

Educational techniques to reduce outdoor water use

Introduction: About 30 percent of the total water used by each family in the US is devoted to outdoor water use, most of it is dedicated to watering the lawn, some experts estimate that up to 50 percent of water used for irrigation is wasted due to evaporation, wind, or runoff caused by overwatering¹.

This added to the growing population is increasing the demands in water supplies in everywhere, increasing the efficiency in urban water use is crucial to secure the availability of water for the future generations.

Promote outdoor efficiency use is a challenging activity since this consumption is not based in human needs but in preferences². Educational techniques affect the consumption by changing the behavior of consumers as they find out more about water resources and better ways to use it.

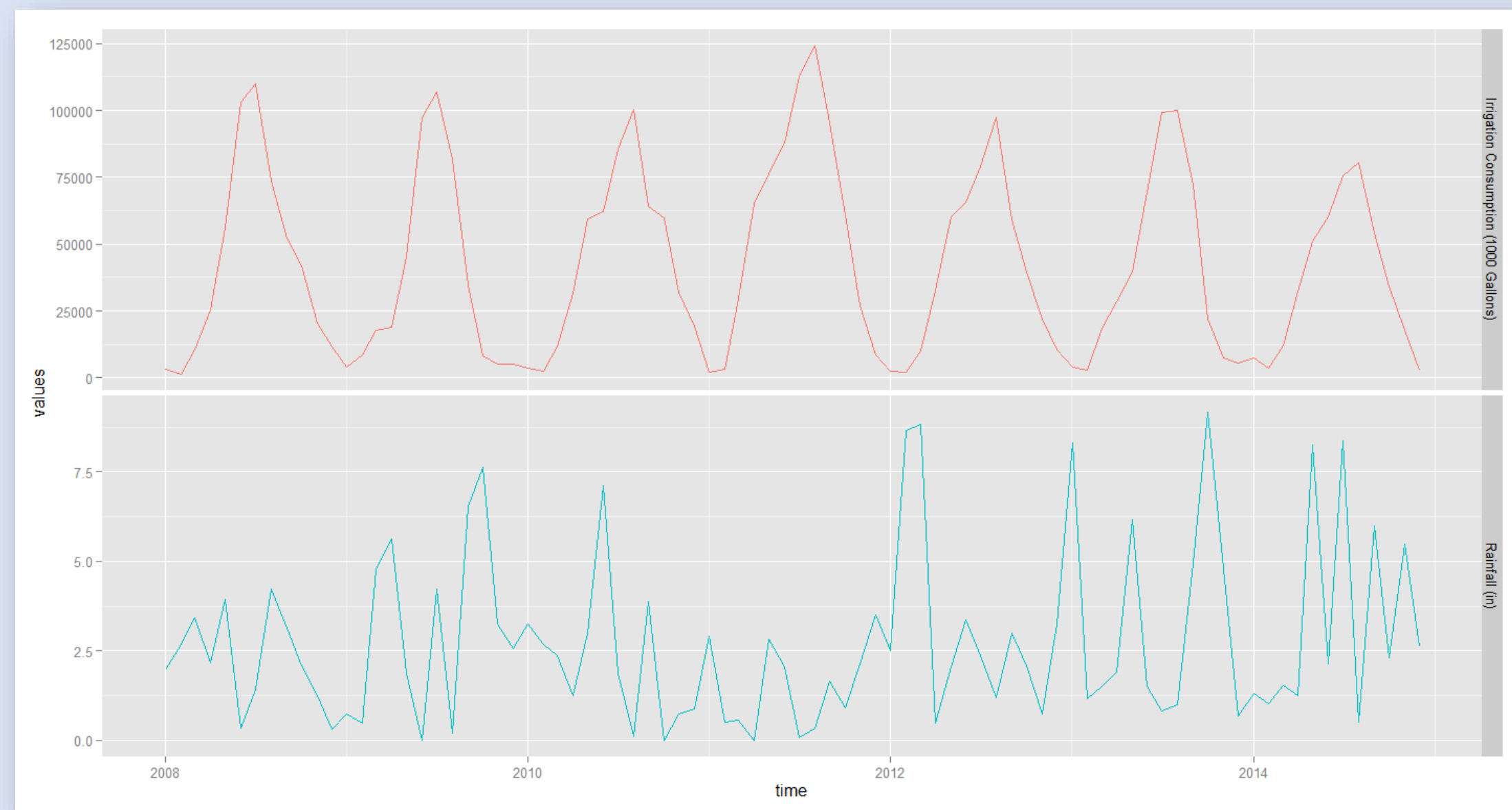


Figure 1. Irrigation water consumption in 10³ gallons (red) for the selected landowners and rainfall (inches) in college station (blue) for 2008-2014.

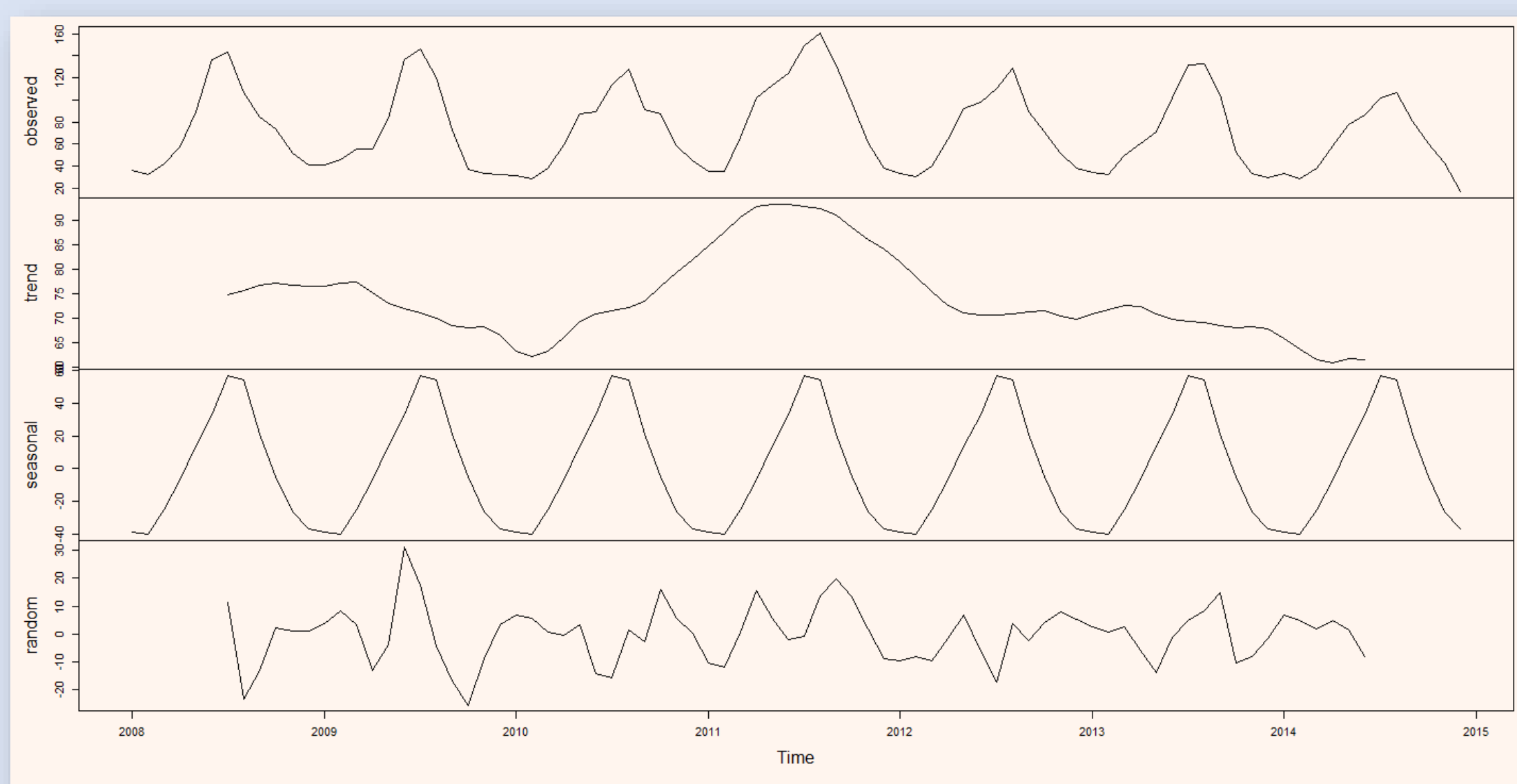


Figure 2. Decomposition of the total water consumption for the 5565 selected homeowners. (10⁶ gallons)

Methodology: A water budget (eq. 1) is an accounting of the water that flow into and out an area, it was originally used to compute the irrigation requirements for crops, in this case the water budget is computed to determine the landscape needs of a household.

$$Q_{IR}(t) = cA_{irr} (k_c ET_0(t) - P(t))^3 \quad (1)$$

Where;

$Q_{IR}(t)$ is the water budget volume for month t ,
 c is a conversion factor to volumetric units,
 A_{irr} is the irrigable landscape area,
 k_c is the crop coefficient. (0.65 for St. Augustine grass)
 ET_0 is the average monthly evapotranspiration, and
 P is the cumulative precipitation.

Major water users were identified by selecting those with total consumption greater than 100000 gallons during the peak grow period between the April and September, 5565 single family households meet that criteria and their consumption represent approximately 30% of the city residential demand, over 85000 residents.

Some of the strategies applied in the city of College Station to reduce outdoor water use are;

- Offering free irrigation audits or “checkups” This plan initiated in 2010, focused in those large consumers, teaching when to water, how much and for how long (Figure 3), also looking for problems with the irrigation systems.
- Water budgets. Figure 4.
- Weekly suggestions. Figure 3.

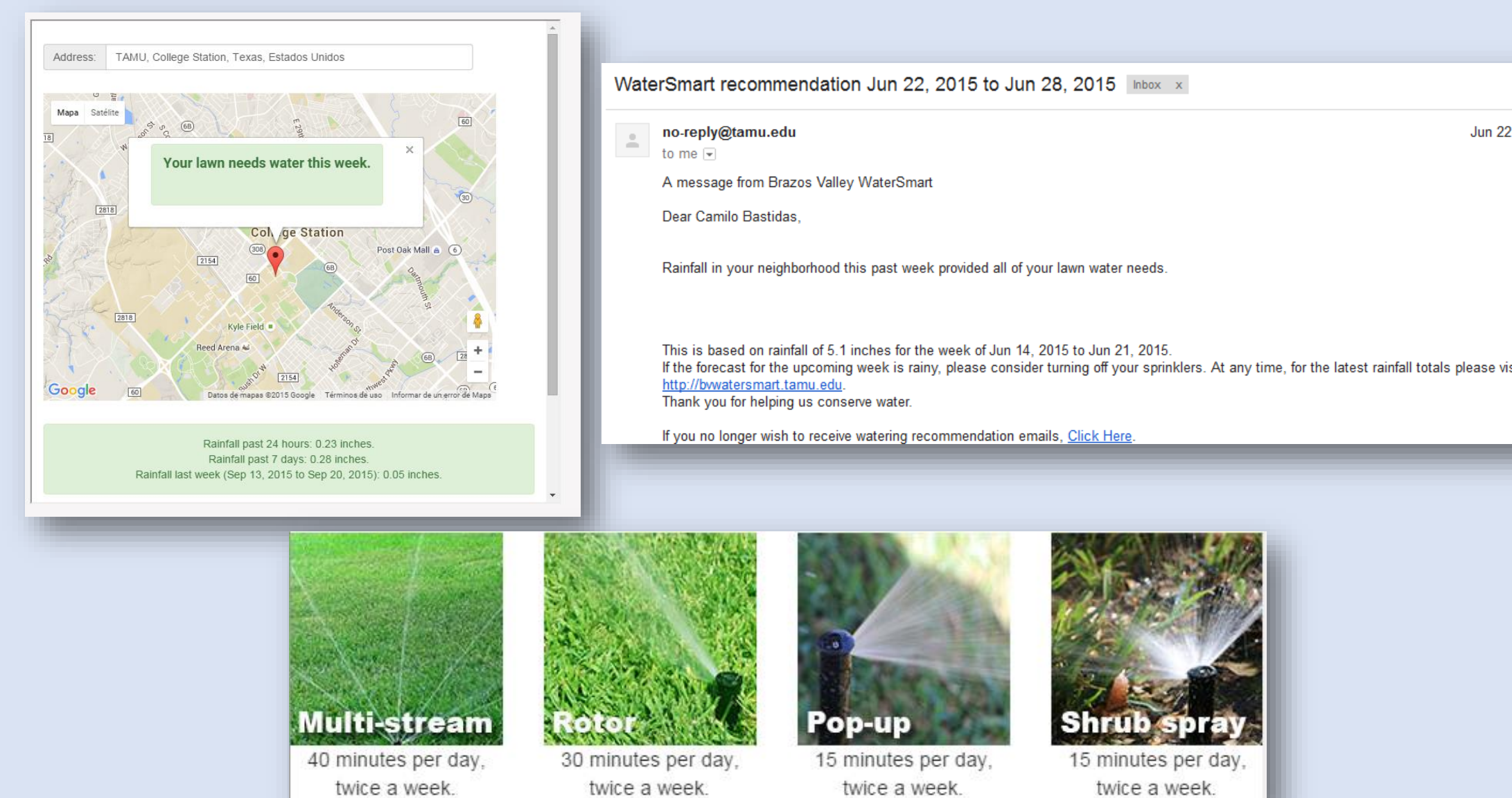


Figure 3. Weekly recommendations from the new educational initiative started in 2015.

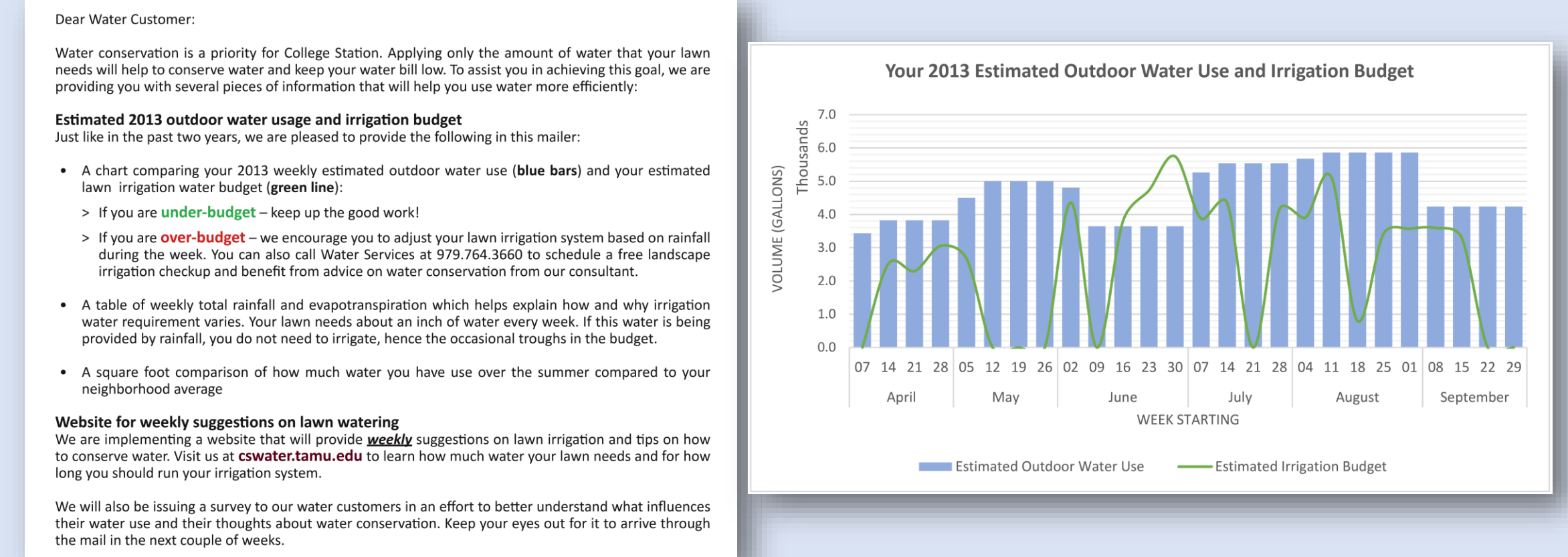


Figure 4. Water Budget samples.

Findings: Common system problems can be observed in figure 5. By analyzing the data we can observe a low correlation between rainfall and irrigation consumption in most cases, this indicates that most customers set the system and let it run regardless the rainfall events, which can be evident by looking at figure 1, however in more than 20% of the cases there is a positive change in this practice by 2014.

The total annual water use trend is downward in Figure 2 (it was affected by the drought of 2011), this can be an indicator that the educational efforts are having effect. The weekly notification program has started this year and the results will be evaluated by the end of the irrigation period. We can observe that the seasonal factor is driven by outdoor water use during the period from April to September in which the monthly total consumption can be more than double the value of the months with the lowest water use.

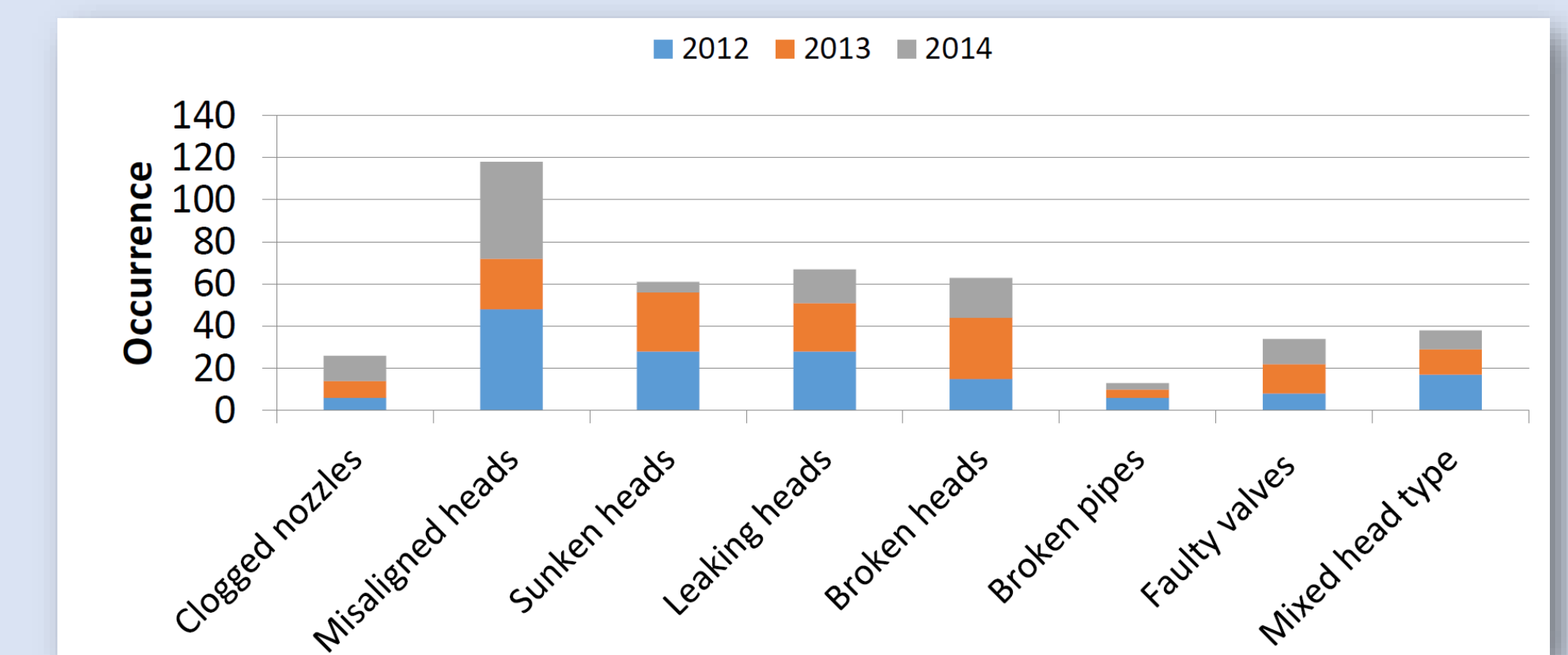


Figure 5. Common System Hardware Problems⁴.

References:

- ¹ The Saving Water Partnership “Water Efficient Irrigation Study: Final Report.” EPA. May 2003
- ² Kjelgren, R., Rupp, L., and Kilgren, D. (2000). “Water conservation in urban landscapes.” Hortscience, 35(6), 1037-1040.
- ³ Christopher, A (2014). “Assessing urban residential irrigation performance”.
- ⁴ David W. Smith. Characterization of Residential Irrigation Management in College Station, Texas (2012-2014).