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A. Introduction

Alex-tronix has been designing and manufacturing irrigation controllers both for the agricultural and landscape industries since 1977. Our company mission is to design controllers that save water and energy in the simplest and most cost effective way possible. The U.S. Dept of Energy recognized our efforts and awarded Alex-Tronix a grant to continue developing these types of irrigation controls. The following comments and recommendations are based upon our company mission and in an effort to continue fulfilling the intent of the grant.

B. Answers to technical workshop questions of June 1, 2009

1. Water waste can be generally defined as irrigation water that does efficiently reach the plant root zone. Examples of waste are overwatering which causes runoff, watering past the root zone, overspray, broken or sprinklers or valves, and poor system design and installation. These factors contribute to the system inefficiency. A smart controller or smart add on device cannot address most of these inefficiencies, which typically account for at least 50% of the landscape water wasted.
2. A smart controller or smart add on device that can make existing conventional controllers smart can only address the remaining usable irrigation, typically 50% or less of all the landscape water used.
3. Definitions:
    a. A smart controller is one that can adjust its watering daily based upon current climatological conditions. It should not be limited to ET based controllers.
    b. Smart add on devices such as the Rain Bird ET Manager and the Alex-tronix Universal Smart Module can modify the outputs of existing controllers to simulate a smart controller.

c. A rain sensor can be generally classified as hygroscopic or a tipping bucket type, and can either be hard wired or wirelessly connected to the controller.
d. Moisture sensors are generally understood to be ground moisture sensors and one or more are strategically placed near the plant root zone to measure the soil moisture level and determine if irrigation is required.
e. An irrigation system should be defined as comprising the controller, valves, piping, and water delivery devices (sprinklers, rotors, drippers, etc…) and its design.

4. I am not qualified to answer hydraulic related questions. Sorry.
5. Same as 4
6. We should have some measure of determining the amount of energy saved in pumping water and add to it the ensuing cost of maintenance, treatment, and delivery. The savings of postponing the cost of infrastructure upgrading the pumping, treatment, and delivery should also be incorporated into this measurement.
7. Please define existing (non smart) controllers as conventional controllers and not dumb controllers. The performance standard should be: can a controller or add on device automatically adjust itself or the conventional controller it is attached to daily adjust the watering schedule of the controller based upon the current environmental conditions and the time of the year? This differentiates a conventional controller from a smart controller
8. A smart controller can improve the efficiency of root zone water delivery and minimize runoff. To further improve system efficiency, the system design, including operating pressure, pipe sizing, sprinkler coverage and efficiency, and valves must be modified. In addition, the system must be properly monitored and maintained.
9. There are two ways to make the automation smart: Use a self contained smart controller, or add a device. In general, an add on attached to a conventional controller that modifies its output to

satisfy the SWAT test should be compatible with all existing controllers.

10. Exaggerated claims are common place by manufacturers. Realistically, it is very possible to obtain at least 10% savings up to 25% savings in water consumption under normal operation (not installed, programmed, and supervised by professional personnel). Professional water audits, installation and programming and the use of a rain switch is required to obtain the higher range of the 25% savings.
11. Labeling should include a SWAT rating-10 for 100% adequacy and efficiency, 9 for an average of 98% or higher of average adequacy and efficiency, 8 for 96%-98% average, 7 for 94%, or some such rating. The EPA will come out with its own Water sense labeling. Example: SWAT efficiency 9. A second rating could include a cost factor combined with a simplicity factor. For example for a unit cost under $100, with less than 3 steps of programming and installation with no service fees, an "A rating" is awarded. Having a service fee drops it to a B rating, More than 5 steps drops it an additional rating, going over $100 up to $200 drops it another rating. So for example, a unit that costs $225 with 5 steps programming and no monthly fee makes it a "C" rating. Combining this with a 98% SWAT rating makes the overall rating "9C". We may call this Swat tested, programmed and installed rating as "SWATED 9C". A "SWATED 10A" would be the highest possible rating.
12. The independent SWAT testing and posting of results on the Irrigation Association site should be adequate evidence. Valves, rotors, emitters, and rain sensor testing protocols are being developed.
13. The difference of energy used by a conventional controller versus a smart controller is insignificant, with both operating the same solenoid operated 24 VAC valves. The differences of energy are due to environmental sensor current draw, power required for wireless data reception, and the type of transformer being used. The smart

controllers which are more expensive tend to use larger transformers. The power saved with reduced pumping with resulting decreased maintenance, water treatment, piping and generally reduced infrastructure upgrading costs are far more significant. I am no expert on this matter, but I recommend that the water and energy saved and the treatment and infrastructure cost savings should be quantified in a dual indication. For example, if 2000 acre feet of water are saved annually resulting in a reduced pumping energy of 3 megawatts, this could be reported as a 2/3 figure (in thousands of acre feet and megawatts). The infrastructure and labor cost savings could be quantified and expressed in millions of dollars saved. If an estimated 1.5 million dollars is saved over a baseline year for each locality from maintenance, treatment, or infrastructure improvements, the resulting rating could be something like 2/3/1.5. Note: these figures are for demonstration only and not meant to represent an actual or realistic result. The three figures could be added together to see if they meet a minimum statewide standard. This approach needs to be explored for practicality.

14. A conventional controller expected lifespan of a commercial irrigation controller is generally considered to be 10-15 years. Retail types of residential controllers (economy models) are probably in the 5-10 year range if mounted indoors. A controller mounted Outdoors with more severe environment, in a more rugged plastic housing than indoor units, but subject to vandalism, lifespan could be 5-7 years. There is no reason to think that smart controllers should have shorter life spans unless it has a nearby mounted weather station which is much more exposed to vandalism and malfunction. A smart controller with a weather station list price can be in the range of $300 to more than a thousand dollar. I recommend you look at the Bureau of Water Reclamation report on all available smart controllers and moisture sensors for a complete listing of features, functions, and cost. An updated report will be available this fall.

15. Enforcement of the sale of compliant equipment after Jan 1 2012 should be done in two ways: Sampled visual inspection of irrigation controllers or sensors sold in retail stores (Home Depot, Lowe's, Ace Hardware, etc…) and a sampled inspection at wholesale distributors shelves such as Ewing, John Deere, etc… Fines could be imposed for stocking non-compliant products. I do not agree with this type of police action, but this would be the only way. Installation of prohibited products would be more difficult if the non compliant devices are purchased through the internet or from outside California. This may lead to a black market industry of landscape contractors purchasing devices from the internet or from outside California and privately installing them at a cost lower than the higher cost smart controllers.
16. Not qualified to answer this question.
17. Twice a year starting with 2012, request the retail stores and wholesale distributors to report the sale of smart controllers, add on devices, and soil moisture sensors. This will serve two purposes: To insure that the outlets are selling the smart devices, and secondly to see the periodic increase of sales because unless there are many new housing developments, most sales and installations of smart devices will take place when the existing controllers are no longer working. Most homeowners would rather not spend the money for a new system they do not understand, cannot program and do not trust, and do not want to pay a monthly service fee. Landscape contractors will reluctantly begin to install these smart controllers because of the training required to learn the dozens of new smart controllers on the market. Their personnel turnover rates will not encourage them to train their people so they can go to another competitor landscape firm with this free training. In addition, contractors will not want the call backs to reprogram or re explain the operation of the controllers to the homeowners.

C. PERSONAL OBVERSATIONS, COMMENTS, AND RECOMMENDATIONS

1. As stated earlier, I strongly support saving water and energy in the simplest and most effective way in the irrigation industry.
2. I believe that landscape irrigation should do its share to help conserve water.
3. I support the IA and SWAT committee's commitment to conserve water for landscaping
4. I also believe that the SWAT testing protocols are the best methods that we currently have to provide a standard by which the EPA, DWR, and our industry have by which water conservation potential is based.
5. Smart controllers should not be referred to exclusively mean ET controllers. The IA definition that smart controllers are climatologically based is acceptable. Smart technology should not be limited to ET based controllers.
6. Implementation of bill 1881 should not be limited to smart controllers. Add on devices that are SWAT tested and are capable of making existing conventional controllers smart should be allowed for sale. Otherwise, most if not all controllers require add on devices to make them smart. For example, the Rain Bird ET manager is an add on device, the Hunter ET System requires a separately purchased weather station and module to make the Hunter controllers smart, the Hunter Solar Sync is an add on device that makes their controllers smart, the Weather Matic Smart Line requires the purchase of an add on weather station to make it smart, rain switches help to make controllers smart, ground moisture sensors are technically add ons that make controllers smart. Finally, even controllers such as the Hydro-Point and its Toro and IrriTrol counterparts require wireless ET data transmission to make them smart. These add ons which work either with just certain models or universally with any model should be included as allowed to be sold after Jan 2012. Otherwise, technically, no product will technically qualify as a self contained smart controller.

7. Battery powered irrigation controllers comprise about 10% of all controllers sold in the U.S. These used to account for approximately 150,000 units a year, most of which would be valve box battery powered controllers. No manufacturer is, to my knowledge, making them smart. Most of these units are generally very inexpensive and making them smart would require wireless weather station transmission which will more than double the cost over existing valve box controllers. In addition, due to the limited amount of battery power available for the controllers, it may not be practical to have a wireless receiver in the controller. It is also difficult to transmit wireless data more than 100 feet to a controller mounted below ground level, which would limit the distance that the weather station could be placed. The prospect of frequently replacing batteries in the valve box installed controllers is not appealing to many users and these issues need to be considered before issuing an edict that includes replacing battery powered controllers with smart valve box battery powered controllers.
8. There is a basic incompatibility between smart water application and limited landscape watering schedules as was recently imposed by LAWP and other water districts in the state. A smart controller accumulates either ET or an equivalent to ET until a calculated threshold is reached and then allows irrigation to occur to refill the depleted landscape plant root zone. This may occur during a non-watering day. In the case of the LAWP, with only Mondays and Thursdays as allowed watering days, further limited during certain times of those two days during the summer, it is likely that the ET based watering day may fall several times a month on a non watering day during the summer, thereby severely underwatering the landscape. This will most likely result in loss of all the landscaping. The probable solution for individual homeowners will be to disable the smart controller and use it as a conventional controller an water several times a day on the allowed day to compensate for the restricted watering days. This will make extremely likely that

overwatering will occur with the water going past the root zone, with probable significant runoff. The net result will be to not save any water. In addition, this will significantly increase the pumping load in that all customers will turn on their irrigation system on the same day and likely at the same time of day if the watering is limited to certain hours of the day. This increased pumping and delivery load will lower available water pressure, resulting in under coverage, thereby decreasing the system efficiency further. Because smart controllers have not been readily accepted for the last three years of education and rebate programs, LAWP has resorted to these measures to conserve water. While MWD has not adopted these measures, may California water districts are considering water restriction measures which may not be consistent with the smart controller approach. I believe that there are two ways to save water: With Smart technology, or through rationing, but not both at the same time unless the customer is offered an option to go with either way. The Southern Nevada Water Authority (SNWA) tried rebate programs for over two years with only 35 smart controllers rebated out of a possible 500,000 potential users in Clark County. The SNWA is now evaluating the use of a lockout timer to automate their mandatory watering schedules as an alternative to smart technology. With 600 add ons installed, initial indications are that compliance with their mandatory watering schedules went from 20% to 80% with the Alex-Tronix proposed approach. SNWA projects a 10% water saving with adherence to their watering schedules, or about 33,000 acre feet. I strongly urge the committee and DWR to consider this information in their implementation of 1881 and its consequences. I therefore recommend that municipally mandated watering schedules and smart controller use not be implemented simultaneously.

9. The following analysis is meant to be a realistic calculation as to how much of the total water used by California can be saved with smart controllers in order that the California Energy Commission, the DWR, and the EPA be not disappointed by the massive industry efforts taken

by the irrigation industry. A cost estimate is also provided for conversion to smart controllers throughout California.

a. According to the 2005 California Water Plan Update, the state uses a total of 79.5 million acre feet (Maf) of water annually. Of this amount, 36.9 Maf (46.4%) is for environmental purposes, 33.8 Maf (42.5%) is used by agriculture, and 8.8 Maf (11%) is for urban use.
b. Urban requirements use are for residential (70%), commercial, and industrial needs. Of the residential, 55% is for outdoor use, of which approximately 90% is for landscaping. Therefore, 8.8 Maf x 70% x 55% x 90% = 3.05 Maf is the total landscape irrigation usage.
c. An average existing irrigation system may be typically 50% efficient. This may be due to poor design or installation, un-maintained sprinklers or valves, or deficient water pressure.
d. A smart controller by itself cannot improve the hydraulic system design, installation, water pressure, or poor maintenance. Hence it can only improve upon the remaining 50% of irrigation.
e. According to the report submitted by Aquacraft at the June 1, 2009 Energy Commission meeting, a study of 3112 smart controllers located throughout California accounted for an overall water saving of 14.5%. Some other studies have reported somewhat higher water savings. If we assume an overall average water saving of 18% with smart controllers. The potential water savings that can be attributed to the use of smart controllers can be calculated as 3.05 Maf total landscape water use x 50% smart controller manageable irrigation efficiency x 18% average reported water savings=.2745 Maf.
f. The total potential water savings possible with smart controllers assumes that all existing residential controllers in California are converted to a smart controllers-possibly 6

million units. This .2745 Maf maximum saving is .34% of all the water used by the state.

g. The Laird bill projected to be in effect on January 1, 2012 only requires that new sales an installations after that date must be of a compliant water saving type (presumably smart). It will probably take 5-10 years to completely convert the state to smart controllers. Therefore it is likely that no more than 20% of the existing conventional controllers will be converted to smart controllers by the end of 2012. This will further reduce the maximum possible water savings of .2745 Maf.
h. Finally, it is not likely that for a variety of reasons, those who do convert will not continue using the controllers as smart controllers. Difficulty in programming and unwillingness to continue paying monthly ET service fees may be the reasons.
i. A smart ET based controller will accumulate ET until it determines that the plant root zone needs watering. This
j. It is estimated that the average retail cost of a residential smart controller will average to $200 a unit by 2012. In addition to that cost, most homeowners will need installation and programming assistance, (most controllers will require a weather station or a monthly service fee) and a water landscape audit to determine the sprinkler precipitation rates, soil type, crop coefficient factor, and slope of the landscape. With a total average cost of $500 per unit, the total cost to convert 6 million controllers will be about 3 billion dollars. This cost will eventually be borne by taxpayers in either tax increases, bonds, or raised water fees, or the actual purchase of the controllers themselves. With an estimated optimistic conversion of 20% by the end of 2012, the realistic water savings in the next 3 ½ years will be .2745 x 20% conversion x 60% continued use after 1 year (some discontinuation due to monthly fees, some due to complexity, some due to incompatibility to watering schedules) =.033 Maf.

k. The question becomes: Do we want to spend 3 billion dollars to save .033 Maf of water statewide in the next 3 ½ years?
l. I have recommendations related to this issue, but that is not a matter being considered by the California Energy Commission.
m. My commitment to water conservation in the most efficient and cost effective manner and my commitment to DOE required me to make this reality check. I hope I can be proven wrong in my calculations.