

Water Savings Models for Utilities with Permanent Twice Weekly Watering Schedules

Developed by Heather Rose, Fall 2019

Water saving by lowering single family GPCD with reduction in irrigation demand.

A new SF gpcd was created based on estimating the reduced irrigation demand for single family homes if a year-round twice weekly permanent watering schedule were enforced by the utility. This was considered to be the utility's current SF gpcd's minus the fraction of outdoor water demand that would be reduced due to the watering schedule multiplied by a compliance factor.

See Equation 1 below for reduced SF gpcd calculation:

$$SF_{GPCD_{reduced}} = SF_{GPCD_{avg}} - \left[\left(SF_{GPCD_{avg}} - GPCD_{indoor} \right) \times \left(F_{reduction} \times C_f \right) \right] \quad (\text{Eq.1})$$

Terms

$SF_{GPCD_{avg}}$ = Average Single Family GPCD for the utility.

Data taken from TWDB Survey for Water User Groups

$$GPCD_{indoor} = \frac{137.7 \frac{\text{gal}}{\text{house,day}} (\text{DeOreo 2016})}{2.63 \frac{\text{capita}}{\text{house}} (\text{US Census Bureau 2019})} = 52.36 \text{ gallons per person per day for indoor water use}$$

$F_{reduction}$ = Fraction of reduction in irrigation events.

Assuming an average 3 waterings per week reduced to two, $F_{reduction} = 1/3$

C_f = Compliance Factor, Percent of Connections in compliance with ordinance, set to 50%

Projected Savings:

To estimate projected water savings, water demand forecasts can be created for years 2020, 2030, 2040, 2050 and 2060 based on each water user groups' average single family GPCD, and population projections for those years available on the TWDB website. The first forecast is based on a base case water demand with no enforced watering schedule. The second forecast is created based on the reduced gpcd if a twice weekly permanent watering schedule were enforced. The forecasted water savings is considered to be the difference between these two water demand scenarios. The total forecasted base case demand, reduced demand and water savings is the sum of forecasts for all water user groups.

Equation 2 below shows the calculation for forecasted demand base case for the utility with their current SF gpcd:

$$SF_{WU_basecase_i} \left(\frac{af}{yr} \right) = SF_{GPCD_{avg}} \times P_i \times \frac{365 \text{ days}}{\text{year}} \times \frac{1 \text{ af}}{325,851 \text{ gallons}}, \text{ for } i\text{th year} \quad (\text{Eq. 2})$$

Equation 3 below shows the calculation for forecasted reduced demand the utility with an enforced watering schedule:

$$SF_{WU_reduced_i} \left(\frac{af}{yr} \right) = SF_{GPCD_{reduced}} \times P_i \times \frac{365 \text{ days}}{\text{year}} \times \frac{1 \text{ af}}{325,851 \text{ gallons}}, \text{ for } i\text{th year} \quad (\text{Eq. 3})$$

Equation 4 below shows the projected water savings for the utility with an enforced watering schedule:

$$\text{Water Savings}_i \left(\frac{af}{yr} \right) = SF_{WU_basecase_i} - SF_{WU_reduced_i}, \text{ for } i\text{th year} \quad (\text{Eq.4})$$

Terms

$SF_{GPCD_{avg}}$ = Avereage Single Family GPCD for the utility.

P_i = Population of utility for *i*th year , available on Texas Water Development Board website

The total forecasted demand was considered to be the sum of the forecasted base case demands, reduced demands, and water savings for all utilities. Equations 5, 6, and 7 below show this calculation.

$$\text{Total Base Case Demand}_i \left(\frac{af}{yr} \right) = \sum_1^n WUGs [SF_{WU_basecase_i}], \text{ for } i\text{th year} \quad (\text{Eq. 5})$$

$$\text{Total Reduced Demand}_i \left(\frac{af}{yr} \right) = \sum_1^n WUGs [SF_{WU_reduced_i}], \text{ for } i\text{th year} \quad (\text{Eq. 6})$$

$$\text{Total Water Savings}_i \left(\frac{af}{yr} \right) = \sum_1^n WUGs [SF_{WU_basecase_i} - SF_{WU_reduced_i}], \text{ for } i\text{th year} \quad (\text{Eq. 7})$$

Note:

Utilities with a single family gallons per capita per day less than 60 gpcd should be omitted as these homes are likely not irrigating.

Resources

DeOreo, William (2016). *Residential End Uses of Water*. Water Research Foundation.

Available at: <http://www.waterrf.org/Pages/Projects.aspx?PID=4309>

Texas Demographic Center (2019). *Texas Population Projections 2010 to 2050*.

Available at:

https://demographics.texas.gov/Resources/publications/2019/20190128_PopProjectionsBrief.pdf

Texas Water Development Board (2019). *Population and Water Demand Projections*.

<http://www.twdb.texas.gov/waterplanning/data/projections/index.asp>

Texas Water Development Board (2019). *Regional Water Planning Data*.

<https://www.twdb.texas.gov/waterplanning/data/rwp-database/index.asp>

US Census Bureau (2019)

<https://www.census.gov/quickfacts/fact/table/US/HCN010212>