Attachment 1: Description of Emissions Reduction Measure Form

Title: *Urban Water Use Efficiency*

Type of Measure (check all that apply):

☑ Direct regulation
☑ Monetary Incentive
☑ Voluntary
☐ Other Describe:
☐ Market-based compliance:
☑ Non-monetary incentive
☑ Alternative Compliance Mechanism

Responsible Agency: State Water Resources Control Board (SWRCB), Department of Water Resources (DWR), California Energy Commission (CEC), and California Public Utilities Commission (CPUC)

Sector:

☐ Transportation
☐ Other Industrial
☐ Agriculture
☐ Sequestration
☑ Electricity Generation
☐ Refineries
☐ Cement
☑ Other Describe: Water

2020 Baseline Emissions Assumed (MMT CO2E):

The electricity used by the water sector should be included in the baseline forecast for the electricity sector.

DWR's current trends scenario in the State Water Plan (B-160) predicts urban water use increasing by 3 million acre-feet (MAF) by 2030. The Climate Action Team report states that providing 44 million AF of water used annually in California produces 44 million tons of CO2. This would imply that a 3 MAF increase in urban water use would lead to a baseline increase of 3 million tons of CO2E by 2030. Assuming a linear increase, by 2020 the increase would be approximately 1.7 million tons CO2.

This estimate is conservative, however, as it does not take into account 1) how widely the energy use varies between northern and southern California and 2) the increasing energy intensity of marginal water supplies. Since much of the additional demand for water is likely to occur in Southern California and the Central Valley, and since many of the new supplies would be more energy intensive than existing supplies, the actual increase in emissions from an additional 3 MAF of urban water use would likely be substantially higher than the estimate above.

Percent Reduction in 2020: up to 4.8 MMT CO2E

Cost-Effectiveness ($/metric ton CO2E) in 2020: -$145/metric ton CO2E

Description:
The state should establish and implement a loading order for water resources that makes water use efficiency the state's top priority resource. The State Water Resources Control Board and the California Public Utilities Commission in consultation with DWR, should implement the following policies. Legislation may be needed for some of these actions.

1. Establish a public goods surcharge on every acre-foot of water delivered in California, with the proceeds of that surcharge used to fund efficiency programs.
2. Determine water efficiency potential. Require water use efficiency potential studies by each water agency, or by groups of water agencies engaged in integrated regional planning.
3. Establish efficiency targets. Require each water agency or groups of agencies to establish targets for water efficiency. The Board should review these targets to ensure they will capture all cost-effective savings.
4. Integrate water efficiency into water agencies' portfolio. Require water agencies to invest in all efficiency savings that are cheaper than other alternatives. This funding should supplement the public goods charge to ensure that all cost-effective savings are captured.
5. Standardize evaluation, measurement, and verification protocols to determine progress towards meeting these efficiency goals.
6. Require annual reporting. Require water agencies or groups of agencies to report annually on their progress towards meeting their targets.
7. Remove financial disincentives for water agencies by decoupling revenues from sales so that water agencies are no longer hurt financially by investments in efficiency.
8. Require urban water system audits and assessment of economically recoverable losses. To protect against waste and unreasonable use the SWRCB should require urban water suppliers to conduct water loss audits in accordance with the American Water Works Association (AWWA) methodology and to identify and develop a plan to reduce economically recoverable losses.
9. Implement regulatory and incentives programs to maximize the water efficiency potential of new and existing development. For example:
    a. Adopt water efficiency standards for buildings, landscaping, and appliances,
    b. Strengthen LEED water conservation requirements and other green building programs
    c. Offer rebate and incentive programs to help customers save water.
10. DWR should revise the demand management measures contained in the Urban Water Management Planning Act, which were developed 15 years ago, to reflect new technologies and analysis – such as improved understanding of the energy savings of water conservation.
11. The State Water Resources Control Board should work with the Department of Water Resources (DWR), the Air Resources Board, the California Energy Commission, and the Public Utilities Commission, to complete a study that more fully quantifies energy savings and greenhouse gas emission reductions that would be available from aggressive water conservation efforts, including identification of ways to reduce the most energy intensive water use and to achieve all cost-effective savings.

In addition, the majority of California's water is used for agricultural irrigation. There are widely varying estimates of the potential for efficiency in this sector. The Department of Water Resources identifies up to 600 TAF, while the Pacific Institute identifies up to 4.5 MAF. Certainly if economic efficiency, as well as irrigation efficiency is included, the potential for reducing water use in agriculture is quite large. However, the GHG emission reductions from reducing agricultural water use vary widely depending on where and how those reductions are achieved. Some agricultural water use has high embedded energy value, and associated GHG emission reduction potential. Pumping water from the Delta or from deep groundwater basins can be very energy intensive. However, some agricultural water is gravity fed. Also, some irrigation efficiency improvements, such as converting from flood irrigation to sprinklers or drip can actually increase energy use; this increase may or may not be offset by the savings from reducing the amount of pumping or conveyance energy.

We recommend that the State Water Resources Control Board, in consultation with the Department of Water Resources, conduct a study identifying the most energy-intensive agricultural water use, and make recommendations regarding the most cost-effective way to reduce GHG emissions by improving agricultural water use efficiency.

Emission Reduction Calculations and Assumptions:

1. Potential for Urban Water Efficiency Savings

DWR estimates potential reductions in urban water use of up to 3.1 million acre-feet (MAF) by 2030.[1] The analysis also noted that: advances in water-saving technology over the next 25 years, which the CBDA analysis did not evaluate, potentially could push savings beyond these levels. The Pacific Institute estimates potential reduction of 3.5 MAF below the DWR current trends scenario by 2030.[2] We estimate that the policies described above could accelerate the rate of savings and achieve savings of up to 3 MAF by 2020.

2. Energy Savings from Water Efficiency

According to research by the Public Interest Energy Research Program (PIER), the following table reflects the embedded energy, apart from end use, required for water in indoor and outdoor uses in Northern and Southern California.[3] The difference between indoor and outdoor water use in this table is attributable to wastewater treatment.

	Southern California	Northern California
Indoor water use (kWh / AF)	4,340	1,800
Outdoor water use (kWh / AF)	3,700	1,170

[1] California Department of Water Resources, *California Water Plan Update 2005: A Framework for Action*, Bulletin 160-05 (Sacramento, CA: 2005), Volume 2, p.22-4.
[2] Peter H. Gleick, et al. *California Water 2030: An Efficient Future* (Oakland, CA: September, 2005)
[3] Navigant Consulting, *Refining Estimates of Water Related Energy Use in California*, prepared for the California Energy Commission, Public Interest Energy Research Program (December, 2006) CEC 500-2006-118

The report further noted that energy applied in end uses—typically, pumping, and heating—accounts for more than 50 percent of the water-related energy consumption. That energy is not captured in the above table.

According to NRDC's *Energy Down the Drain* report, end use energy is conservatively estimated at 3,900 kWh/AF, which does not apply to outdoor use.

Total energy savings per acre foot, including end use energy, would be as follows:

	Southern California	Northern California
Indoor water use, including end use (kWh / AF)	8,240	5,700
Outdoor water use (kWh / AF)	3,700	1,170

There is some potential for double counting end-use energy savings between these water efficiency programs and the electric and natural gas utility energy efficiency programs (e.g., for showerheads, faucet aerators, clothes washers, etc.). However, we include the end-use energy savings because this proposal represents a significant ramp-up in water efficiency far beyond the savings the existing programs have captured.

Assuming that 2/3 of the water savings, or 2 MAF, occur in Southern California, and that 50% of the water savings across the state are from outdoor water use, the total electricity savings as a result of the water efficiency would be 15,375 GWh by 2020, broken down as follows.

	Southern California (kWh/AF)	Water Efficiency Savings (MAF)	Subtotal	**Northern California (kWh/AF)**	Water Efficiency Savings (MAF)	Subtotal
Indoor water use	8,240	x 1 MAF	= 8,240 GWh	5,700	x .5 MAF	= 2,850 GWh
Outdoor water use	3,700	x 1 MAF	= 3,700 GWh	1,170	x .5 MAF	= 585 GWh
	Subtotal So. Cal.		**11,940 GWh**	**Subtotal Northern Cal.**		**3,435 GWh**
	Total		**15,375 GWh**			

3. GHG Reductions from Energy Savings from Water Efficiency

The draft *Updated Macroeconomic Analysis of Climate Strategies Presented in the March 2006 Climate Action Team Report* provides standardized emission factors for electricity, including 313 kg CO_2e per MWh of electricity avoided.[4] As a result, the 15,375 GWh of electricity savings in 2020 from urban water efficiency would provide **4.8 million metric tons of CO_2e**.

These figures likely underestimate the true emissions reduction potential because they do not consider the energy required for new (marginal) water supplies, which tend to be more energy

[4] Climate Action Team Economics Subgroup, *Updated Macroeconomic Analysis of Climate Strategies Presented in the March 2006 Climate Action Team Report*, Public Review Draft, September 7, 2007.

intensive than existing supplies.[5] Also, energy savings and associated emission reductions could be even higher if these water use efficiency efforts focused on the most energy intensive sources of water supply.

Cost-Effectiveness Calculation and Assumptions:

According to DWR, urban efficiency costs range from $223 - $522/AF.[6] However, the DWR analysis did not include the per AF cost of achieving the full 3.1 MAF. Using an average cost of $370/AF, conserving 3 MAF would cost $1.1 billion. However, this is not the net cost. Avoided supply side alternatives are likely to cost from between $300-$1300/AF[7], with $600/AF a reasonable average. This would bring the total avoided costs to $1.8 billion. Therefore the water savings provide net economic savings to society, at **-$145 / metric ton CO_2**.[8] Savings could be further increased (and costs could be reduced) by adoption of efficiency standards and codes.

Implementation Barriers and Ways to Overcome Them:

Numerous studies have indicated the potential for saving millions of acre-feet of water through improving water use efficiency in California. Indeed, the State Water Plan indicates that urban water efficiency is the single most important tool for meeting California's future water needs. Yet the state is not on target to achieve those water savings. A recent analysis by the CALFED Bay-Delta program revealed that in the urban sector the voluntary process based on the Memorandum of Understanding Regarding Urban Water Conservation in California is not working as intended and its impact on urban water use remains well below its full potential." (CALFED Bay-Delta Program, Water Use Efficiency Comprehensive Evaluation, (Sacramento, CA: August 2006) p.3.)

California is an acknowledged leader in energy efficiency. To advance water efficiency in California into the 21st century, this proposal presents an approach modeled upon the state's remarkable success in energy efficiency. Successful implementation of this package of policies will require collaboration among CARB, SWRCB, DWR, CPUC, CEC, and the Legislature.

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[5] As noted by the PIER report: "When considering potential energy efficiency due to decreased water use, energy intensities related to the marginal water source are most appropriate. This is because decreased water use should result in a decrease in the last water source employed—generally the most expensive water source. Most analyses to date…have tended to consider this intra-marginal source of water as the marginal source of water. It is correct to consider the intra-marginal source as marginal if current demand conditions are sustained. Water demand, however, is rarely static or decreasing. Urban water demand, for example, is often directly related to population. If populations are increasing, which is the case in California, it is likely that water demand is also increasing. In this instance, gains in water efficiency are more likely to result in the ability to forestall implementation of the next available, or extra-marginal, water source." (Navigant Consulting, *Refining Estimates of Water Related Energy Use in California*, prepared for the California Energy Commission, Public Interest Energy Research Program (December, 2006) CEC 500-2006-118, p.9)

[6] Department of Water Resources, *California Water Plan Update*, Bulletin 160-05, Vol. 2, Chapter 22, p. 5.

[7] Water recycling cost range from $300- $1300/AF, from *Water Recycling 2030: Recommendations of California's Recycled Water Task Force*, June 2003; Seawater desalination costs for California are likely to be in the range of $1000/af or more, from Pacific Institute, *Desalination with a Grain of Salt: A California Perspective* (Oakland, CA: 2006) p. 39.; groundwater desalination $250-$500/AF, from Department of Water Resources, *California Water Plan Update*, Bulletin 160-05, Vol. 2, Chapter 6, p. 5..

[8] ($1.1 billion - $1.8 billion)/4.8 million tons CO_2e = -$145 / ton CO_2e.

Potential Impacts on Criteria and Toxic Pollutants:

The draft *Updated Macroeconomic Analysis of Climate Strategies Presented in the March 2006 Climate Action Team Report* provides standardized emission factors for criteria pollutants from electricity, which are indicative of the magnitude of emissions avoided. The report provides factors of 0.018 kg NO_x per MWh of electricity and 0.018 kg PM_{10} per MWh of electricity.[9] As a result, the 15,375 GWh of electricity savings in 2020 from urban water efficiency would provide emission reductions of **approximately 277 metric tons of NOx and approximately 277 metric tons of PM_{10}.**

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[9] Climate Action Team Economics Subgroup, *Updated Macroeconomic Analysis of Climate Strategies Presented in the March 2006 Climate Action Team Report*, Public Review Draft, September 7, 2007.