WaterSense® Water Budget Approach

The *WaterSense New Home Specification* defines the criteria a home must meet in order to earn the WaterSense label. It addresses indoor water use, outdoor water use, and homeowner education.

To meet the specification's Landscape Design Criteria (Section 4.1.1), the builder must design the landscaped area using the WaterSense Water Budget Tool. The Water Budget Tool guides the builder, landscape professional, or irrigation professional certified by a WaterSense labeled program[1] through the water budget calculations. This document provides an overview of the tool, as well as detailed instructions for using the tool. The builder shall submit a copy of the completed Excel tool or a copy of the Water Budget Tool Report generated by the Web-based version of the tool as part of the inspection package.

I. Background

The water budget approach serves as a design tool, allowing the professional to design a sustainable landscape based on a regionally appropriate amount of water. A water budget is a site-specific method of calculating an allowable amount of water to be used by the landscape and then designing the landscape to meet this budget. The budget takes into account plant type, plant water needs, irrigation system design, and applied water that the landscape receives either by irrigation or by precipitation, as described in detail below. Water budgets must be associated with a specified amount of time, such as a week, month, or year.

The tool, available both online and as a Microsoft Excel spreadsheet format on the WaterSense website, guides the user through the water budget calculation in three parts. First, the tool calculates the amount of water a standard landscape would require and the amount of water the designed landscape is allowed in order to be considered water-efficient. Next, the tool calculates how much water the designed landscape requires based on climate, plant type, and irrigation system design. Lastly, it determines whether the designed landscape meets EPA's criteria.

The WaterSense program considers two major factors when designing specifications for water efficiency: water use and performance. In order to be eligible for labeling, products must use less water while performing as well as or better than conventional models. Performance of a landscape can be judged by the presence of healthy plants and the ability to meet user expectations for both functionality and aesthetic effects. It is important to ensure that every plant can have access to the water it needs or it will affect both aspects of the performance concerns—the health of the plant and the aesthetic quality of the landscape. For purposes of the specification, it was determined that a performance-based approach to compliance, i.e., designating a water allotment and allowing the landscape designer to meet it in any number of ways, would allow the most flexibility and ease of meeting the criteria. The allotment approach means that the builder or landscape professional must put thought into the landscape plan. This

[1] An irrigation professional certified by a WaterSense labeled program (i.e., certified irrigation professional) has demonstrated an expertise in water-efficient irrigation technology and techniques. A listing of eligible certified irrigation professionals can be found by visiting WaterSense's Directory of Certified Professionals.

is likely to lead to a landscape that has more "curb appeal" and increases the value of the home, benefiting both the environment and the homeowner.

WaterSense chose a well-maintained lawn composed entirely of cool season turfgrass as the baseline, or conventional, model and a 30 percent reduction in associated water use as the reduction that would result in water efficiency. This does not mean that WaterSense believes a lawn should be watered with 70 percent of the water it requires, but that a plant mix should be selected that would use 30 percent less water than a landscape composed entirely of turf. The data used to calculate water use, discussed below, is modeled across the entire United States by zip code, resulting in site-specific allotments. Therefore, while everyone must achieve the same minimum percentage reduction, the actual requirement, in gallons of water, varies greatly based on what is appropriate for each region. Additionally, the data are conservative in nature in order to result in a landscape capable of withstanding the most challenging months of the year.

Data

The tool requires two climate-based inputs in addition to the types of vegetation planted and the types of irrigation equipment installed. These two climate-based inputs are local reference evapotranspiration (ET_o) and rainfall. In order to make an easy-to-use tool, it was imperative to have a standardized set of data that covered the entire country. While there are numerous local sources of rainfall data, local ET_o, data sets are scarce. However, the International Water Management Institute (IWMI) produced a World Water and Climate Atlas (www.iwmi.cgiar.org/WAtlas/Default.aspx) that used 1961–1990 weather station data across the world to model monthly summary data for a number of parameters, including standardized Penman-Monteith reference evapotranspiration rates. The U.S. data were extracted and summarized with an average value for each zip code using ESRI ArcGIS version 9.3.[2] In order to be consistent, both in terms of actual data and the process used to model it, WaterSense also extracted the 1961–1990 precipitation data to create the Water Budget Data Finder. After the user enters a zip code, the Water Budget Data Finder displays the peak watering month, associated ET_o, and associated rainfall amounts for that zip code. Builders must use the values provided by the Water Budget Data Finder in the WaterSense Water Budget Tool.

WaterSense designated the peak watering month to be the month when ET_o exceeds precipitation by the greatest amount. This month was chosen because it identifies the month during which the landscape will require the most supplemental irrigation. For locations where precipitation always exceeds ET_o, the peak watering month is the month with the highest ET_o.

The tool also requires the use of a landscape coefficient for each category of vegetation planted. Theoretically, these coefficients reduce ET_o by a percentage, based on species type, to portray the water needs of each plant. While extensive research has been conducted on the water needs of various types of turfgrasses, very little data exists on the water needs of other vegetation, including groundcovers, shrubs, and trees. Additionally, the landscape coefficient varies depending on location, meaning that the available data cannot automatically be ascribed to the same species in different regions. However, vegetation can be described in broad categories as high water-using, medium water-using, or low water-using. In order to make a functional tool, WaterSense has assigned relative factors to each category within the broad plant types: trees, shrubs, groundcover, and turfgrass. The coefficients chosen were based on

[2] More information on this process is available at: www.epa.gov/watersense/nhspecs/wb_data_finder.html.

research done in California and are also used by the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED®) for Homes Rating System (2008). As better data become available nationwide, WaterSense intends to revise the tool to incorporate these advances.

Appropriate Uses of the Tool

As discussed, the data chosen for the tool represent conservative estimates for the major variables included in the tool. Additionally, generalizations and assumptions were made in order to simplify the tool and make it applicable nationwide. The tool functions well for its intended purpose of promoting a conservative landscape design. However, it should not be used to determine irrigation scheduling amounts, as it would likely result in the over-application of water. Local sources of real-time data are more appropriate for this purpose.

Explanation of Calculations

Baseline

In order to determine which landscapes are water-efficient, there must be a standard against which to judge water use. The Water Budget Tool set the baseline amount of water at the amount of water required by a site if the landscaped area is watered at 100 percent of local reference evapotranspiration (ET_o). ET_o is representative of the amount of water lost from a well-maintained expanse of average-height green grass and the surrounding soil.[3] It varies by region, depending on the amount of sun, wind, humidity, and temperature at a location. Hot, dry, and windy locations have higher ET_o values than cool, humid locations. As explained above, this tool uses data based on 30-year historical averages for these variables.

Equation 1: Baseline

$$Baseline = ET_o \times A \times C_u$$

Where:
ET_o = Local reference evapotranspiration (inches/month)
A = Landscaped area (square feet)
C_u = Conversion factor (0.6233 for results in gallons/month)

Landscape Water Allowance

The landscape water allowance (LWA) is the amount of supplemental water allotted for the designed landscape. For purposes of the specification, the LWA is 70 percent of the baseline amount of water that would be needed if the entire landscape was covered by a well-maintained expanse of average-height green grass.

The water budget method assumes that all plants will require some amount of supplemental water. EPA has assumed that a landscape will have a variety of vegetation that have different

[3] Irmak, S. and D. Haman. 2003. "ABE 343: Evapotranspiration: Potential or Reference?" Agricultural and Biological Engineering Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida.

water needs and that none of the vegetation in a residential landscape will need 100 percent of ET_o. Thus, the allotment can be met by incorporating a mixture of high, medium, and low water-using plants in the design of the landscape. The LWA does not mean that each plant is only given 70 percent of the water it needs to survive.

Equation 2: Landscape Water Allowance

$$LWA = 0.70 \times Baseline$$

Where:
LWA = Landscape water allowance (gallons/month)

Landscape Water Requirement

The landscape water requirement (LWR) is the amount of supplemental water required by the design of the established landscape. The LWR is calculated by dividing the landscape into hydrozones, determining the LWR for each hydrozone, and then adding these totals together. Separate hydrozones should be calculated for each category of vegetation planted (trees, shrubs, groundcover, turfgrass). Additional hydrozones should be calculated within vegetation categories if different types of irrigation equipment are used on the same type of planting.

The LWR is based on ET_o, the landscape coefficient, the area of the hydrozone, the lower quarter distribution uniformity (DU_{LQ}) of the associated type of irrigation equipment, and a portion of local rainfall designated as allowable rainfall (R_a). The landscape coefficient (K_L) is a factor used to modify ET_o that factors in the different vegetation species planted (the species factor [K_s]); the conditions at the location where vegetation is planted, such as the amount of sun and wind (the microclimate factor [K_{mc}]); and how closely the plants are grouped together (the density factor [K_d]). $K_L = K_s \times K_{mc} \times K_d$. Both K_d and K_{mc} range from 0.5 to 1.4, therefore, for the purposes of this tool, WaterSense is assuming K_d and K_{mc} are both approximately equal to 1.0 (their average values) to reduce the complexity of the calculations and simplify the equation to $K_L = K_S$.

The first step of calculating the LWR for a hydrozone consists of modifying ET_o according to plant type. Since ET_o is based on the water requirements of a high water-using grass, relative percentages of ET_o are set as the requirements for different categories of vegetation. Low water-using plants, such as a native groundcover, require a much lower percentage of ET_o than a high water-using tree, such as a fruit tree. As explained above, the percentages used to modify ET_o in the tool are not exact determinations of the water requirements of specific plantings, but are relative percentages based on a limited amount of data compiled on the water use of vegetation in California. Pools, spas, and ornamental water features are assigned the same coefficient as high water-using turfgrass to account for the high amount of evaporation expected from these features.

After ET_o is modified to account for vegetation type, the LWR is further reduced by the amount of water that can be supplied by precipitation. For the purposes of this tool, WaterSense is allowing 25 percent of the 30-year historical average rainfall to be counted toward a plant's needs. Some portion of each rain event cannot be used by plants, such as rain that falls in short, extreme bursts and washes away before infiltrating the soil. Estimates of the amount that is useful to plants, commonly referred to as "effective rainfall," vary depending on a number of

factors but is often considered to be approximately 50 percent.[4] The rainfall allowance in this tool is a fraction of effective rainfall and leads to a more conservative landscape design. This landscape design will be more resilient in drier-than-average years or periods of unexpected drought.

Irrigation systems rarely water plants with 100 percent efficiency. For example, water sprayed from nozzles can be affected by moderate amounts of wind and the shape of a landscape design may not match the pattern in which water is distributed. This results in some areas of the landscape receiving less water than the rest of the landscape. To avoid patches of wilted vegetation, irrigation systems are scheduled to deliver more water than the amount required based solely on the type of vegetation. This tool modifies the LWR using average lower-quarter distribution uniformity (DU_{LQ}) values for each type of irrigation equipment. Distribution uniformity is the measure of uniformity of irrigation water applied over an area. DU_{LQ} is the ratio of the average of the lowest 25 percent of measurements to the overall average measurement. This is in excess of what would typically be required when scheduling an irrigation system, which should be based on site-specific conditions and minimized as much as possible, but is included in the tool to promote a more conservative landscape design. The data for the irrigation type and DU_{LQ} are based on the Irrigation Association's *Landscape Irrigation Scheduling and Water Management* (IA 2005).

If irrigation systems are not being installed on the site by the builder, an irrigation type still must be designated for each plant type and any pools, spas, or ornamental water features. For low water-using trees, shrubs, and groundcover, standard drip irrigation is assumed. For all other categories of vegetation, fixed spray irrigation is assumed. This is to account for the type of system that might be installed after the home is sold. For the same reason, if irrigation systems are only installed on a portion of the landscape (e.g., only on turfgrass but not on shrubs), the remaining portions of the designed landscape must use the same assumptions. The specification requires that pools, spas, and ornamental water features be treated as turfgrass for single-family homes.[5] Thus, for the purposes of the tool, for single-family homes, these features are assigned fixed spray irrigation in order to account for the expected replacement of water lost to evaporation. Areas containing permeable hardscape (e.g., porous pavement) or non-vegetated softscape (e.g., mulched areas) are assigned no irrigation and do not count toward the landscape water requirement.

Equation 3: Landscape Water Requirement

$$LWR_H = \frac{1}{DU_{LQ}} \times [(ET_o \times K_L) - R_a] \times A \times C_u$$

Where:
LWR_H = Landscape water requirement for the hydrozone (gallons/month)
DU_{LQ} = lower quarter distribution uniformity (dimensionless)
ET_o = Local reference evapotranspiration (inches/month)
K_L = Landscape coefficient for the highest water-using plant in that hydrozone (dimensionless)

[4] Irrigation Association (IA). 2005. *Landscape Irrigation Scheduling and Water Management*. [*Currently out for review*].
[5] For multi-family buildings, common-use pools/spas and all areas that are reserved for private use of a particular residence/unit are excluded from the landscaped area.

R_a = Allowable rainfall, designated by WaterSense as 25% of the site's peak monthly rainfall
A = Area of the hydrozone (square feet)
C_u = Conversion factor (0.6233 for results in gallons/month)

Results

The final part of the tool displays the water allowance and water requirement calculated for the designed landscape. The LWR must be less than the allotted amount in order for the landscape design to meet the criterion in the specification.

The tool also calculates and displays the total amount of turfgrass used in the landscape.

Lastly, the tool displays the percent water reduction achieved by the designed landscape. This information may be used for a variety of purposes, such as comparing different landscape designs to choose which would be the most efficient design for a particular location.

II. Instructions for the Excel-Based Version of the Water Budget Tool

Each worksheet is formatted in an identical fashion:

- The blue section at the top displays the user, builder, and site information. Once the information is entered for Part 1, it is automatically populated into Parts 2 and 3 of the tool.
- The yellow section displays the equation(s) used in each worksheet.
- The gray section is the area of the worksheet where the user enters the required data.
- The green section displays the result.

Note: The tool only allows information to be entered into the white cells.

Before completing the tool, the user will need to gather the required peak watering month, ET_o, and rainfall data from the Water Budget Data Finder, as well as information regarding the proposed vegetation and irrigation system equipment. To use the Water Budget Data Finder, enter the zip code in which the home is being built. It will display the required inputs, which will be verified as part of the process for inspecting the home.

Part 1: Determining the Baseline and Landscape Water Allowance

1. Complete the site information in the blue section at the top of the worksheet. Enter the peak watering month for the site. Also, choose "yes" or "no" to indicate whether an irrigation system is being installed on the site.

2. Complete Step 1A by entering the area of the landscape in square feet. The landscaped area is defined as "The designed area of landscape excluding the footprint of the home and permanent hardscape areas such as driveways, sidewalks, and patios. Septic drainage fields and public right-of-ways should also be excluded from this calculation."

3. Complete Step 1B by entering the ET_o in inches obtained from the Water Budget Data Finder for the site's peak month.

4. The baseline and LWA are displayed.

5. Click on the worksheet tab labeled "Part 2—LWR" at the bottom of the screen to calculate the landscape water requirement.

Part 2: Determining the Landscape Water Requirement

1. Complete Step 2A by entering the rainfall in inches obtained from the Water Budget Data Finder for the site's peak watering month.

2. Complete Step 2B by filling Table 1 with the required information. The information should reflect the proposed design of the established landscape. When completed, the total area of all of the hydrozones/landscape feature areas must equal the landscaped area entered in Part 1 to avoid an error message in Part 3. For each hydrozone/landscape feature area, complete the following information:

    a. Hydrozone/Landscape Feature Area: Enter the area of the hydrozone or landscape feature in square feet.

    Plant Type or Landscape Feature: From the drop-down list, choose the plant type (e.g., trees—high water requirement, turfgrass—medium water requirement, etc.) or landscape feature (e.g., permeable hardscape, non-vegetated softscape, or pool, spa, or water feature) for the associated hydrozone/landscape feature area. If there are multiple plant types or landscape features within one hydrozone, enter the feature with the highest water requirement. The landscape coefficient (K_L) for the respective plant type (or landscape feature) will automatically populate in the adjacent cell.

    In general, a high value for K_L is used for plants that need a lot of water, and a low value is used for plants that need little water. As a general rule of thumb, species requiring the indicated amounts of water are designated as follows[6]:

    - High K_L: Species that need more water than most plants within that type of vegetation (e.g., trees, shrubs, groundcover, turfgrass) or use 70 to 90 percent of ET_o.
    - Moderate K_L: Species that need a typical amount of water as compared to other plants within that type of vegetation or use 40 to 60 percent of ET_o.
    - Low K_L: Species that need less water than most plants within that type of vegetation or use less than 30 percent of ET_o.

    If you are not familiar with the K_L values for the proposed plant types, contact your local cooperative extension, nursery, or landscape professional for guidance.

    For permeable hardscape and non-vegetated softscape, the K_L is assumed to be zero and no water requirement will be assigned in Table 1. For a pool, spa, or water feature, the associated K_L is set at 0.8.

[6] University of California Cooperative Extension and California Department of Water Resources. 2000. *A Guide to Estimating Irrigation Water Needs of Landscape Plantings in California.* The Landscape Coefficient Method and Water Use Classifications of Landscape Species (WUCOLS) III.

b. Irrigation Type and Lower Quarter Distribution Uniformity (DU_{LQ}): For each hydrozone, choose the type of irrigation (e.g., standard drip, rotor) that will be installed. According to the specification, sprinkler irrigation (fixed spray and rotor) may only be used on areas of turfgrass that are not on slopes greater than 4:1 (i.e., 25 percent or 14°) or strips less than 4 feet wide. The associated DU_{LQ} will automatically populate in the adjacent cell.

   Note: If the hydrozone/landscape feature area is designated as permeable hardscape or non-vegetated softscape then choose "no irrigation" from the drop-down list. For single-family homes, if the hydrozone/landscape feature area is designated as "Pool, Spa, or Water Feature," then set the irrigation type to "fixed spray."

   If irrigation is not being installed on the site at this time: Although not installing irrigation, an irrigation type must be chosen. Use the following types of irrigation as indicated:
   - Drip-Standard: Low water-using trees, shrubs and groundcover.
   - Fixed Spray: All turfgrass categories and medium and high water-using trees, shrubs, and groundcover.
   - No Irrigation: Permeable hardscape and non-vegetated softscape areas.

c. LWR_H: The LWR for each hydrozone, in gallons per month, will be calculated by the tool and displayed in this column.

3. The result is displayed in the green section.

4. Click on the worksheet tab labeled "Part 3—Results" at the bottom of the screen to review the results of the Water Budget Tool.

Part 3: Results

If the total area of the hydrozone/landscape feature areas entered in Part 2 does not equal the landscaped area entered in Part 1, an error message in red text will appear at the top of the gray section requesting that Table 1 be completed.

1. Review the LWA and LWR calculated in Part 1 and Part 2.

2. Review the total area of turfgrass in the designed landscape. The percentage of designed landscape that is composed of turfgrass, pools, spas, and/or water features is also displayed.

3. The result is displayed in the green section.
   a. If the blue cell displays "Yes" then the water budget criterion is met (i.e., LWR < LWA).

   b. If the blue cell displays "No" then the designed landscape requires more water than the site is allotted. Adjustments should be made to the composition of the landscape and/or irrigation system in Step 2B of the Water Budget Tool. Then return to Part 3—Results to see if the revised design meets the water budget criterion.

When all of the information has been entered into the tool and the water budget has been met, print an entire copy of the completed tool and submit it to the builder to be included in the inspection documentation. This documentation must be provided to the builder prior to a home being inspected for compliance with EPA criteria.

III. Definitions

Allowable rainfall (R_a): The amount of rainfall WaterSense is allowing to be incorporated into the water budget.

Baseline: The amount of water required by a site if watered at 100 percent of local reference evapotranspiration (ET_o).

Hydrozone: Grouping of plants with similar water and environmental requirements for irrigation with one of more common station/zone valves.[7]

Landscape coefficient (K_L) : Coefficient used to modify reference ET, which includes a species factor (K_s), density factor (K_d), and microclimate factor (K_{mc}). ($K_L = K_s \times K_d \times K_{mc}$).[8]

Landscape water allowance (LWA): A volume of water allocated to the entire landscape area over a specified period of time.

Landscape water requirement (LWR): The amount of water required by the landscape over a specified period of time.

Landscaped area (A): The designed area of landscape excluding the footprint of the home and permanent hardscape areas such as driveways, sidewalks, and patios. Septic drainage fields and public right-of-ways should also be excluded from this calculation.

Lower quarter distribution uniformity (DU_{LQ}): Distribution uniformity is the measure of uniformity of irrigation water applied over an area. DU_{LQ} is the ratio of the average of the lowest 25 percent of measurements to the overall average measurement.

Non-vegetated softscape: Areas of the landscape that are not hardscape and not planted (e.g., mulched areas).

Permeable hardscape: Material that covers the ground but allows water and oxygen to penetrate the soil. A concrete driveway would be impermeable hardscape whereas brick without mortar on sand would be permeable hardscape. Other common permeable hardscapes include decomposed granite, patio blocks, or flagstone surfaces, as long as no mortar is used.

Reference evapotranspiration (grass reference evapotranspiration) (ET_o): Rate of evapotranspiration from an extensive surface of cool season grass cover of a uniform height of 12 centimeters, actively growing, completely shading the ground, and not short of water.[9]

[7] Weinberg and Roberts 1988 and Water Management Committee 2001 in Irrigation Association (IA). 2005. *Landscape Irrigation Scheduling and Water Management*. [*Currently out for review*]
[8] Landscape 2000 in Irrigation Association (IA). 2005. *Landscape Irrigation Scheduling and Water Management*. [*Currently out for review*].

Water budget: A water budget is used to calculate the amount of water a landscape needs, taking into account the inputs and outputs of water to and from the root zone. Inputs, such as precipitation, are subtracted from outputs, such as evapotranspiration, to calculate the water needs of the landscape. Many factors are taken into consideration when calculating a water budget, such as plant type and irrigation system efficiencies.

[9] FAO 1998 and ASCE 1990 in Irrigation Association (IA). 2005. *Landscape Irrigation Scheduling and Water Management*. [*Currently out for review*]

IV. Example

A new home in Chicago, Illinois, is being constructed on a 1/3-acre lot. The area remaining after subtracting the square footage of the home, driveway, and sidewalk is 12,280 square feet (ft^2). The builder is providing landscape for the entire yard and an irrigation system will be installed for all portions of the landscape. The builder plans to use vegetation from three main categories: high water-using turfgrass, medium water-using shrubs, and low water-using groundcover. Additionally, there will be a 150-square-foot deck and some areas that are not vegetated, but covered with mulch.

Fixed spray irrigation is going to be installed on the turfgrass and standard drip irrigation is going to be installed for the shrubs and groundcover.

According to the Water Budget Data Finder, the peak watering month for Chicago (zip code 60653) is June. ET_o during June is 6.43 inches and the average rainfall is 3.56 inches.

The builder completes the WaterSense Water Budget Tool and comes up with the following:

- 7,150 ft^2 high water-using turfgrass
- 2,200 ft^2 medium water-using shrubs
- 2,030 ft^2 low water-using groundcover
- 900 ft^2 non-vegetated softscape (includes deck)

This design meets the water budget using turfgrass on 58 percent of the landscaped area. The builder achieves a 30 percent designed water use reduction from the baseline scenario.

Part 1 – Baseline & LWA

WaterSense New Home Specification: Water Budget Tool (V 1.02)

This water budget tool shall be used to determine if the designed landscape meets Criteria 4.1.1 of the specification.
Please refer to the WaterSense Water Budget Approach for additional information.

Your Name:	Landscaper
Builder Name:	WaterSense Builder
Lot Number/Street Address:	123 WaterSense Street
City, State, Zip Code:	Chicago, IL 60653
Peak Watering Month:	June

Obtain from Water Budget Data Finder at www.epa.gov/watersense/nhspecs/wb_data_finder.html

Is an irrigation system being installed on this site? yes

This worksheet determines the baseline and the landscape water allowance (LWA) for a site based on its peak watering month.

The baseline is the amount of water required by the site during the peak watering month if watered at 100 percent of reference evapotranspiration (ET_o). The following formula is used to calculate the baseline:

$$Baseline = ET_o \times A \times C_u$$

Where:
ET_o = Local reference evapotranspiration (inches/month)
A = Landscaped area (square feet)
C_u = Conversion factor (0.6233 for results in gallons/month)

The LWA is the water allotment for the site. The following formula is used to calculate the LWA:

$$LWA = 0.70 \times Baseline$$

Where:
LWA = Landscape water allowance (gallons/month)
Baseline = ET_o x landscaped area x 0.6233

To calculate the Baseline and LWA for a site, enter the designed landscaped area and average monthly reference evapotranspiration for the site's peak watering month. (Enter data in white cells only.)

STEP 1A - ENTER THE LANDSCAPED AREA (A)

12,280 Area of the designed landscape (square feet)

STEP 1B - ENTER THE AVERAGE MONTHLY REFERENCE EVAPOTRANSPIRATION (ET_o)

6.43 Average monthly reference ET (inches/month) for the site's peak watering month

Obtain from Water Budget Data Finder at www.epa.gov/watersense/nhspecs/wb_data_finder.html

OUTPUT - BASELINE FOR THE SITE

49,219 Monthly baseline (gallons/month) based on the site's peak watering month

OUTPUT - WATER ALLOWANCE FOR THE SITE

34,453 Monthly landscape water allowance (gallons/month) based on the site's peak watering month

Next Step: Click on the next tab labeled *Part 2 - LWR* to calculate the landscape water requirement.

Part 2 – LWR

WaterSense New Home Specification: Water Budget Tool (V 1.02)

This water budget tool shall be used to determine if the designed landscape meets Criteria 4.1.1 of the specification.
Please refer to the WaterSense Water Budget Approach for additional information.

Your Name:	Landscaper
Builder Name:	WaterSense Builder
Lot Number/Street Address:	123 WaterSense Street
City, State, Zip Code:	Chicago, IL 60653
Peak Watering Month:	June
Is an irrigation system being installed on this site?	yes

This worksheet determines the monthly landscape water requirement (LWR) for a site based on its peak watering month.

The monthly LWR is the water requirement specific to the designed landscape. The sum of the LWRs for each hydrozone equals the site LWR.
The following formula is used to calculate the LWR for each hydrozone:

$$LWR_H = \frac{1}{DU_{LQ}} \times [(ET_o \times K_L) - R_a] \times A \times C_u$$

Where:
LWR_H = Landscape water requirement for the hydrozone (gallons/month)
DU_{LQ} = Lower quarter distribution uniformity
ET_o = Local reference evapotranspiration (inches/month)
K_L = Landscape coefficient for the type of plant in that hydrozone (dimensionless)
R_a =Allowable rainfall, designated by WaterSense as 25% of average peak monthly rainfall (R)
A = Area of the hydrozone (square feet)
C_u = Conversion factor (0.6233 for results in gallons/month)

To calculate the LWR for the site, enter the information requested below for the site's peak watering month. (Enter data in white cells only.)

STEP 2A - ENTER THE AVERAGE MONTHLY RAINFALL (R) AT THE SITE FOR THE PEAK WATERING MONTH IDENTIFIED IN PART 1

3.56 **Average monthly rainfall (inches/month) for the site's peak watering month**

Obtain from Water Budget Data Finder at www.epa.gov/watersense/nhspecs/wb_data_finder.html

STEP 2B - COMPLETE TABLE 1 BELOW (enter data in white cells only)

Enter the area of the hydrozone (square feet). The total area must equal the landscaped area entered in Step 1A.
Choose the plant type from the dropdown list (source data is displayed in Table 2).
Choose the irrigation type from the dropdown list (source data is displayed in Table 3; guidance is displayed in Table 4 and Table 5).

Table 1. Landscape Water Requirement

Zone	e Feature Area (sq. ft.)	Plant Type or Landscape Feature	Landscape Coefficient (K_L)	Irrigation Type	Uniformity (DU_{LQ})	LWR_H (gal/month)
1	7,150	Turfgrass - High water requirement	0.8	Fixed Spray	65%	29,168
2	2,200	Shrubs - Medium water requirement	0.5	Drip - Standard	70%	4,555
3	2,030	Groundcover - Low water requirement	0.2	Drip - Standard	70%	716
4	900	Nonvegetated Softscape		No Irrigation	NA	-
5						-
6						-
7						-
8						-
9						-
10						-
11						-
12						-
13						-
14						-
15						-
Total Area	12,280	Landscape Water Requirement for the Site (gal/month)				34,439

Table 2. Plant Type or Landscape Feature and Associated Landscape Coefficient

Plant Type or Landscape Feature	K_L Water Requirements		
	Low	Medium	High
Trees	0.2	0.5	0.9
Shrubs	0.2	0.5	0.7
Groundcover	0.2	0.5	0.7
Turfgrass	0.6	0.7	0.8
Pool, Spa, or Water Feature	0.8		
Permeable Hardscape	0		
Nonvegetated Softscape	0		

Source: Based on LEED for Homes Rating System 2008

Table 3. Distribution Uniformity

Irrigation Type	DU_{LQ} or EU*
Drip - Standard	70%
Drip - Press Comp	90%
Fixed Spray	65%
Micro Spray	70%
Rotor	70%
No Irrigation	NA

*Lower quarter distribution uniformity (DU_{LQ}) applies to sprinkler zones and emission uniformity (EU) applies to drip/microirrigation zones.
Source: (The Irrigation Association, October 2001) in Landscape Irrigation Scheduling and Water Management, IA 2005.

Table 4. Appropriate Irrigation Types - Landscaped Areas with Irrigation Systems

IF THE PLANT TYPE IS:	THEN THE IRRIGATION TYPE CAN BE:			
	Drip - Standard	Drip - Press Comp	Fixed Spray	Micro Spray*
Trees	x	x		x
Shrubs	x	x		x
Groundcover	x	x		x
Turfgrass	x	x	x	x

* Micro spray may only be used on vegetation other than turfgrass if it meets the definition of microirrigation system, according to the 2009 WaterSense Single-Family New Home Specification: "Microirrigation System- The frequent application of small quantities of water on or below the soil surface as drops, tiny streams or miniature spray through emitters or applicators placed along a water delivery line. Microirrigation encompasses a number of methods or concepts; such as bubbler, drip, trickle, mist or spray and subsurface irrigation. For purposes of this specification, microirrigation includes emission devices that have flow rates less than 30 gallons per hour."

Table 5. Appropriate Irrigation Types - Landscaped Areas without Irrigation Systems

IF THE PLANT TYPE OR LANDSCAPE FEATURE IS:	THEN THE IRRIGATION TYPE SHALL BE:		
	Drip - Standard	Fixed Spray	No Irrigation
Trees, Shrubs, or Groundcover with Low Water Requirements (K_L = 0.2)	x		
Trees, Shrubs, or Groundcover with Medium or High Water Requirements (K_L > 0.2)		x	
Turfgrass with Low, Medium, or High Water Requirements (K_L > 0.2)		x	
Pool, Spa, or Water Feature		x	
Permeable Hardscape			x
Nonvegetated Softscape			x

*Please see additional information in the WaterSense Water Budget Approach for landscapes installed without irrigation systems.

OUTPUT - WATER REQUIREMENT FOR THE SITE

34,439 **Monthly landscape water requirement (gallons/month) based on the site's peak watering month**

Next Step: Click on the next tab labeled *Part 3 - Results* to view the results.

Part 3 – Results

WaterSense New Home Specification: Water Budget Tool (V 1.02)

This water budget tool shall be used to determine if the designed landscape meets Criteria 4.1.1 of the specification.
Please refer to the WaterSense Water Budget Approach for additional information.

Your Name:	Landscaper
Builder Name:	WaterSense Builder
Lot Number/Street Address:	123 WaterSense Street
City, State, Zip Code:	Chicago, IL 60653
Peak Watering Month:	June
Is an irrigation system being installed on this site?	yes

EPA WaterSense

This worksheet determines if the designed landscape meets the water budget.

If the landscape water requirement is LESS than the landscape water allowance, then the water budget criterion is met.
If the landscape water requirement is GREATER than the landscape water allowance, then the landscape and/or irrigation system needs to be redesigned to use less water.

STEP 3A - REVIEW THE LWA AND LWR FROM PART 1 AND PART 2

LWA 34,453 (gallons/month) LWR 34,439 (gallons/month)

STEP 3B - REVIEW THE TOTAL AREA OF TURFGRASS* IN THE DESIGNED LANDSCAPE FROM STEP 2B

The designed landscape contains 7,150 square feet of turfgrass.* This is 58% of the landscaped area.

*This includes the area of any pools, spas, and/or water features, designated by WaterSense to be counted as turfgrass.

OUTPUT - DOES THE DESIGNED LANDSCAPE MEET THE WATER BUDGET?

YES If YES, then the water budget criterion is met.
If NO, then the landscape and/or irrigation system needs to be redesigned to use less water.

The designed landscape water requirement is a 30% reduction in water use from the baseline calculated in Part 1.