

BEYOND

SMART CITIES

WATER EFFICIENCY - GREEN BUILDING TECHNOLOGY

TRAINING PROGRAM

FOR GREEN BUILDING AND SUSTAINABILITY SPECIALISTS

KRISHNAJI PAWAR, LEED AP BD+C, GSAS CGP, ISO 14001:2015, GCP

WATER EFFICIENCY SPECIALIST CURRICULUM

CERTIFIED WATER EFFICIENCY SPECIALIST

CWES

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INDOOR WATER USE REDUCTION - PREREQUISITE

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LEARNING OBJECTIVES

Intent of indoor Water Use Reduction

Behind the intent

Step by Step Guidance

Required Documentation

Terms and Definitions

WE- PR- DESIGN

INTENT

To reduce indoor potable water consumption and preserve no and low cost potable water resources.

POTENTIAL TECHNOLOGIES & STRATEGIES

☒ Potable water usage in buildings constitutes a large portion of freshwater consumption. Strategies to reduce potable water use in buildings entail the selection of efficient plumbing fixtures, fixtures, and equipment. Fixtures that use 20% to 50% less water than code-required levels are now widely available. The WaterSense label was developed by the U.S. Environmental Protection Agency to identify these efficient fixtures and ensure that higher efficiency does not come at the cost of performance. The WaterSense label has been incorporated as a requirement for this credit to ensure that fixtures in a LEED building are both water efficient and high performing.

INDOOR WATER USE REDUCTION

REQUIREMENTS

For the fixtures and fittings listed in Table 1, as applicable to the project scope, reduce aggregate water consumption by 20% from the baseline. Base calculations on the volumes and flow rates shown in Table 1. All newly installed toilets, urinals, private lavatory faucets, and showerheads that are eligible for labeling must be WaterSense labeled (or a local equivalent for projects outside of the U.S.).

Fixture or fitting	Baseline (gals./unit)	Baseline (20 units)
Toilet (water closet)	4.0 gpm ¹	4.0 gpm
Urinal	10 gpm ²	1.8 gpm
Private lavatory (restroom) faucet	0.5 gpm at 60 psi ³ at all other except private applications	18 gpm at 40 GPa, all other except private applications
Private lavatory faucets	0.5 gpm at 60 psi	0.3 gpm at 40 GPa
Kitchen faucet (excluding dishwashers and secondary sink fixtures)	0.3 gpm at 60 psi	0.3 gpm at 40 GPa
Showerhead ⁴	2.5 gpm at 80 psi per shower stall	0.3 gpm at 300 psi per shower stall

IMPLEMENTATION

REQUIRED DOCUMENTATION

Documentation	Attributes	Minimum Number of Submittals	Frequency of Review
WaterSense labels, manufacturer's literature	None	1	1
Water meter per submittal	None	1	1

For the fixtures and fittings listed in Table 1, as applicable to the project scope, reduce aggregate water consumption by 20% from the baseline. Base calculations on the volumes and flow rates shown in Table 1. All newly installed toilets, urinals, private lavatory faucets, and showerheads that are eligible for labeling must be WaterSense labeled (or a local equivalent for projects outside the U.S.).

Fixture or fitting	Baseline (gP units)	Baseline (gP units)
Toilet (water closet)*	1/6 gpf	4 gpf
Urinal*	1/3 gpf	3.8 gpf
Public lavatory (restroom) faucet	0.5 gpm at 60 psi** all others except private applications	1/8 gpm at 45 kPa, all others except private applications
Private lavatory faucets	2.2 gpm at 60 psi	8.3 gpm at 45 kPa
Kitchen faucet (excluding faucets used exclusively for firing operations)	2.2 gpm at 60 psi	8.3 gpm at 45 kPa
Showerheads*	2.5 gpm at 80 psi per shower stall	9.5 gpm at 550 kPa per shower stall

REQUIRED DOCUMENTATION

Documentation	All projects		Projects with aquifers in process under
	Prescriptive	Usage-based calculations	
PODQ (aquifers, manufacturers' information)	X	X	X
Indoor water use calculator		X	

BEHIND THE INTENT

Potable water usage in buildings constitutes a large portion of freshwater consumption. Strategies to reduce potable water use in buildings entail the selection of efficient plumbing fittings, fixtures, and equipment. Fixtures that use 20% to 50% less water than code-required levels are now widely available. The WaterSense label was developed by the U.S. Environmental Protection Agency to identify these efficient fixtures and ensure that higher efficiency does not come at the cost of performance. The WaterSense label has been incorporated as a requirement for this credit to ensure that fixtures in a LEED building are both water efficient and high performing.

In some buildings, intensive appliance and process water use can exceed water use from fixtures and landscape combined. This is especially true for buildings with cooling towers or evaporative condensers. Appliance and process water use is therefore addressed specifically with a separate set of requirements.

Because the WE section is designed around an "efficiency first" model, the prerequisite deals only with the efficiency of fixtures and fittings; alternative or nonpotable water sources that offset potable water demand are also addressed in the corresponding credit.

BEHIND THE INTENT +

WE prerequisite Indoor Water Use Reduction incorporates feedback from and market barriers identified by LEED project teams. The intent of these changes is to make prerequisite compliance more achievable and relevant to international project teams by recognizing regional variations while maintaining the stringency of requirements for water performance.

STEP-BY-STEP GUIDANCE

STEP 1. SELECT COMPLIANCE PATH

- Determine the appropriate compliance path(s) for the project.
- Compliance Path 1 (Prescriptive Achievement) is for projects whose installed fixtures do not exceed WaterSense maximum levels. Compliance is documented through product cutsheets or fixture schedules.
 - Compliance Path 2 (Usage-Based Calculation) is for projects that cannot demonstrate the 20% reduction for each fixture based on manufacturers' documentation. Using the indoor water use calculator provided by USGBC, the project team must perform calculations to show that, in aggregate, the fixtures comply with prescriptive requirements. Projects pursuing points under WE Credit Indoor Water Use Reduction must use this compliance path.

STEP 2. SELECT WATERSENSE-LABELLED PRODUCTS

Select WaterSense-labeled products for all newly installed fixtures that are eligible for labeling by verifying that the manufacturer and model are listed on the WaterSense website. The WaterSense label can be found for fixtures in the following product categories:

- Tank-type toilet (water closet)
- Water-using urinals
- Private lavatory faucets
- Showerheads

The following fixture types are not labeled by WaterSense and must comply with the percentage reduction criteria:

- Tankless toilets
- Composting toilets and waterless toilets
- Waterless urinals
- Public lavatory faucets

Using urinals is an acceptable water savings strategy.

Newly installed sensors or flow restrictors added to private lavatories or showers must be WaterSense labeled.

For private lavatories, WaterSense requires a maximum flow rate of 1.5 gallons per minute at 60 pounds per square inch and a minimum flow rate of 0.8 gallons per minute at 20 pounds per square inch. The installed fixtures in the design case must use the rated flow rate from the manufacturer and the underlying assumptions must remain consistent between the baseline and design cases.

For projects in countries where WaterSense-labeled products are not readily available, see [Further Explanation, International Tip](#).

STEP-BY-STEP GUIDANCE

STEP 3. SELECT HIGH-EFFICIENCY FEATURES

For all product categories, including those covered by WaterSense, specify low-flow fixtures. Where possible, select fixtures that meet or exceed the 20% reduction indicated in the prescriptive requirements.

Some equipment does not need to meet the 20% reduction threshold (see [Further Explanation, Equipment Water-Using Equipment](#)).

The interactions between urinals and urinalometers which thresholds each fixture and fitting must meet (see [Further Explanation, Public Restrooms](#)).

For public restrooms or urinal fixtures, see [Further Explanation, Urinals or Nonwaterless Urinal Closets](#).

Doors can be defined as public, private, kitchen or entrance, depending on use and location. Kitchen sinks include all sinks in public or private buildings that are used with patterns and purposes similar to residential kitchen sinks, food or meal preparation sinks, office kitchenware sinks, staff lounge sinks, party or function service sinks, which observations are used primarily for residential kitchen sinks, and commercial food service kitchen hand sinks that do not pass through a grease interceptor are considered kitchen sinks.

STEP 4. SELECT HIGH-EFFICIENCY APPLIANCES

Select appliances that meet the labeling or performance requirements outlined in the prescriptive requirements.

ENERGY STAR for not be readily available at all sites (see [Further Explanation, International Tip](#)).

Commercial projects with noncommercial, standard-sized dishwashers must comply with the residential dishwasher requirements.

Residential criteria include all noncommercial-grade clothes washers in office spaces, daycare centers, and so on.

Ice machines that are eligible for the ENERGY STAR label—for example, ice machines within refrigerators—do not need to comply with the prescriptive requirement.

STEP 5. DESIGN PROCESS WATER SYSTEMS

Where applicable, select air handler technologies and equipment that meet the standards for process water in the prescriptive requirements.

For heat exchangers, the requirements apply to systems such as chillers, air handlers, ice machines, air handlers, HR machines, CT systems, and other medical equipment the cooling for which involves large amounts of water and energy.

Design mechanical cooling systems to meet or exceed potable water use and to capture and reuse excess generated heat. Total air-cooled or liquid-cooled cooling instead of open-loop (i.e., once-through) systems for needed equipment. Redesigning the cooling in critical applications may be required, as emergency backup, consider recirculating systems, draining technology, and holding tanks, as well as recirculate water sources for air-cooled vacuum pumps and once-through cooling systems.

For medical equipment, consider designing and including a dedicated nonpotable water loop to serve medical waste.

If discharge waste temperature is regulated, consider recovering and reusing the system's waste heat for non-temperature heating (e.g., domestic water preheating).

STEP-BY-STEP GUIDANCE

STEP 6. DEVELOP CHALLENGE YOUR NARRATIVE, IF APPLICABLE

Describe the reasons that a project team's prescriptive requirements are not met, including the reasons, conditions, delays, and so on.

COMPLIANCE PATH 1: PREScriptive ACHIEVEMENT (PRESCRIPTIVE ONLY)

Each of the listed projects must meet the following prescriptive limit for flow rate (maximum).

TABLE 1: COMPLIANCE PATH 1: PREScriptive ACHIEVEMENT (PRESCRIPTIVE ONLY)

Flow rate (maximum)

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TABLE 1 List of water use reduction strategies

Daily water use for each fixture type	×	Fixture flow or flow rate	×	Duration of use	×	Days	×	Number of persons per day
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- The duration of all number of users, and uses per person per day must be the same in both the baseline and the design cases.
- Quick flush toilet flush rates must be calculated as the average using a 12 (high flush low flush) ratio.
- Heating/cooling measured in gallons (liters) per cycle (ton, ton) and cycle duration in manufacturer's documentation must be converted to a flow rate in gallons (liters) per minute (gpm, lpm). Use Equation 2 to perform the conversion.

$$\text{Flow rate (gpc)} = \left\{ \frac{\text{Olfenure rate (gpc)} \times X}{\text{Olfenure rate (gpc)}} \right\}$$

For example, convert a 0.2 gpc-relating faucet with a 10 second cycle duration as follows

5. Repeat, convert a 0.75- μs master event with a 0.2-second cycle duration as follows:

$$\left\{ \frac{0.75 \mu\text{s} \times 10^{-6}}{0.2 \text{ sec}} \right\} \times 0.2 \text{ sec}$$

Fixture or fitting	Baseline (gP units)	Baseline (l/s units)
Toilet (water closet)*	1.6 gpf	6.3 lps
Urinal*	1.0 gpf	3.8 lps
Public lavatory (restroom) faucet	0.5 gpm at 60 psia ^a or others except private applications	1.9 lpm at 415 kPa, or others except private applications
Private lavatory faucets	2.2 gpm at 60 psi	8.3 lpm at 415 kPa
Kitchen faucet (excluding faucet used exclusively for filling operations)	2.2 gpm at 60 psi	8.3 lpm at 415 kPa
Showers ^b	2.5 gpm at 80 psi per shower stall	9.5 lpm at 550 kPa per shower stall

* WaterSense label available for this product type
 gpf = gallons per flush
 gpm = gallons per minute
 psi = pounds per square inch

^a l/s = liters per flush
 lpm = liters per minute
 kPa = kilopascals

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REQUIREMENTS +



Table 2. Standards for appliances

Appliance	Requirement
Residential clothes washers	ENERGY STAR or performance equivalent*
Commercial clothes washers	ENERGY STAR or performance equivalent
Residential dishwashers (standard and compact)	ENERGY STAR or performance equivalent*
Pre-rinse spray valves	≤ 1.3 gpm (4.9 lpm)
Ice machine	ENERGY STAR or performance equivalent and use either air-cooled or closed-loop cooling, such as chilled or condenser water system

gpm = gallons per minute

lpm = liters per minute

*Projects in Europe may install residential appliances meeting the EU A label.

Appliance and Process Water Use
Install appliances, equipment, and processes within the project scope that meet the requirements listed in the tables below. Existing appliances intended for reuse in the project are not required to meet the requirements in Table 2.

REQUIREMENTS +



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Ice machine	ENERGY STAR or performance equivalent and use either air-cooled or closed-loop cooling, such as chilled or condenser water system

gpm = gallons per minute

lpm = liters per minute

*Projects in Europe may install residential appliances meeting the EU A label.

Table 3. Standards for processes

Process	Requirement
Heat rejection and cooling	No once-through cooling with potable water for any equipment or appliances that reject heat
Cooling towers and evaporative condensers	Equip with <ul style="list-style-type: none">• makeup water meters• conductivity controllers and overflow alarms• efficient drift eliminators that reduce drift to maximum of 0.002% of recirculated water volume for counterflow towers and 0.005% of recirculated water flow for cross-flow towers

Appliance and Process Water Use
Install appliances, equipment, and processes within the project scope that meet the requirements listed in the tables below. Existing appliances intended for reuse in the project are not required to meet the requirements in Table 2.

REQUIREMENTS +



Table 4. Standards for appliances

Kitchen equipment	Requirement (IP units)	Requirement (SI units)
Dishwasher		
Undercounter	≤ 1.6 gal/rack	≤ 6.0 liter/rack
Stationary, single tank, door	≤ 1.4 gal/rack	≤ 5.3 liter/rack
Single tank, conveyor	≤ 1.0 gal/rack	≤ 3.8 liter/rack
Multiple tank, conveyor	≤ 0.9 gal/rack	≤ 3.4 liter/rack
Flight machine	≤ 160 gal/hour	≤ 600 liter/hour
Food warmer		
Batch	≤ 4.6 gal/hour/pan	≤ 22 liter/hour/pan
Cook-to-order	≤ 10 gal/hour/pan	≤ 38 liter/hour/pan
Combination oven		
Countertop or island	≤ 3.3 gal/hour/pan	≤ 13 liter/hour/pan
Roll-in	≤ 3.5 gal/hour/pan	≤ 13 liter/hour/pan

Table 5. Process requirements

Discharge water temperature (temporarily)	Where local requirements limit discharge temperature of fluids into drainage system, use temperature device that links water temp when equipment discharges hot water (oil). Provide thermal recovery heat exchanger that cools drained discharge water below code-required maximum discharge temperatures while simultaneously preheating start makeup water (oil). If fluid is steam condensate, return it to boiler.
Venturi-type flow-through vacuum generators or aspirators	Use no device that generates vacuum by means of water flow through device into drain.

Healthcare, Retail, Schools, and Hospitality Only
In addition, water-consuming appliances, equipment, and processes must meet the requirements listed in Tables 4 and 5.

INTERNATIONAL TIPS

Refer to the LEED v4 reference guide, with the following modifications:

International projects located where standard water supply pressure is different than the LEED baseline supply pressure values may calculate the water consumption of flow fixtures and fittings at the local standard water supply pressure. Product cut-sheets must demonstrate that the fixture or fitting complies with the LEED baseline flow rate.

✓ Projects that are unable to provide manufacturer documentation of the fixture flow rate at the LEED baseline water supply pressure may use the local standard supply water pressure in the design case and the standard LEED baseline flow rates in the baseline case.

✓ Projects served by water supply pressures different than specified in LEED may install pressure compensating aerators in flow fixtures to achieve the desired flow rate without compromising user satisfaction.

INTERNATIONAL TIPS +

The EU A label for residential appliances is an acceptable alternative to ENERGY STAR. The EU Eco design and Labelling framework establishes minimum performance standards for the energy and environmental performance of appliances and products.

The CEE Commercial Clothes Washer Specifications no longer active. Commercial clothes washers require the ENERGY STAR label or performance equivalent.

✓ Performance equivalent refers to both the energy and water criteria in the ENERGY STAR product specifications, available on the ENERGY STAR website.

✓ Products must meet the standards of the current version of ENERGY STAR as of the date of their purchase.

REQUIRED DOCUMENTATION

Documentation	All projects		Projects with appliance or process water
	Prescriptive	Usage-based calculation	
Product cutsheets, manufacturers' information	X	X	X
Indoor water use calculator		X	

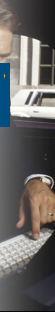
REFERENCED STANDARDS

- ✓Energy Policy Act (EPAct) of 1992 and as amended: eere.energy.gov/femp/regulations/epact1992.html
- ✓EPAct 2005: eere.energy.gov/femp/regulations/epact2005.html
- ✓International Association of Plumbing and Mechanical Officials Publication IAPMO/ANSI UPC 1-2006, Uniform Plumbing Code 2006, Section 402.0, Water-Conserving Fixtures and Fittings: iapmo.org
- ✓International Code Council, International Plumbing Code 2006, Section 604, Design of Building Water Distribution System: iccsafe.org
- ✓WaterSense: epa.gov/watersense
- ✓IgCC/ASHRAE 189.1 cooling tower and evaporative condenser requirements: ashrae.org/resources--publications/bookstore/standard-189-1



CONNECTION TO ONGOING PERFORMANCE

LEED O+M WE credit Water Performance : Selecting efficient fixtures, fittings and appliances in the design phase helps ensure that projects will use less water throughout the building life cycle, which may help improve a project's water performance score.



TERMS AND DEFINITIONS

- ✓Closed-loop cooling a system that acts as a heat sink for heat-rejecting building and medical equipment by recirculating water. Because the water is sealed within the system, some closed-loop cooling systems use non potable water (such as recycled process water harvested from an air handler's cooling coil condensate).
- ✓Conductivity the measurement of the level of dissolved solids in water, using the ability of an electric current to pass through water. Because it is affected by temperature, conductivity is measured at 25°C for standardization.
- ✓Drift water droplets carried from a cooling tower or evaporative condenser by a stream of air passing through the system. Drift eliminators capture these droplets and return them to the reservoir at the bottom of the cooling tower or evaporative condenser for recirculation.

