WaterSense® Draft Specification for Homes Supporting Statement

1.0 Introduction

The U.S. Environmental Protection Agency's (EPA's) WaterSense program released the first version of its specification for labeled homes in 2009 with the *WaterSense Single-Family New Home Specification* and issued modifications in 2012 and 2014 to expand the scope to multifamily buildings and include minor revisions, respectively. The goal of the WaterSense labeled homes program is to encourage the construction and purchase of water-efficient, high-performing homes that use of water- and energy-efficient products and include advanced design. The program aims to reduce indoor and outdoor water use in homes and encourage community infrastructure savings.

On April 18, 2019, WaterSense released the *WaterSense Draft Specification for Homes, Version 2.0,* which aims to further promote residential water efficiency and help enable market transformation in the building industry. The specification is applicable to single-family homes and multifamily buildings and can apply to new and existing homes.

The EPA intends for the *WaterSense Specification for Homes, Version 2.0* to:

- Provide flexibility in the technical requirements for homes constructed to the WaterSense specification without compromising overall water efficiency or performance.
- Ensure that WaterSense labeled homes are high-performing with regard to water efficiency and homeowner satisfaction.
- Provide quantifiable potential water and utility cost savings for individual homeowners.
- Improve regional applicability.
- Improve collaboration with existing green building certification programs.
- Use existing infrastructure for certification and verification purposes to ease requirements for home builders and verifiers who confirm home compliance with the specification.
- Use the WaterSense program's resources efficiently.

2.0 Current Status of Water Use in Residential Homes

New home construction is an optimal opportunity to establish the use of water-efficient products and practices by both builders and homebuyers. To provide perspective, there were nearly 1.2 million new single-family homes and multifamily units constructed in 2018,[1] representing significant cumulative water use. By installing water-efficient products, appliances and design elements during construction, the EPA intends to transform building practices to reduce lifetime water and energy use and utility costs.

Federal regulations have addressed water use and efficiency inside the home over the past quarter century. The Energy Policy Act of 1992 (EPAct 1992) established the maximum flush volume for toilets at 1.6 gallons per flush (gpf), and the maximum flow rate for bathroom sink

[1] U.S. Census, 2019. *Monthly New Residential Construction, December 2018.* March 26, 2019. Table 5b. www.census.gov/construction/nrc/pdf/newresconst.pdf

faucets, kitchen faucets and showerheads at 2.5 gallons per minute (gpm). Subsequently, in 1998, the U.S. Department of Energy (DOE) adopted a maximum flow rate standard of 2.2 gpm for all faucets. In 2012 and 2016 respectively, the DOE issued new regulations mandating minimum water efficiency requirements for clothes washers and dishwashers.[2,3] The WaterSense and ENERGY STAR® programs promote water efficiency in plumbing fixtures and appliances that are above these national standards.

Two studies completed over the past 20 years best characterize water use in the residential sector. The American Water Works Association (AWWA) Research Foundation completed a 1999 study, *Residential End Uses of Water* (REUW1999),[4] that provided the first detailed analysis of residential water use patterns and efficiency levels in the United States. The Water Research Foundation (WRF) completed an updated study in 2016, *Residential End Uses of Water, Version 2* (REUW2016),[5] providing an expanded assessment and analysis of single-family water use across North America. REUW2016 also presents updated information about water use patterns, as compared to REUW1999. Table 2-1 summarizes the average daily per capita indoor water use for North American homes, as identified by both residential studies.

Table 2-1. Daily Indoor Per Capita Water Use

Type of Use	Daily Indoor Water Use (gallons per capita per day)	
	REUW1999	REUW2016
Toilets	18.5	14.2
Clothes Washers	15.0	9.6
Showers	11.6	11.1
Faucets	10.9	11.1
Leaks	9.5	7.9
Other	1.6	2.5
Baths	1.2	1.5
Dishwasher	1.0	0.7
Total	**69.3**	**58.6**

Over the 15-year period between the two REUW studies, residential per capita indoor water use decreased 15.4 percent. While this reduction is significant, there are still opportunities for additional water savings. A 2011 study by William DeOreo found that new homes built with high-

[2] DOE, 2012. Energy Conservation Program: Energy Conservation Standards for Residential Clothes Washers. Direct Final Rule. May 31,2012. www.regulations.gov/document?D=EERE-2008-BT-STD-0019-0041
[3] DOE, 2016, Energy Conservation Program: Energy Conservation Standards for Residential Dishwashers; Final Rule. December 13, 2016. www.regulations.gov/document?D=EERE-2014-BT-STD-0021-0033
[4] Mayer, Peter W. et al., 1998. *Residential End Uses of Water.* Published by the AWWA Research Foundation and American Water Works Association.
[5] DeOreo, William B., Peter Mayer, Benedykt Dziegielewski, and Jack Kiefer, 2016. *Residential End Uses of Water, Version 2.* Published by the Water Research Foundation.

efficiency plumbing fixtures, appliances and design practices (considered to be roughly equivalent to homes built to the *WaterSense Specification for New Homes, Version 1.0*) had an average indoor daily per capita water use of 36.7 gallons per day, which is 37 percent more water-efficient than North American homes surveyed for REUW2016.[6] The EPA intends for the *WaterSense Specification for Homes, Version 2.0* to serve as a resource to help achieve additional household water savings.

The WaterSense labeled homes program is an initiative designed to actively promote the transformation of the mainstream homebuilding industry towards increased water efficiency. Through the revised specification and resulting program structure, the EPA intends to collaborate directly with existing green home building programs to promote a national ethic of water efficiency. By affirming the technical efficacy of existing home certification programs with regard to water efficiency, WaterSense aims to raise the profile of water efficiency in the broader green building industry. Through recognition of homes that meet specific performance and efficiency criteria, WaterSense hopes to drive builder and consumer confidence during the home buying process.

3.0 Definitions

For definitions related to the revised WaterSense labeled home program, refer to the *WaterSense Draft Home Certification System, Version 2.0*.

4.0 Overview of Program Changes in Version 2.0

Motivation for Revision

Based on feedback from stakeholders, years of program operation, and changes in the home building marketplace that have occurred over the last decade, the EPA has decided to revise its specification and certification process for WaterSense labeled homes. Since the original specification was introduced in 2009, water-efficient products have become more accessible and effective, and consumer demand for water-efficient homes has increased. With Version 2.0, WaterSense aims to accommodate a broader network of water efficiency professionals interested in participating in the WaterSense labeled homes program, which had been limited in the original program structure. The revision will also allow WaterSense to acknowledge a growing number of regional home certification and/or labeling programs operating across the United States.

With this proposed revision, the EPA will: 1) require that homes meet a minimum set of quality performance criteria (via a mandatory checklist); and 2) require that homes meet an efficiency requirement (set at 30 percent more water-efficient than a home built using typical construction practices to national level codes, standards, and common landscape practices). This specification structure reduces the prescriptive requirements (with the exception of key WaterSense labeled plumbing products), and focuses on WaterSense's key objective of saving water while allowing builders to choose the approach that best fits their market, practices and strategy. Under the revised specification and certification structure, the EPA will recognize credible certification programs or standards that have valid approaches to demonstrate compliance with the water efficiency requirement for homes. The EPA will also allow the programs to offer the WaterSense label in ways conducive to their existing structures and the needs of their stakeholders. By encouraging other organizations to administer the program and

[6] DeOreo, William B, 2011. *Analysis of Water Use in New Single-Family Homes.*

issue the WaterSense label in conjunction with their existing certifications, the revised specification will increase flexibility among, and access to, a larger network of verifiers and raters. Builders, in turn, will be able to choose home certification programs that suit their needs and the needs of their customers. The flexibility inherent in the revision will allow for the inclusion of regional or local programs that may be able to better address regional climate variability and local water efficiency priorities.

By adding flexibility to the technical requirements, as well as to the program and certification structure, the EPA seeks to increase the reach of the WaterSense homes program and make it possible for more homes to earn the WaterSense label, while maintaining an equal (or greater) level of water efficiency and performance.

Proposed Revised Program Structure

Home Certification Organizations (HCOs) will be central to the proposed revised program structure. HCOs will be responsible for implementing a program for the verification, certification and labeling of homes for WaterSense. They will be responsible for submitting a Proposed Certification Method (PCM), which details the methodology and protocols the HCO intends to use to determine whether a home meets the water efficiency requirements included in the *WaterSense Specification for Homes, Version 2.0*. Other than requiring that homes include specific WaterSense labeled plumbing products and be free of water leaks, WaterSense does not dictate the specific requirements that a PCM must contain or the structure for which certification is granted.

The EPA will evaluate and approve HCOs to ensure they have the capability, competence and proper controls to certify and label homes for WaterSense. The EPA will also evaluate and approve the HCO's PCM to ensure that: 1) the method was developed in a fair and transparent manner; and 2) homes certified in accordance with the PCM, to an efficiency level or requirements the HCO has specified for WaterSense, will consistently meet WaterSense's efficiency requirements. The EPA has developed a technical evaluation process to test the PCM's technical effectiveness, which is discussed in more detail in Section 7.0. Upon approval by the EPA, the PCM will become a WaterSense Approved Certification Method (WACM). Hereafter, the EPA will use the term WACM to refer to the approved certification method with the threshold or specific requirements the HCO has designated to earn the WaterSense label. WaterSense will periodically review WACMs for efficacy and maintain oversight of the HCOs' implementation and use of the WaterSense label.

Home builders that partner with WaterSense can achieve certification through an HCO of their choosing. Candidate homes must be verified and certified in accordance with the *WaterSense Specification for Homes, Version 2.0* and the HCO's WACM requirements to earn the WaterSense label. Trained verifiers will be responsible for inspecting homes to determine whether they meet these requirements.

Documents Associated With the Revision

This supporting statement describes three documents associated with the specification revision: the *WaterSense Specification for Homes, Version 2.0*; the *WaterSense Home Certification System, Version 2.0*; and the *WaterSense Technical Evaluation Process for Approving Home Certification Methods, Version 1.0*. These three documents used in concert comprise the revised WaterSense labeled homes program structure. This supporting statement describes the purposes of the components in each document.

5.0 WaterSense Specification for Homes, Version 2.0

The revised specification establishes technical criteria that homes must meet to earn the WaterSense label. The specification contains two components: 1) the Mandatory Checklist; and 2) the water efficiency requirement.

Mandatory Checklist

In addition to an overall water efficiency requirement (discussed below), homes must meet all requirements included on the Mandatory Checklist for WaterSense Labeled Homes, listed in Appendix B of the *WaterSense Draft Specification for Homes, Version 2.0*. This includes WaterSense labeled plumbing fixtures (i.e., toilets, lavatory faucets and showerheads), which have been independently certified to perform as well or better than standard models, while also using less water. In addition, WaterSense labeled homes are also required to pass a pressure-loss test on all water supply lines, which indicates the absence of leaks. For a home to earn the label, there may not be visible leaks from specified elements of the plumbing system--including the plumbing fixtures identified above--or from other water-using systems and appliances installed in the home by the builder. Leaks can adversely impact a home's water use and result in added homeowner costs or even property damage.

The Mandatory Checklist is intended to ensure that all WaterSense labeled homes, regardless of the HCO or WACM under which they are certified, contain a minimum set of features that will meet homeowners' expectations for product performance. For the Mandatory Checklist, the EPA selected items that are universally applicable to all homes and have minimal incremental cost.

Although the Mandatory Checklist does not include outdoor requirements (beyond requiring irrigation systems to be leak-free), outdoor components are still part of the revised WaterSense homes specification. Based on the structure of the EPA's technical evaluation, discussed in Section 7.0, homes with the expectation of significant outdoor water use would not meet the water efficiency requirements without accounting for and reducing outdoor water use.

Table 5-1 presents the requirements of the Mandatory Checklist.

Table 5-1. Mandatory Checklist for WaterSense Labeled Homes

Item	Requirements	Confirmed
Leaks	Pressure-loss test on all water supplies detected no leaks	☐ Yes ☐ No
	Free of visible leaks from hot water delivery system	☐ Yes ☐ No
	Free of visible leaks from toilet(s), as determined through visual assessment and by conducting a dye tablet test in each toilet to ensure the flapper is not leaking	☐ Yes ☐ No
	Free of visible leaks from bathroom faucet(s)	☐ Yes ☐ No
	Free of visible leaks from showerhead(s)	☐ Yes ☐ No
	Free of visible leaks from bathroom tub faucet(s), i.e., tub spout(s), when showerhead(s) is activated, as determine through visual assessment after showerhead has been activated for one minute	☐ Yes ☐ No
	Free of visible leaks from kitchen and other sink faucet(s)	☐ Yes ☐ No
	Free of visible leaks from other fixtures or appliances (e.g., clothes washers, dishwashers, hose bibs, irrigation systems) at point of use or point of connection to water distribution system	☐ Yes ☐ No
Toilets	WaterSense labeled[7]	☐ Yes ☐ No
Bathroom sink faucets	WaterSense labeled[7]	☐ Yes ☐ No
Showerheads	WaterSense labeled[7]	☐ Yes ☐ No

Efficiency Requirement

The specification stipulates that homes must be at least 30 percent more water-efficient than typical new construction. A home's water efficiency is determined through compliance with the HCO's WACM. WaterSense will review and approve an HCO's program requirements to determine if homes certified in accordance with the WACM will use 30 percent less water than typical new construction. This process is explained in more detail in Section 7.0.

WaterSense set the water efficiency requirement at 30 percent based on analysis of typical features in homes, common efficiency measures and potential impacts across different climates. WaterSense is using a percent reduction to provide flexibility while retaining the focus on the program's primary objective of saving water. The percent reduction gives builders flexibility to select technologies or practices best suited to their techniques, style and market, as long as they cumulatively achieve 30 percent water savings. The percent reduction also scales with climate. Homes in more arid regions, for example, typically have higher annual water usage due to irrigation demands. These homes will need to take more substantial outdoor water efficiency measures to meet the efficiency requirement. The percent reduction can also be easily translated to water and cost savings.

[7] A listing of WaterSense labeled toilets, bathroom sink faucets and showerheads can be found at: www.epa.gov/watersense/product-search.

WaterSense typically requires that products be at least 20 percent more water-efficient relative to standard products to be eligible for the WaterSense label. WaterSense has chosen to set a higher water savings target for homes to account for indoor and outdoor water savings potential, which cumulatively provides more opportunities for water savings. Additionally, the homebuilding community has transformed over the past decade and has adopted many water-efficiency features as standard practice. The EPA wants to encourage the market to become even more water-efficient by recognizing homes and builders that go above and beyond.

6.0 WaterSense Home Certification System, Version 2.0

The *WaterSense Home Certification System, Version 2.0* documents the process for certifying and labeling homes in compliance with the *WaterSense Specification for Homes, Version 2.0.* It also defines the roles and responsibilities of parties associated with home certification and labeling, namely HCOs, verifiers, builders and the EPA.

HCO Organizational Requirements

WaterSense has identified six components of certification to ensure that an HCO has a structure in place to effectively certify homes, as well as issue and maintain the integrity of the WaterSense label. The following section describes the purpose of each certification component in the context of the certification system. The *WaterSense Draft Home Certification System, Version 2.0* contains more details on the requirements associated with each component.

As part of the final home certification system, HCOs will be required to establish procedures to address each of the following components:

1. **Independent oversight** ensures that the administration of the WACM and certification and labeling of homes for WaterSense is governed in a fair and impartial manner.
2. **Quality assurance** ensures that inspections and certifications are conducted in a consistent, accurate and appropriate manner. Quality assurance helps maintain the integrity of the WaterSense label and ensures that anticipated water savings and home performance are realized. Quality assurance also provides a mechanism for resolving complaints regarding home verification and/or certification.
3. **Verifier training and authorization** is intended to prepare verifiers to conduct accurate and consistent verifications, complete necessary paperwork, and comply with quality assurance standards. Following training and authorization, verifiers should be prepared to verify a home in accordance with the *WaterSense Specification for Homes, Version 2.0* and the HCO's WACM.
4. **Home verification protocols** establish requirements by which the HCO and its verifiers verify and certify homes for the WaterSense label. These protocols serve an important function for consumers, since accurate verifications identify homes that meet the expected water savings and performance.
5. **Impartiality** ensures that conflicts of interest (COI) related to the verification and certification of homes do not exist or have been resolved. When HCOs ensure impartiality, verifiers and designee(s) can fulfill their responsibilities in a manner that does not compromise the integrity of the HCO's certification program or the issuance of the WaterSense label.

6. **Messaging and reporting** create a link between WaterSense and HCOs. Through clear channels of communication, WaterSense can relay program information to stakeholders and track key program outputs.

By addressing each certification component, HCOs maintain the integrity of the WaterSense label and ensure that homes that are certified to the *WaterSense Specification for Homes, Version 2.0,* demonstrate expected water savings and performance.

HCOs will be responsible for verifying and certifying homes to the *WaterSense Specification for Homes, Version 2.0*. The HCO will be permitted to delegate most responsibilities to a "designee," such as a provider of hired or contractor verifiers or other organization that supports adherence to the certification requirements. However, the HCO will be required to oversee all delegated activities and will retain ultimate responsibility for the verification and certification of each home. Since controlling the use of the label is essential to certification programs such as WaterSense, it is important that responsibility for controlling label use remain centralized with the HCO, rather than dispersed among designees.

Some responsibilities cannot be delegated to a designee and must be executed by the HCO. The HCO holds ultimate responsibility for issuing the WaterSense label to homes. The HCO will also be responsible for reporting information on authorized verifiers and certified new homes to WaterSense. Section 5.0 of the *WaterSense Draft Home Certification System, Version 2.0* summarizes key responsibilities for approved HCOs and provides logistical details to help HCOs implement each responsibility.

HCO Certification Method Development Process

The certification system indicates acceptable approaches for HCOs to follow as they develop or adopt a PCM. These approaches are identified to help ensure HCOs are meeting the needs of a broad set of stakeholders. An HCO will be able to use one of three options to demonstrate its PCM was developed following an open and transparent process. The requirements also help the EPA conform to the National Technology Transfer and Advancement Act, which stipulates that federal agencies rely on technical standards developed and adopted by voluntary consensus standards bodies, as opposed to using government-unique standards. Following are three optional approaches for HCOs to meet these requirements:

1. Utilize an American National Standards Institute (ANSI) approved standard.
2. For public agencies, demonstrate compliance with the administrative and transparency requirements associated with standards and policy development of the jurisdiction having authority over the program.
3. Provide written documentation demonstrating that the certification method was developed in accordance with a set of criteria, based on the ANSI Essential Requirements,[8] as presented in the *WaterSense Home Certification System, Version 2.0.*

The three options will ensure maximum flexibility for HCOs in the development of their PCMs, while generally providing for the same level of openness and transparency.

[8] ANSI Essential Requirements: Due process requirements for American National Standards. Edition: January 2019. www.ansi.org/essentialrequirements/

HCO Application and Approval

Prospective HCOs will apply to the EPA to be eligible to oversee the certification and labeling of homes for WaterSense in accordance with the *WaterSense Specification for Homes, Version 2.0*. As part of their application, prospective HCOs will provide supplemental documentation that indicates how the HCO meets each certification component.

HCOs that satisfactorily meet the EPA's criteria will be eligible to sign a licensing agreement. The licensing agreement is the legal document between the EPA and the HCO that controls the use and distribution of the WaterSense label and formally identifies the HCO as the entity ultimately responsible for the label. As part of this responsibility, the HCO helps maintain the integrity of the WaterSense label.

7.0 WaterSense Technical Evaluation Process for Approving Home Certification Methods, Version 1.0

Under the *WaterSense Draft Specification for Homes, Version 2.0*, the EPA requires homes that earn the WaterSense label to be at least 30 percent more water-efficient than a comparable home of typical new construction based on national codes, standards, and common landscape practices. The specific requirements and/or the features a home must have to meet the water efficiency criteria will be dictated by an HCO's WACM. To that end, the EPA has established a technical evaluation process to assess water savings that can be achieved through the criteria and performance thresholds established within a PCM. The EPA will approve PCMs that meet the water efficiency criteria, as demonstrated through the technical evaluation. This technical evaluation provides assurance that the homes that ultimately earn the WaterSense label can deliver the anticipated water efficiency.

This supporting statement generally describes the technical evaluation process and the rationale behind the EPA's approach. The *WaterSense Draft Technical Evaluation Process for Approving Home Certification Methods, Version 1.0,* provides full details on the approach and assumptions for assessing potential water savings and approving PCMs.

Defining Reference Homes

Because home design and characteristics, such as number of bedrooms (which relates to occupancy) and lot size (which relates to landscape area), can significantly influence a home's water use, the EPA will assess a PCM's water use and savings across a series of "reference home designs." These reference homes are intended to represent a range of characteristics relative to typical home and landscape sizes for single-family and multifamily homes. The intent is to assess the PCM's ability to differentiate homes that can meet the 30 percent water efficiency requirement across a broad potential range of home designs.

The EPA identified features to include in its reference home design from the U.S. Department of Housing and Urban Development (HUD) 2017 Survey of Construction, and reviewed U.S. Census data to identify typical design features, such as number of bedrooms, bathrooms and lot size. The EPA used this data to estimate the prevalence of the design features in single-family and multifamily construction, including number of plumbing fixtures (toilets, lavatory faucets, kitchen faucets), appliances (clothes washers, dishwashers), and landscaped area.

For each reference home, the EPA also estimates a theoretical irrigation requirement based on the geographic scope of the specific PCM. The requirement takes into account the local

modified net evapotranspiration ($NetET_o$) which takes into account reference evapotranspiration, rainfall and specific watering months. For larger regional or national scale programs, the reference home uses the applicable range of modified $NetET_o$ and rainfall values. This enables the EPA to more accurately evaluate and assess savings associated with the outdoor water use and the balance between indoor and outdoor use based on the potential geographic area where the PCM may be applied.

Defining the "Least Efficient" Home

The EPA will review the requirements of the PCM and will define and evaluate water savings for one or more home and landscape designs based on the minimum requirements a home needs to meet to achieve the PCM's proposed designation for WaterSense. These home and landscape designs will represent the criteria that potentially result in the "least efficient" homes that can earn the WaterSense label. This conservative approach provides assurance that homes with a variety of configurations certified under the PCM will be able to meet or exceed the 30 percent water efficiency requirement established in the *WaterSense Specification for Homes, Version 2.0*.

Assessing Water Savings Over a Baseline Home

For each reference home, the EPA will evaluate indoor and outdoor water use associated with a baseline home that includes features typical of new construction (based on national codes, standards and common landscape practices) and compare it to a water-efficient home that has the features represented in the "least efficient" home(s) for the PCM.

This technical evaluation assesses water use and savings for specific features for which the EPA has identified studies, research or other data that suggest quantifiable savings can be achieved from implementation of that feature. Wherever possible, the EPA utilized industry recognized studies, such as the Water Research Foundation's REUW2016 (cited above), to identify water use, water savings, or water use patterns of different fixtures, appliances, or systems. The EPA otherwise based savings estimates on the best available data.

Table 7-1 lists the features for which the EPA currently assesses savings in the technical evaluation. The specific calculations and assumptions for assessing the baseline and water-efficient home water use are detailed in the *WaterSense Draft Technical Evaluation Process for Approving Home Certification Methods, Version 1.0*.

Table 7-1. Features Impacting Baseline and/or Efficient Home Water Use Under Technical Evaluation

Indoor	Outdoor

• Toilets
• Showerheads
• Lavatory faucets
• Kitchen faucets
• Clothes washers
• Dishwashers
• Bathtubs
• Hot water delivery/recirculation system
• Thermostatic shutoff valves in showers
• Leaks and leak detection systems
• Other (if applicable)
	• Plant type(s) (i.e., turf, shrubs/ornamentals, xeriscape)
	• Irrigation type (s) (i.e., spray or microirrigation)
	• Pressure-regulating sprinkler bodies or pressure-regulating valve
	• Irrigation scheduling technologies, including:
	  ○ WaterSense labeled weather-based irrigation controller
	  ○ Soil moisture-based control technology
	  ○ Rain shutoff device (rain sensor)
	• Efficient irrigation design or professional irrigation audit
	• Residential Irrigation Capacity Index (RICI) score[9]

8.0 Specification Transition

Implementation of major revisions to the WaterSense labeled homes program will require a transition period to allow homes previously designed, permitted and/or started with the intention of pursuing the WaterSense label under the *WaterSense New Home Specification, Version 1.2,* to be completed and certified. The transition period will also ensure that HCOs will be able to apply for and receive EPA approval to issue the WaterSense label under the revised program structure.

Prospective HCOs can apply to the EPA to be approved to oversee the certification and labeling of homes for WaterSense immediately following publication of the *WaterSense Specification for Homes, Version 2.0.*

Homes pursuing the WaterSense label under *WaterSense New Home Specification, Version 1.2,* must be permitted for construction within 6 months of the publication of the *WaterSense Specification for Homes, Version 2.0.* The final inspection must be completed for homes pursuing the WaterSense label under Version 1.2 of the specification within 12 months (1 year) of publication of the *WaterSense Specification for Homes, Version 2.0.*

The *WaterSense Specification for Homes, Version 2.0,* will become effective 6 months following its publication. After that time, builders designing homes intended for WaterSense certification

[9] The RICI score is a ratio based on the sum of flow rates for each irrigation valve and the irrigated area. In the most basic terms, the higher the RICI score, the higher the anticipated irrigation water use. More information is presented in the *WaterSense Technical Evaluation Process for Approving Home Certification Methods, Version 1.0.*

shall follow the requirements of the final *WaterSense Specification for Homes, Version 2.0,* and the WACM under which they would like to receive the WaterSense label.

9.0 Potential Water, Energy, and Cost Savings

The structure of the *WaterSense Specification for Homes, Version 2.0* assures the EPA that homes that earn the WaterSense label have demonstrated at least 30 percent water savings compared to typical new construction. However, because indoor water use is largely dependent on occupancy, and outdoor water use can vary greatly depending on local climate and landscape size, it can be challenging to pinpoint the average water use of typical new construction.

Water Savings

To quantify household water savings for a WaterSense labeled home, the EPA used its technical evaluation process and tool (described in more detail in Section 7.0). However, in place of the reference homes, the EPA assumed national average household occupancy (2.65 occupants per household)[10] and an average landscape size (5,826 square feet).[11]

Depending on local climate, annual water use for an average home of typical new construction could be between 102,800 gallons of water per year (approximately 43,300 gallons indoor and 59,500 gallons outdoor) and 257,500 gallons of water per year (approximately 43,300 gallons indoor and 214,200 gallons outdoor). Homes built to the water efficiency requirement of being at least 30 percent more water-efficient compared to typical new construction could therefore save between 30,800 gallons and 77,300 gallons of water annually.

For the purposes of estimating potential national water savings, the EPA assumes average household water savings will be 54,050 gallons of water per year. Extrapolated to the national level, if 10 percent of newly constructed single-family homes in the United States earned the WaterSense label,[12] potential estimated annual water savings could be up to 4.3 billion gallons of water (see Calculation 1)

Calculation 1: National Water Savings Potential

$$54{,}050 \text{ gallons savings per year per home}^{13} \times 79{,}500 \text{ homes}^{14} = 4.3 \text{ billion gallons of water}$$

Energy Savings

The energy savings of a WaterSense labeled home will vary depending on the water-efficient design and features of the WACM. The energy savings in a WaterSense labeled home are a result of the decrease in the overall hot water use from more efficient distribution, fixtures and

[10] U.S. Census Bureau. 2017 American Community Survey 1-Year Estimates.
[11] DeOreo, William B., Peter Mayer, Benedykt Dziegielewski, and Jack Kiefer, 2016. *Residential End Uses of Water, Version 2.* Published by the Water Research Foundation. Table 6.31.
[12] This is representative of the approximate market share of the ENERGY STAR Certified Homes Program. www.energystar.gov/newhomes/energy_star_certified_new_homes_market_share
[13] Assumed average savings based the range of estimated water savings achievable by improving water efficiency by 30 percent.
[14] Based on U.S. Census Bureau, Characteristics of New Single-Family Houses Completed, 2017. 795,000 single-family homes were completed in 2017.

appliances. Therefore, energy savings would primarily be associated with indoor efficiency measures, specifically hot water savings from installation of water-efficient showerheads, lavatory and kitchen faucets, dishwashers, clothes washers, and reduction in structural and/or behavioral waste from hot water delivery.

To estimate potential energy savings, the EPA assumes that a home achieves a 30 percent reduction in total indoor water use (see Calculation 2), and that 33.2 percent of this water is hot (based on the breakdown of hot and cold water use identified in REUW2016,[15] see Calculation 3).

Calculation 2: Estimated Indoor Water Savings per Household

$$43{,}300 \text{ gallons of indoor water use per year} \times 30 \text{ percent water savings} = 12{,}990 \text{ gallons of indoor water savings per year}$$

Calculation 3: Estimated Hot Water Savings per Household

$$12{,}990 \text{ gallons of hot water saved per year} \times 33.2 \text{ percent hot water} = 4{,}310 \text{ gallons of hot water saved per year}$$

This expected hot water savings results in 789 kilowatt-hours (kWh) of electricity savings or 3.49 thousand cubic feet (Mcf) of natural gas savings each year (see Calculation 4 and Calculation 7).

Calculation 4: Electricity Savings per Household From Hot Water Savings

$$4{,}310 \text{ gallons of hot water saved per year} \times 0.183 \frac{\text{kWh}}{\text{gallon}} = 789 \text{ kWh of electricity per year}$$

Water heating consumes 0.183 kWh of electricity per gallon of water heated (see Calculation 5), assuming:

- Specific heat of water = 1.0 British thermal units per pound (BTU/lb) ·°F
- 1 gallons of water = 8.34 lbs
- 1 kWh = 3,412 BTUs
- Incoming water temperature is raised 75°F[16]
- Water heating process is 100 percent efficient electric hot water heating[17]

[15] DeOreo, William B., Peter Mayer, Benedykt Dziegielewski, and Jack Kiefer, 2016. *Residential End Uses of Water, Version 2.* Published by the Water Research Foundation. Table 6.25.
[16] DOE, 2014. Technical Support Document: Energy Efficiency Program for Consumer Products and Commercial and Industrial Equipment: Residential Clothes Washers. Office of Energy Efficiency and Renewable Energy, Building Technologies Program, Appliances and Commercial Equipment Standards, p. 7-3.
[17] Ibid.

Calculation 5: kWh of Electricity per Gallon of Water Heated

$$\frac{\left(1 \text{ gallon} * 1.0 \frac{\text{BTU}}{\text{lbs} \cdot °\text{F}}\right) \times \left(\frac{1 \text{ kWh}}{3{,}412 \text{ BTUs}}\right) \times \left(\frac{8.34 \text{ lbs}}{1 \text{ gallon}}\right) \times 75°\text{F}}{100 \text{ percent efficiency}} = 0.183 \text{ kWh/gallon}$$

Calculation 6: Natural Gas Savings per Household From Hot Water Savings

$$4{,}310 \text{ gallons of hot water saved per year} \times 8.09 \times 10^{-4} \frac{\text{Mcf}}{\text{gallon}} = 3.49 \text{ Mcf of natural gas per year}$$

Water heating consumes 8.09 x 10^{-4} Mcf of natural gas per gallon of water heated (see Calculation 7 and Calculation 8), assuming:

- Specific heat of water = 1.0 BTU/lb ·°F
- 1 gallons of water = 8.34 lbs
- 1 therm = 99,976 BTUs
- 1 Mcf = 10.307 therms
- Incoming water temperature is raised 75°F[18]
- Water heating process is 75 percent efficient natural gas hot water heating[19]

Calculation 7: Therms of Natural Gas per Gallon of Water Heated

$$\frac{\left(1 \text{ gallon} * 1.0 \frac{\text{BTU}}{\text{lbs} \cdot °\text{F}}\right) \times \left(\frac{1 \text{ therm}}{99{,}976 \text{ BTUs}}\right) \times \left(\frac{8.34 \text{ lbs}}{1 \text{ gallon}}\right) \times 75°\text{F}}{75 \text{ percent efficiency}} = 0.00834 \text{ therms/gallon}$$

Calculation 8: Mcf of Natural Gas per Gallon of Water Heated

$$0.00834 \frac{\text{therms}}{\text{gallon}} \times \left(\frac{1 \text{ Mcf}}{10.307 \text{ therms}}\right) = 8.09 \times 10^{-4} \text{ Mcf/gallon}$$

In addition to the energy savings from the home itself, WaterSense estimates that an additional 173 kWh of electricity is saved by not supplying the average 54,050 gallons of total water saved per home and treating the average 12,990 gallons of indoor water saved per home[20] (see Calculation 9). If 10 percent of newly constructed single-family homes in the United States

[18] Ibid.
[19] Ibid.
[20] Water used for irrigation would not have been treated at a wastewater treatment facility.

earned the WaterSense label, national energy savings could exceed 42.3 million kWh and 144 million cubic feet (MMcf) of natural gas each year (see Calculation 10 and Calculation 11).

These calculations are based on the following assumptions:

- Approximately 48 percent of new homes in the United States heat their water using electricity, and 52 percent heat their water using natural gas.[21]
- Approximately 89 percent of households in the United States are connected to a water supply.[22]
- Total electricity required to supply water (including pumping raw water, filtration/treatment and distribution) is 0.0021 kWh per gallon.[23]
- Total electricity required to treat wastewater is 0.0025 kWh per gallon[24] and only water savings from indoor uses would have been treated.

Calculation 9: Electricity Savings From Not Supplying Saved Water to the Home

$$\left[12{,}990 \text{ gallons of indoor water savings per year } \times \left(0.0021 \frac{\text{kWh}}{\text{gallon}} + 0.0025 \frac{\text{kWh}}{\text{gallon}}\right)\right] + \left[54{,}050 \text{ gallons of total water savings per year } \times 0.0021 \frac{\text{kWh}}{\text{gallon}}\right] = 173 \text{ kWh of electricity saved per year}$$

Calculation 10: National Electricity Savings Potential

$$(789 \text{ kWh per home per year} \times 0.48 \times 79{,}500 \text{ homes}) + (173 \text{ kWh per home per year} \times 0.89 \times 79{,}500 \text{ homes}) = 42.3 \text{ million kWh of electricity per year}$$

Calculation 11: National Natural Gas Savings Potential

$$(3.49 \text{ Mcf per home per year} \times 0.52 \times 79{,}500 \text{ homes}) = 144{,}276 \text{ Mcf of natural gas per year}$$

Cost Savings

National average water and wastewater costs for residential customers are $11.02 per 1,000 gallons.[25] It is possible, although uncommon, that a homeowner could be billed separately for these utility service connections and would therefore only incur the water supply costs for water used for irrigation.

[21] U.S. Census Bureau. American Housing Survey. 2017. 58,800,000 homes use natural gas to heat water and 54,160,000 homes use electricity to heat water.
[22] U.S. Census Bureau. American Housing Survey. 2017.
[23] Electric Power Research Institute (EPRI), 2013. Electricity Use and Management in the Municipal Water Supply and Wastewater Industries, EPRI, Palo Alto, California, November 2013 Report 3002001433.
[24] Ibid.
[25] Raftelis Financial Consulting, 2016. 2016 Water and Wastewater Rate Survey. American Water Works Association.

Based on the water savings presented above, the EPA estimates that WaterSense labeled homes could save between $340 and $850 annually in water supply and wastewater costs.

Factoring in potential energy savings, the average household with electric water heating may save an additional $104 annually.[26] The average household with natural gas water heating can save an additional $38 annually.[27]

In total, a WaterSense labeled home could save between $378 and $954 annually on utility bills compared to typical new construction.

10.0 Request for Comments, Timeline and Next Steps

Interested parties can provide input on any and all aspects of the *WaterSense Draft Specification for Homes, Version 2.0*; *WaterSense Draft Home Certification System, Version 2.0*; and/or *WaterSense Draft Technical Evaluation Process for Approving Home Certification Methods, Version 1.0*. Please submit written comments should to watersense-programs@erg.com.

All comments, except data claimed as confidential business information (CBI), become a part of the public record. In the case that comments are CBI, they can be submitted as such through the EPA's contractor, Eastern Research Group, Inc. (ERG). Sensitive business information can be claimed confidential under 40 CFR Part 2, Subpart B. ERG has an EPA-approved security plan in place to protect CBI from unauthorized disclosure. All data submitted as confidential will be handled as such. CBI should not be submitted electronically but can be submitted as a hard copy document or on a CD, DVD, or flash drive. Data submitted as CBI will not become a part of the public record unless aggregated and masked to conceal the identity of the submitter.

Data claimed as CBI should be submitted to:

Eastern Research Group, Inc.
Attn: WaterSense Helpline
2300 Wilson Boulevard, Suite 350
Arlington, VA 22201

WaterSense will accept feedback on the information presented above and will consider and respond to all comments and information provided by stakeholders and the general public.

[26] Based on a national residential average of $0.1325/kWh for 2019. U.S. Energy Information Administration. Short Term Energy Outlook. Price Summary Table. Accessed March 4, 2019.
[27] Based on a national residential average of $10.79/Mcf for 2019. U.S. Energy Information Administration. Short Term Energy Outlook. Price Summary Table. Accessed March 4, 2019.