Water Rating Index (WRI)

Overview

A Water Rating Index (WRI) score can be applied toward Water Efficiency compliance under the New Construction (804.1) and Single-Family Certified (1204.4) scoring paths of the 2020 National Green Building Standard™ (NGBS). The process and underlying equations for generating a WRI score are detailed in Appendix D of the 2020 NGBS.

Home Innovation Research Labs has determined the Appendix D text, as written, includes several areas in conflict with building eligibility elements described in Chapter 3, or is otherwise incomplete or inaccurate.

Interpretation by Home Innovation Research Labs for Green Certification

To prepare a usable calculator tool for scoring and verification purposes, Home Innovation staff deemed it necessary to make several interpretations related to this issue. These interpretations are detailed in this document (in *italics*) and reflected in the "Amended Appendix D" that is included in the Verifier's Resource Guide (VRG).

D101.3 Capabilities

Appendix D D101.3(1) states the WRI calculation applies to both new and existing construction.

The NGBS only references WRI within the New Construction and Single-Family Certified paths. As Home Innovation does not intend to issue WRI scores independently from NGBS Green Certification, certified WRI scores are only available for newly-constructed buildings.

Appendix D D101.3(2) states the WRI calculation is available for one or more of the following building types:

a. One- and two- family dwellings;
b. Townhouses not more than three stories above grade in height; and
c. Multifamily buildings as a whole building, or individual dwelling units provided that each unit has a separate water meter.

Home Innovation issues WRI scores to single-family homes, townhomes, and multifamily buildings of all sizes (i.e., all building types that are eligible for NGBS Green Certification under the New Construction and Single-Family Certified pathways).

We believe the story limit included within Appendix D was intended as a definition of what constitutes a townhome rather than a true restriction of building eligibility. Per the IRC classification, all townhomes

are at or below three stories. Home Innovation found no building science reason to limit townhomes of a certain height.

Home Innovation issues WRI scores for whole buildings, not individual dwelling units. This aligns with how NGBS compliance is assessed. Per Section 303 Green Buildings, residential buildings and the residential portions of mixed-use buildings are assessed in their entirety for NGBS compliance.

D101.5 Compute Water Rating Index

Appendix D D101.5 states, "The WRI shall be computed as a percentage of the combined indoor and outdoor water use in relation to the combined indoor and outdoor water baseline."

Appendix D, as written, does not address common areas; however, Home Innovation determined it prudent to evaluate the water demand of multifamily common areas, such as party rooms, lavatories, and laundry facilities. In most other areas of the NGBS, all residential portions, including residential common areas, are evaluated for compliance.

Amended Appendix D within the VRG includes an additional section for Indoor Common Area and has adjusted equations that reflect how those values factor into the overall WRI calculation. This section was developed using reputable water volume and use factors derived largely from The Handbook of Water Use and Conservation.[i]

D101.6 Indoor Water

Appendix D D101.6(2) includes the following equation for calculating Number of Occupants: "NumOccupants = bedrooms + 1."

As written, Appendix D does not identify how to extend this equation to multifamily buildings. It also does not include guidance regarding how Number of Occupants would be calculated in the case of group living (e.g., dormitories and independent living facilities), where it cannot be assumed that there will be a master bedroom with two occupants.

When creating the WRI Calculator, Home Innovation included prompts that ask the user to enter the total number of 0-/1-bedroom, 2-bedroom, 3-bedroom, and 4-bedroom units. The Number of Occupants is calculated based on those inputs.

For group living, users are instructed to enter a bedroom value based on the total expected number of occupants to per unit. For example, a 2-bedroom unit planned to house 4 individuals would be entered as a 3-bedrooom unit.

Table 1 "Water Use for Baseline and Verified Devices" in D101.6(4) identifies baseline water volume per occupant per day for each device, as well as expected uses for the devices per occupant per day.

Home Innovation identified that this table includes an error related to clothes washer water volume. As written, the baseline volume per occupant is 7.41. The correct value should be "17.41." The 7.41 value is unrealistically low, given that most high-efficiency clothes washer are between 15 and 30 gallons.

Per capita water use from a clothes washer is presently 16 gallons/person/day, but it was as high was 21 gallons/person/day before 1980. A value of 17.41 would put the baseline around the estimate daily use by Americans around 1985. That is a more reasonable value for a representation of "typical" home water use.

Appendix D D101.6(5a) does not include a clear equation for verified structural wastewater.

Home Innovation determined the equation should be as follows:

> *StructuralWasteWater(verified) = NumOccupants x Daily Hot Water Draws x VerifiedStructuralWaste*

Daily Hot Water Draws is applied as 1.22 hot water draws per person per day. This value was derived from the U.S. EPA's WaterSense Homes Draft Technical Evaluation Process for Approving Home Certification Methods 1.0.[ii]

Appendix D D101.6(5b)(ii) includes three exceptions for the Estimated Vertical Pipe equation within the Baseline Structural Waste section.

(1) Add half floor height for one story house with crawlspace and water heater on first floor or in garage
(2) Add half floor height for 1 story with slab
(3) Subtract 1 floor height for 2 story slab on grade

The intent of these exceptions is unclear, and Home Innovation elected not to apply them to the WRI Calculator. Inclusion of these exceptions would instill inconsistencies between the baseline and verified calculations, as similar construction details are not reflected in the verified structural waste equation.

Appendix D D101.6(6)(iv) considers verified leaks within the Other Water Use section.

Because the NGBS Green program only plans to issue WRI scores to newly-constructed buildings, we do not allow verified leaks to be factored into water use calculations.

D101.7 Water Capture for Potential Reuse

Appendix D D101.7(1)(d) provides incomplete information about the appropriate applications of captured water. Not all indoor and outdoor water uses are identified as potential applications for captured water.

Home Innovation assumed the following applications for the captured water type, which enable a building to achieve a score as low as 0; all water can be offset by captured water.

Capture Type	Uses
Rainwater	Toilet Urinal Shower Bathtub Lavatory Faucet Dishwasher Clothes Washer Pools/Spas Irrigation
Greywater	Toilet Urinal Irrigation
Blackwater	Irrigation

For multifamily buildings with common areas, water reuse credits are applied toward in-unit water use first, then to common area uses. Structural waste can be offset as well, when the user identifies that all water is from captured water sources.

D101.8 Outdoor Calculations

Appendix D D101.8(2a) says, "To define the water months, take the number of frost days in a year, divide by twelve, and round to the nearest whole month."

In developing the WRI tool, Home Innovation identified that the WRI equation for watering months did not yield a usable number. The corrected equation for calculating water months is:

Water Months = 12 – (Number of Frost Days in a year / 30), rounded to the nearest whole month

[i] Vickers, Amy. 2001. *Handbook of Water Use and Conservation: Homes, Landscapes, Businesses, Industries, Farms* (WaterPlow Press, Amherst, MA), Fourth printing: 2012.

[ii] U.S. EPA. *WaterSense Draft Technical Evaluation Process for Approving Home Certification Methods, Version 1.0*, last modified April 18, 2019, https://www.epa.gov/sites/production/files/2019-04/documents/ws-homes-draft-technical-evaluation-v1.pdf.