified five technologies out of the hundreds that DOE had funded that more than paid for the whole program in energy savings for consumers. EPA ought to be doing that kind of assessment from the beginning of any water efficiency research program.

Specific Water Efficiency Research Needs

Indoor plumbing product and appliance performance testing and savings measurement.

This research, largely funded to date by individual water utilities, has been very successful in results achieved even though modestly budgeted. The principal purpose of the testing is to verify that the flow rate or flush volume of the fixtures is at the proper standard, that it can be sustained over time, and that the product performs properly under all conditions. Many independent studies have been completed or are underway, funded by dozens of water utilities and municipalities in U.S. & Canada. Initially undertaken because these utilities wished to test the products they were offering in rebate programs, the studies added value by ranking products for consumers and in identifying needed areas of change for manufacturers. As a result, new specifications have been drawn and products developed; the high-efficiency 1.28 gallon per flush toilet is an example of a product that evolved based on this work and which was subsequently used productively by the WaterSense program. Another example is the 1.6 gallon per minute pre-rinse spray valve used in food preparation establishments. Only five years ago pre-rinse spray valves were the subject of prototype research at the Food Service Technology Center. After testing, and then successful field installation, they proved successful are now a national standard in the 2005 revisions to the Energy Policy Act.

Attached is a spreadsheet of research needs. Some research projects are already underway, but most remain unfunded as of this date and need sponsorship. More work is needed in this area to ensure that products perform well as the water efficiency of those products is improved. The consumer needs that performance assurance to make smart investments in water efficiency. The projects total $770,000 over two years.

Some examples of this work from the attached spreadsheet:

- Evaluating new commercial food steamers that are boiler-less and connection-less;
- Testing the transport of waste in drain lines connected to water efficient plumbing;
- Testing the flow rates of showerhead and multiple shower systems;
- Testing the performance and rating of 460 toilet fixture models; and
- Quantifying the savings, if any, of sensor activated faucets and flush valves.

Here are some additional research ideas for the indoor water use sector:

a) **Reduce the waste of water in hot water lines.** This waste is both a water and energy problem. A hot water distribution field study is needed to assess the solutions for reducing water waste in new construction as well as in designs for retrofitting existing household and commercial buildings. (Estimated budget: $350,000.)

b) **Test the water factor ratings of water using appliances such as dishwashers and clothes washers** in a lab setting and in the field. Since the water factor rating (or

amount of water needed to complete an appliance cycle) is a measure of a machine's water efficiency, it should be tested the same as plumbing fixtures have been tested. Another consideration is the performance of these machines over their life cycle, looking at factors like customer satisfaction, reliability, and cost. (Estimated budget: $300,000.)

Specific Water Efficiency Research Needs

Outdoor water use management and improved landscape irrigation efficiency.

According to NASA, turf grass is the largest irrigated crop in the U.S, irrigating three times the area of any other crop. As a result, in most areas of the U.S., outdoor irrigation of landscapes is the largest single category of average and peak water use in the urban environment. To determine the water needs of their landscape, Americans have historically relied on the research of agricultural scientists to determine the water needs of plants – even those grown in urban landscapes. This is problematic as the goals of agriculture (maximizing growth and yield) are often different from the goal of urban irrigation (maximizing appearance while minimizing maintenance and water use). Defining the water needs of plants for American urban environments is a huge challenge, but one that must be tackled in order to increase outdoor water efficiency.

Despite droughts and water supply shortages, outdoor water use in this country is steadily increasing. Formerly a fraction of household water use, in some areas of the country it approaches 80% of the water consumed by the average American single-family household. (The national average is likely between 10% and 50%). Water conservation programs have been very successful indoors; retrofitting a home with water efficient fixtures saves roughly 30% of a household's indoor water use, as studies have shown. The nation needs to be as effective with outdoor water use. More research and development is needed to better understand not only where the best efficiency improvements lie in irrigation system design, installation, and management, but also to understand what motivates the consumer and to identify educational and marketing needs.

Here are some research ideas for the outdoor water use sector:

a) **Optimize urban irrigation efficiency: minimize water use while maximizing appearance.** This study would measure the water needs of key urban crops such as turf grass and popular ornamental plants under a variety of climatic and soil conditions, in order to develop evapotranspiration (ET) crop coefficients that can be used to minimize unnecessary supplemental water use. This data is particularly important as advances in irrigation technology make it possible to take advantage of this information. In addition, this study would identify the extent of deficit and surplus irrigation practices in the U.S. and the implication of these practices for optimizing irrigation efficiency. (Estimated budget: $5,000,000.)

b) **Development of regional plant water use lists.** In order to create landscapes that would have differing levels of drought tolerance, it is necessary to develop plant lists that consumers can use to develop water efficient landscapes with or without the use of permanent in-ground irrigation systems. This issue is particularly critical in new growth

areas where land grant colleges have historically focused on agricultural research only. (Estimated budget: $1,000,000.)

c) **Develop irrigation product protocols for installation and management standards** to eliminate inefficient irrigation systems from the marketplace and to encourage consumer retrofit. (Estimated budget: $1,000,000.)

d) **Design effective landscape marketing programs** in a technology transfer approach to the customer. The best solution for reducing outdoor water use will not be effective if the consumer doesn't participate. (Estimated budget: $500,000.)

e) **Designing irrigation systems for efficient application rates.** Most in-ground irrigation systems are installed for convenience, not designed for efficiency. Even those using reclaimed water are often inefficient. Many water utilities start their programs for the reuse of domestic wastewater believing that reused water should be free or very inexpensive in order to sell the product, and therefore it doesn't matter how much recycled water is applied to the landscape. Times have changed. Reuse water now needs to be conserved as well, both from a conventional water supply shortage management perspective and cost of service perspective. Regardless of the source of water, research is needed to create high efficiency examples that can be utilized as "model" designs that can be adopted by utilities, contractors, and homeowners. (Estimated budget: $1,000,000.)

f) **Evaluate the reliability of projected savings from irrigation restriction ordinances.** Many communities are restricting the number of days per week that irrigation is allowed. Some field experience is suggesting that restricting the number of days may actually increase water use, as customers tend to over-irrigate on their designated days. This study would empirically evaluate the extent that consumers are overcompensating, thereby estimating true water savings potential of ordinance-based strategies. (Estimated budget: $300,000.)

g) **Encourage as federal policy separate, dedicated metering and measurement of water used for landscape irrigation.** When landscape water use is accurately measured and separately billed to the customer, opportunities for incentivizing efficiency emerge. Experience has shown that water budgets applied to these irrigated areas are a successful strategy in getting consumer response. Unless the customer knows how much water is being applied annually to the landscape, efficiency practices cannot be effectively marketed.

h) **Establish testing facilities for independent evaluation of conventional as well as alternative irrigation systems.** Third party testing is critical to maintaining credibility, and at present no independent testing facilities for irrigation exist except small installations at selected universities. This is a significant issue for the proposed WaterSense label on irrigation equipment, whereas plumbing products bearing the WaterSense label have been third-party certified as to efficiency standards and performance. We need to build an independent third party irrigation testing and certification facility. (Estimated budget: $2,000,000.)

i) **Evaluate the suitability of rainwater harvesting to reduce water use and reduce storm water runoff impacts.** This option has been proven successful where rainfall is regular. However, it can also be successful in more arid regions. A nationwide study can identify geographic locations where rainwater harvesting would be cost-effective, reliable, and can assess any potential side effects of rain water harvesting or regulatory barriers that may exist. (Estimated budget: $200,000.)

Specific Water Efficiency Research Needs

Integrative Research on Selected Topics.

This research is not directly tied to any specific water efficiency product or program, but instead assesses overall effectiveness, reliability of savings, or consumer responses. This research is critical to evaluating beneficial water use efficiency strategies from a policy as well as program planning perspective.

a) **Quantify the water and energy connection on a national basis.** The California Energy Commission has conducted research into the embedded value of energy in the state's water supplies. 19% of the state's electric energy demands are related to the pumping, treatment, distribution of drinking water and the collection, treatment and disposal of waste water. 32% of the state's natural gas demands are related to the heating of domestic water. Saving water therefore saves energy and therefore reduces greenhouse gas emissions. It has been quantified in California. But what is the relationship nationally? Regionally? How can water and energy efficiency programs be optimally paired? A national assessment is needed. (Estimated budget: $350,000.)

b) **Develop models for state and regional analysis of the water-energy connection**. More and more cities, regions, and states are adopting very challenging goals to reduce the emission of greenhouse gases. State "Climate Action Plans" call for up to 80% reduction in emissions by 2050. Success will require close attention to all of the human activities associated with the production of greenhouse gases, including water. Creating databases and assessment models for the relationship between water withdrawal, transport, treatment, distribution, end use, and eventual wastewater treatment would aid jurisdictions all over the country in determining what the most cost effective local measures are to implement in programs to reduce climate change impacts. (Estimated budget: $250,000.)

c) **Re-examine baseline data, both residential and non-residential.** Our best, most recent baseline end use data in the U.S. is now 10 years old. In order to plan conservation programs and to forecast future demand it is critical to understand where and how people use water. What potential exists for water conservation? Which end uses should be targeted? What is the saturation rate of efficient fixtures? This fundamental data needs to be collected on a regular basis. This study will quantify where water is used in homes and businesses across the U.S., identifying key opportunities for conservation savings. (Estimated budget: $3,000,000 residential; $3,000,000 commercial/industrial.)

d) **Maximize urban drought response and water shortage demand reductions.** Drought may be a defining feature of the American landscape in the coming decade. When a drought and associated water shortage occurs, urban water providers need reliable information on how to achieve rapid and quantifiable demand reductions. Many of the most sophisticated drought/water shortage response tools must be implemented in advance (such as automatic meter reading and water budgets) through integrated water shortage planning, but others (such as emergency drought pricing and irrigation restrictions) can be implemented quickly when a drought occurs through a similar planning process. Water providers need a toolkit for maximizing drought/water shortage response over a wide range of scenarios including long-term supply shortages. This study will identify a broad range of effective drought/water shortage response and demand reduction measures and implementation regimes that are applicable to water providers across the United States. (Estimated budget: $1,500,000.)

e) **Minimize the economic costs associated with drought response.** Water curtailments due to shortage conditions can result in severe economic damages to both residential and business users. Economic impacts can affect the ways in which urban water providers implement and prioritize management measures. More research is needed to understand the economic costs of coping with water restrictions and the implications for long-term investment in water efficiency and supply development. This study will survey coping behaviors and the range of economic impacts that are likely to be realized during water shortages of various frequencies and durations. The study will assist water providers in properly phasing their drought response plans and will provide and demonstrate criteria for assessing needs for long-term investments in water efficiency for the purposes of increasing water supply reliability. (Estimated budget: $3,000,000.)

f) **Analyze water billing data: Making the Most of an Under-Utilized Resource.** American water utilities typically read water meters and bill their customers once a monthly or every two months. Once this is done, the consumption data is usually stowed away and forgotten. Yet utility billing data is a tremendously rich resource that can be used in a wide variety of ways to target water efficiency efforts, track changes in water use, identify potential leakage, and help with infrastructure and conservation planning. This study will tackle the subject of water billing data from top to bottom, developing a set of best management practices for classifying water customers and storing, maintaining, and utilizing these data to their maximum potential. (Estimated budget: $750,000.)

g) **Analyze the true impacts of "Demand Hardening."** Demand hardening is a theory that puts a negative spin on water conservation efforts. According to this theory, as an area's water conservation potential is maximized there is less that can be done in times of a water shortage or drought. In other words, it is perceived that water conservation may impact a water system's flexibility in times of a water shortage. Field experience suggests that as technology changes and new products appear in the marketplace, there will always be additional conservation potential. However, research should be

undertaken to determine if demand hardening is indeed a negative side effect of water conservation and what can be done to deal with it in times of a water shortage. Metrics also need to be established to determine what constitutes efficient water use to avoid penalizing already efficient water users when drought occurs. (Estimated budget: $400,000.)

h) **Assess the Benefit of Water Conservation on a National Level.** How does water conservation fit within the broader social, economic, environmental and other policy trends facing the country today? Water conservation on a National level and the resulting economic and environmental benefit needs to be studied and well articulated. Why should we conserve water and what is the national benefit as opposed to the local or regional benefit? An in depth study that assesses multiple regions of the United States in regards to fresh water resources, political issues and water rights, Federal policies regarding water supply subsidy, regional water conflicts, current water treatment/delivery infrastructure, current water demands, future water demands, energy implications, and conservation potential will help strengthen our collective understanding of freshwater resources and raise awareness for the need for water conservation. (Estimated Budget: $600,000.)

i) **Opportunities to better utilize waste heat among commercial and industrial water users.** Many businesses need to discharge waste heat from a variety of cooling and process water applications. This waste heat could be better utilized to pre-heat water for other applications by that business or other nearby businesses. Research is needed into opportunities and barriers to the creation of public/private "hot water utilities". These utilities would purchase waste heat and in turn sell hot water or generate energy. These new utilities would help conserve both water and energy by better utilization of industrial waste heat. (Estimated budget: $300,000.)

j) **Analyze the Effectiveness of Consumer Outreach and Education.** It is currently difficult to estimate the savings associated with water conservation outreach and education programs. There is a need for research in this area that will help planners estimate the impact of outreach efforts. What exactly do outreach and education programs provide in regards to social capital and water savings? Actual case studies can be followed and impacts of outreach and education can be determined using qualitative analysis and sophisticated modeling to isolate the actual water savings. (Estimated Budget: $300,000.)

Specific Water Efficiency Research Needs

Opportunities for Innovation in Green Building.

The Brookings Institution estimates that of all the homes that will exist in the US by 2030, a full half of them have not yet been built. This is a significant opportunity: to build that half as sustainably as we can. The trend is unfortunately the reverse. New homes that are now being built use 12-20% more water, as studies have shown. In one development the homes used 60% more water than their neighbors. Research and development needs to take place in this critical area, to foster water-efficient designs alongside specifications for green building materials and energy efficiency.

Here are some research ideas in this area:

a) **Design more effective residential hot water distribution systems.** The designs and specifications should include manifold systems, hot water re-circulating and on-demand systems. (Estimated budget: $400,000.)

b) **Incentivize new building comfort systems and technologies** that will focus on water efficiency. Cooling towers in air conditioning systems are a significant opportunity for water savings. (Estimated budget: $300,000.)

c) **Assess the cost-effectiveness of centralized automatic monitoring systems** for managing water demand. The consumer appears to respond to such systems for managing their energy demands. Would the same be true for water? (Estimated budget: $400,000.)

d) **Analyze the water quality implications of joint use of landscapes for infiltrating storm water and reuse water**. What do we need to know before this strategy gets too prevalent? Are there water quality and health risks? Local Health Department barriers? (Estimated budget: $700,000.)

e) **Develop small scale gray water reuse systems for residential and small commercial use.** One of the best opportunities for conserving water in America is the re-use of gray water for flushing toilets and watering plants. Economically, it often makes sense to accomplish this at the customer level. There are currently numerous barriers to using gray water ranging from western water law to local health codes. This study will examine the issue of gray water and will propose a set of federal regulations that can help clear the way for widespread implementation of small-scale gray water reuse. This study will help Americans to take advantage of one of the easiest and best water saving opportunities available. (Estimated budget: $3,000,000.)

f) **Develop a simple method for the consumer to evaluate water conservation options**. This goes beyond the applicable water saving technologies to get at the cost and benefit issues of water conservation at the consumer level. Simple evaluation techniques need to be developed to help water customers understand life cycle benefits of conservation and therefore the benefits of investing in alternative retrofits or new construction options. This research could result in an educational curriculum, report, and/or instructional website that would provide guidance on determining relevancy and estimating costs and benefits from water efficiency. (Estimated budget: $250,000.)

g) **Create green building guidelines for landscapes that emphasize minimal or no irrigation once established**. The purpose of these guidelines would be to develop model standards that could be adopted by utilities and local governments. (Estimated budget: $500,000.)

ALLIANCE FOR WATER EFFICIENCY
Proposed Research Projects: Estimated Budget Summary

1	Indoor plumbing products research *(separate spreadsheet)**	$870,000
2	Reduce hot water waste	$350,000
3	Test water factor ratings of appliances	$300,000
4	Develop ET crop coefficients	$5,000,000
5	Regional plant water use lists	$1,000,000
6	Irrigation product protocols/standards	$1,000,000
7	Effective landscape marketing programs	$500,000
8	Efficient systems for irrigation application	$1,000,000
9	Study of irrigation restriction ordinances	$300,000
10	Testing facilities for irrigation technology	$2,000,000
11	Evaluate rainwater harvesting	$200,000
12	Quantify water/energy nationally	$350,000
13	Models for analysis of water/energy	$250,000
14	Baseline data: residential	$3,000,000
15	Baseline data: commercial/industrial	$3,000,000
16	Drought response & demand reductions	$1,500,000
17	Economic effects of drought response	$3,000,000
18	Analyze water billing data	$750,000
19	Analyze demand hardening	$400,000
20	Benefits of conservation	$600,000
21	Utilizing waste heat	$300,000
22	Effectiveness of consumer outreach	$300,000
23	Design new hot water distribution systems	$400,000
24	New building comfort systems	$300,000
25	Evaluate consumer real time water monitoring	$400,000
26	Water quality of storm water/reuse water	$700,000
27	Small scale gray water systems	$3,000,000
28	Consumer cost/benefit methods	$250,000
29	Green Building guidelines for minimal landscape watering	$500,000
	TOTAL	**$31,520,000**

*upper limit estimate

Water Efficiency Research Committee Research Project List

Proj No.			Issues to be Addressed	Deliverables	Status
1	**Plumbing Standards - U.S. and Canada** (ONGOING WORK)		STANDARDS: Plumbing standards form the basis for many of the plumbing code provisions. As such, standards are continually evolving as new products and technologies are developed for the marketplace. Today, new water-efficient products and technologies are being developed by the plumbing industry and many creative individuals. In many cases, these products and technologies need to be addressed by standards and permitted by the plumbing codes. The plumbing standards committees are currently addressing the following topics related to water-efficiency and water conservation programs: (1) Currently underway: harmonizing the plumbing standards of the U.S. and Canada to create a single standard that will ultimately result in more water-efficient products in the marketplace; (2) development of showerhead performance specifications as part of ASME A112.18.1/CSA 125.1 and in support of the EPA's WaterSense Program; and (3) about to commence: amendment of the existing ASME ANSI standards for toilets and urinals to fully recognize HETs and HEUs as a separate set of water-efficiency thresholds.	1) Twice annual status reports to participating (funding) organizations 2) Periodic standards updates on selected water efficiency websites 3) New U.S.-Canadian harmonized standards for plumbing fixtures and fittings 4) Standards for high-efficiency urinals (HEUs) and high-efficiency toilets (HETs)	1) Published ASME A112.19.19-2006 for vitreous china non-water urinals 2) Ongoing work to harmonize standards between the U.S. & Canada (toilets, urinals, and other plumbing fixtures & fittings covered by ASME A112 and CSA B45) 3) To begin work toward an additional water-efficiency threshold in the A112.19.2 standard that would cover 0.5-gpf/1.9-lpf urinals (high-efficiency urinals - HEUs) and high-efficiency toilets (HETs). 4) Showerhead standards (A112.18.1), including efficiency and performance, currently being addressed by U.S.-Canadian harmonization group in coordination with the WaterSense Program 5) Additional water-efficient technologies and plumbing products will be introduced in the coming years and may need to be addressed within the national standards.
	Estimated Annual Funding Level	Small			
2	**Plumbing & Building Codes (Residential & Commercial)** (ONGOING WORK)		CODES: Plumbing codes are the means by which new standards are implemented and maintained. For example, the need for codes to fully address and permit non-water urinals is an example of current focus. (Some jurisdictions do not currently permit these urinals for a variety of reasons.) A second critical area is that of incorporating structured plumbing into the plumbing/building codes. The third area of importance relates to expanding the applications of greywater systems into the codes.	1) Twice annual status reports to participating water utilities 2) Periodic updates on selected water efficiency websites 3) Adoption and/or expanding water-efficient technologies into prevailing plumbing codes and building codes (non-water consuming urinals, structured plumbing, greywater systems, and others)	1) Uniform Plumbing Code (UPC) will fully address non-water urinals, 2) **Alliance for Water Efficiency** representation on the UPC Technical Committee and Task Groups will be continued. 3) Additional representation by water-efficiency interests is needed.
	Estimated Annual Funding Level	Small			
3	**UNAR Development & Implementation (Res. & Commercial Toilet Fixtures)** (ONGOING WORK)		UNAR (Uniform North American Requirements) for toilet fixtures: Water utilities implement toilet replacement programs without assurance that predicted water savings will materialize (flapper failure, incorrect flapper replacement, customer tampering with the toilet, unsatisfactory performance, etc.). Furthermore, even with efforts to encourage improved flush performance, a few toilet fixtures are still not stellar performers and generate complaints from customers. UNAR provides information re: which toilet fixtures assure long-term water savings AND meet customers' flush performance expectations. UNAR provides for testing toilet fixtures against its own performance and water savings sustainability requirements. Water utilities are using the web "list" of UNAR-qualified fixtures as criteria for toilet rebate or voucher programs, or for guiding toilet purchases for giveaways or direct install programs. A UNAR for flushometer type toilet fixtures is planned.	1) UNAR qualified toilet lists - documented and posted for public use 2) Periodic progress reports to participating water utilities posted on the web	UNAR for toilets is a combination of Maximum Performance (MaP) testing and the Los Angeles Supplementary Purchase Specification (SPS). A full specification (version 1.2 - posted on the AWE website) has been developed and has been addressed by stakeholder representatives. (Stakeholders include water utilities and plumbing manufacturers.) UNAR is being used by water utilities in the U.S. and Canada as the specification-of-choice for their toilet replacement programs. The list of UNAR-compliant toilet fixtures is posted on the AWE website (and others). The UNAR specification for HETs was one of the bases for the WaterSense specification for HETs. As such, with minimal exception, the two specifications are identical. (NOTE: Ultimately, the WaterSense specification for HETs and listings will replace the UNAR listing for HETs as a higher percentage of UNAR HETs become WaterSense-certified and are labeled with the WaterSense logo.) The next step for the UNAR for toilet fixtures process is to address commercial flushometer valve toilets.
	Estimated Funding Level (Remaining Work)	Small			
4	**Flapper Identification and Listings** (ONGOING WORK)		TOILET FLAPPERS: Toilet flappers are subject to periodic degradation and failure during the life of a gravity-fed fixture and, as a consequence, can lead to leakage and loss of expected water savings. It is critical that the end-user (customer) be equipped with the information needed to identify and locate the correct replacement flapper for the toilet. Tampa Bay Water developed and made public a substantial database on ULF toilets and their flappers - see website: www.toiletflapper.org Using this database, customers will be more likely to install a replacement flapper that maintains the original 1.6-gpf/6.0-L design flush volume. Database needs information "gaps" filled in and must be continually updated as new toilet fixtures are introduced into the marketplace.	1) The database has been posted by Tampa Bay Water on www.toiletflapper.org and will be periodically updated as new information is added. This is an ongoing process and will not be the subject of a "final report" per se.	Up-to-date listing of flappers to be completed annually.
	Estimated Funding Level	Micro			

Water Efficiency Research Committee Research Project List

Proj No.			Issues to be Addressed	Deliverables	Status
5	**Commercial Dishwashers** (WORK YET TO BE FUNDED AND SCHEDULED)		COMMERCIAL DISHWASHERS: Commercial dishwashers in food service operations are significant water users, sometimes involving more than one-half of all water consumed by such an establishment. Both water-efficient and inefficient machines are available in the marketplace. No independently verified field data exists, however, that would yield meaningful performance and efficiency thresholds. This task would involve specification research and a limited amount of field study to provide the needed data.	1) Periodic progress reports to participating water utilities 2) Final report - documented and posted for public use	Funding to be secured. Program would be run through PG&E Food Service Technology Center.
		Estimated Funding Level: Medium			
6	**UNAR for Urinals** (WORK TO BE FUNDED AND SCHEDULED)		UNAR (Uniform North American Requirements) for Urinals: (Refer to Item 6 above) Stakeholders (manufacturers of urinals and water utilities) have requested that urinal fixtures be addressed with a UNAR specification similar to that of toilet fixtures (refer to Item 3 above), covering urinal performance, sustainability, and water savings. UNAR for urinals would yield new standards that can be used by green building programs and water utilities to encourage the reduction in water use by urinal fixtures. Given the recent technological developments in these fixtures, it appears that efficiencies will be significantly improved over the current 1.0-gpf products.	1) UNAR qualified urinal lists - documented and posted for public use 2) Periodic progress reports to participating water utilities posted on the web	This project is dependent upon completing the urinal study outlined as Project 6 above. Work is underway to implement changes to the national standard (ASME A112.19.2/CSA B45). (See Project 1 above for the changes to the national standards.) At that time, this mfr. stakeholder group showed a preference for an initiative by the water utilities to measure performance and water use through the UNAR approach. Later, the standards committee decided that it would instead develop a water-efficiency threshold in the A112.19.2 standard as noted above. Work on this project to begin in 2009 in conjunction with the work undertaken Item 6 above IF standards committee fails to perform its commitment.
		Estimated Funding Level: Small			
7	**Ice Cream Soft-Serve Machines** (WORK TO BE FUNDED AND SCHEDULED)		ICE CREAM SOFT-SERVE MACHINES: Refrigerated ice-cream soft-serve machines are another food service industry product that requires field study as to energy and water-efficiency in order to provide food service industry with data on which machines are the most cost-effective to operate. Further, these products are being considered for inclusion in Federal programs such as Energy Star and Water Star. Without accurate operating data, performance thresholds cannot be developed.	1) Periodic progress reports to participating water utilities 2) Final report - documented and posted for public use	Project to commence when funding becomes available. This project is of low priority.
		Estimated Funding Level: Small			
8	**Field Study - High-Efficiency Toilets (Pressure-Assist and Gravity-Fed only)** (WORK TO BE FUNDED AND SCHEDULED)		HIGH EFFICIENCY TOILETS (HETS): Currently, the only HETs that have been field measured to establish **"real world" water savings** are dual-flush fixtures. Programs currently encouraging the installation of the pressure-assist (1.0-gpf) and gravity-fed single-flush (1.28-gpf) fixtures in residential and commercial applications have no authoritative data available on water savings achieved through replacement of 5.0-, 3.5, and 1.6-gpf fixtures. Instead, "engineered calculations" are used to estimate water use. These calculations do not reflect any changes in user habits as a result of replacing a gravity-fed with a pressure-assist fixture (changing flush frequency, double-flushing, etc.). This study would be the first to yield some important data for the water suppliers implementing HET programs.	1) Periodic progress reports to participating water utilities 2) Final report - documented and posted for public use	Project to commence in 2009 dependent upon funding. (Some minimal funding is available from one water agency in California) This project is of high priority.
		Estimated Funding Level: Medium			
9	**Field Audit - Previously MaP-Tested Toilet Fixtures** (WORK TO BE FUNDED AND SCHEDULED)		MaP-TESTED FIXTURES - FIELD AUDIT OF PERFORMANCE: Nearly 1,000 different toilet fixtures have been MaP tested in a laboratory and the results reported on various water utility websites for the benefit of customers, specifiers, retailers, plumbers, government, water utilities and others. These individuals and organizations rely upon the performance data to make specification and purchase decisions. Unfortunately, feedback received by the authors of the MaP reports indicate that a small number of models available at retail or at supply houses do not appear to perform satisfactorily. Suspicion is growing that the models supplied to and sold at these outlets are not necessarily the same as the model (of the same name and number) originally MaP tested. If such is the case, those models that are not identical to the tested model need to be identified and dealt with. Various avenues are available for that possibility. A more complete scope of work for the proposed audit process is available upon request.	1) Completed test reports will be made available to the non-compliant manufacturer for correction. 2) Failures to correct a performance/design issue will be noted and highlighted in publicly available MaP reports	Project to commence in 2009 dependent upon funding.
		Estimated Funding Level: Small			

Water Efficiency Research Committee Research Project List

Proj No.			Issues to be Addressed	Deliverables	Status
10	**Dipper Wells** (WORK TO BE FUNDED AND SCHEDULED)		DIPPER WELLS: Coffee houses, ice cream establishments, and similar retail operations are required by health authorities to employ some form of ongoing rinsing and/or cleaning of ice cream dippers that are in continuous use. The majority of such establishments use continuous-run dipper wells wherein dippers (scoops) are plunged into the water-filled well (about 1-2 quarts in capacity) after each use. Running water is used to create a continuous exchange of water in the well. Other approaches may be available to maintain health code standards without a continuously running system. This project is designed to evaluate water-saving alternatives to traditional dipper wells and estimate the potential water use reduction in the U.S. and Canada for each such alternative. NOTE: The Food Service Technology Center is considering a major role in this investigation.	1) Periodic progress reports to participating water utilities 2) Final report - documented and posted for public use	Project to commence in 2009 dependent upon funding.
	Estimated Funding Level	Small			
11	**Graywater Systems** (WORK TO BE FUNDED AND SCHEDULED)		GRAYWATER SYSTEMS: The proliferation of package graywater treatment systems for home and business has led to a number of questions about system economic viability, issues with health and plumbing code compliance, system maintenance requirements, public perceptions, and potential water savings that might be capturable. The water utility industry is peripherally involved in a few minor studies to identify answers to some of these questions. A more concerted effort is required in order to answer the questions for water utilities, the public, the plumbing trades, permitting agencies, builders, and health code authorities. NOTE: This is one of two major areas of study being contemplated by the Plumbing Efficiency Research Coalition under the terms of the AWE-IAPMO-PHCC-PMI-ICC Memorandum of Understanding.	1) Periodic progress reports to participating water utilities 2) Final report - documented and posted for public use	Project to commence in 2009 dependent upon funding.
	Estimated Funding Level	Large			
12	**Commercial Building Drainline Systems Study** (WORK TO BE FUNDED AND SCHEDULED)		COMMERCIAL BUILDING DRAINLINE SYSTEMS: With the enactment of the Energy Policy Act of 1992, all toilets manufactured in or imported into the United States were required to flush no more than a maximum average of 1.6 US gallons, effective January 1, 1994 for residential models and January 1, 1997 for all models. At that time, concern for drainline transport efficacy was voiced by many in the plumbing trade and those in various professional associations. However, early reporting and research on 1.6-gpf/6.0-lpf models focused primarily on the flush performance (waste removal) of the various models on the market in response to significant consumer complaints about poor flush performance. Since then, manufacturers have made great strides in improving flushing performance. Intermittent and anecdotal complaints of drain line carry transport problems were not thoroughly researched and largely attributed to older or faulty sanitary drain lines. The advent of toilets flushing at as little as 0.8-gpf/3.0-lpf has focused even more attention on drainlines. The Plumbing Engineering Research Coalition will seek funding to conduct scientific research to determine the effect of reduced flows into our domestic and commercial plumbing systems. Due to the complexity associated with the number of variables in "real world" plumbing systems, it is believed that research is required on several fronts, specifically; computer modeling studies, laboratory testing and field studies conducted on actual plumbing systems. NOTE: This is one of two major areas of study being contemplated by the Plumbing Efficiency Research Coalition under the terms of the AWE-IAPMO-PHCC-PMI-ICC Memorandum of Understanding.	1) Periodic PERC progress reports to participating water utilities and other interested parties 2) Final report - documented and posted for public use	Project to commence in 2009 dependent upon funding.
	Estimated Funding Level	Large			

Water Efficiency Research Committee Research Project List

Proj No.			Issues to be Addressed	Deliverables	Status
13	**Green Building Programs, Standards, and Initiatives** (ONGOING WORK)		GREEN BUILDING: A large number of voluntary green building initiatives have been initiated by various organizations in the past 10 years, some of which are now becoming mandatory in certain jurisdictions through legislation and/or regulation. These initiatives relate to both existing and new buildings in all sectors of the built environment (residential, commercial, institutional, industrial). They take the form of both guidelines (which are not written in code-adapted language) and ANSI standards (code adaptable language). Examples are the USGBC's LEED guidelines, the Green Globes-Green Building Initiative (GBI) ANSI standard, the ASHRAE 189.1 ANSI standard for high-performance buildings, ASHRAE 191 ANSI standard for water efficiency, NAHB's ANSI standard for homes, and countless other regional and local guidelines for new homes. The Alliance is currently involved in most of the national standards and guidelines committees and continues to provide technical advice to the sponsoring organizations developing these products. As water supply and wastewater treatment issues escalate due to climate change, population growth, and aging infrastructure, it is imperative that the Alliance continue its involvement. This project is intended to increase the current level of participation as more attention is given to water efficiency by these organizations.	1) Twice annual status reports to participating (funding) organizations 2) Periodic updates on selected water efficiency websites 3) Proposed new ANSI green building standards circulated for public comment in accordance with ANSI process	Project underway and ongoing with limited AWE funding. Additional funding required to complete the work programmed for 2009 and 2010.
	Estimated Annual Funding Level	Small			
14	**WaterSense Pre-Rinse Spray Valves** (WORK TO BE FUNDED AND SCHEDULED)		Pre-Rinse Spray Valves: EPAct 2005 limits flow rates of pre-rinse spray valves to 1.6 gpm. WaterSense is interested in examining ultra high-efficiency pre-rinse spray valves with a flow rate of 1.0 gpm or less. Specifically, WaterSense would like to investigate if product usage times correlate with performance ratings achieved on the ASTM F2324-03 cleanability test. WaterSense seeks data that asks the following questions: 1. How does water usage and time usage vary among pre-rinse spray valves currently on the market? 2. Do usage times in the field correlate to cleanability times achieved using the ASTM F2324-03 test method?		Project to commence in 2009 dependent upon funding.
	Estimated Funding Level	Small			

Note: All of the above project descriptions are subject to change as new study elements are proposed and existing study elements are completed or modified.

Funding Legend:
Micro = <$20,000
Small = >$20,000 - <$50,000
Medium = >$50,000 - <$100,000
Large = >$100,000