



Department of Safety and Professional Services  
Division of Industry Services  
Plumbing Product Review  
4822 Madison Yards Way  
P.O. Box 7162  
Madison, Wisconsin 53707-7162  
**Phone** 608-266-2112  
**Web** <http://dsps.wi.gov>  
**Email** [dsps@wisconsin.gov](mailto:dsps@wisconsin.gov)  
**TTY: Contact Through Relay**

Governor Tony Evers Dawn Crim, Secretary

May 3, 2022

Dept. of Safety and Professional Services  
Bureau of Technical Services  
Division of Industry Services  
Michael McNally - Section Chief  
4822 Madison Yards Way  
Madison WI 53705

Re: Description: Alternate Standard, Sizing of Water Supply Piping  
Manufacturer: Dept. of Safety and Professional Services  
Product Name: IAPMO Water Demand Calculator (WDC)  
Model Number(s): v. 2.1  
eSLA PTO No.: PP-031603529-PTOAA

The specifications and/or plans for this alternate standard have been reviewed and determined to be in compliance with chapters SPS 382 through 384, Wisconsin Administrative Code, and Chapters 145 and 160, Wisconsin Statutes.

The Department hereby issues an alternate standard approval to s. SPS 382.40(7)(a) based on the Wisconsin Statutes and the Wisconsin Administrative Code. This approval is valid until the end of May 2027. This alternate standard approval is contingent upon compliance with the following stipulation(s):

1. Water supply piping shall be sized and installed in strict accordance with WDC v. 2.1, Chapters 381-386 Wis. Adm. Code and this alternate standard approval. If there is a conflict between the alternate standard and the Wis. Adm. Code or this Alternate Standard Approval, then the Wis. Adm. Code and this Alternate Standard Approval shall take precedence.
2. A copy of this approval letter shall be submitted with all plans using the IAPMO Water Demand Calculator (WDC) v. 2.1.  
  
Plans submitted without a copy of this approval letter may be denied.
3. This alternate standard provides a method for estimating the demand load for the building water supply and principal branches for one- and two-family dwellings as specified in s. SPS 320.02(1)(a), (ce), (cm), or (cs) Wis. Adm. Code and nonpublic multiple dwellings, as defined by s. SPS 381.01(155) and (162) Wis. Adm. Code, with water conserving plumbing fixtures, fixture fittings and appliances.
4. Building control valves and water heater control valves shall be permanently tagged with an indelible weather resistant tag, permanently affixed to the valve body assembly that displays the statement: "This water supply system is sized using IAPMO WDC v. 2.1."
5. The completed water demand calculation sheet shall be posted on, or immediately adjacent to, the building control valve for each one- or two-family dwelling. The completed water demand calculation sheet shall be posted within a mechanical room within 3-ft. of the building control valve for a nonpublic multiple dwellings as defined by s. SPS 381.01(155) and (162) Wis. Adm. Code.
6. All plans submitted to the department using this alternate standard shall conform to s. SPS 382.20(4) Wis. Adm. Code and:
  - a. All piping sized using this alternative standard shall display bold, underlined and italicized GPM loads on the plan sheets.
  - b. Water distribution piping ½-in. in diameter serving two or more plumbing fixtures shall not have a load greater than those assessed per pressure available for uniform loss ("A" value) in Tables SPS 382.40 4-11 Wis. Adm. Code and tables for ASTM D1785 and ASTM F441 in the appendix.
  - c. Each point of reference for pipe sizing shall include a completed WDC calculation sheet. See attached

Label piping here

- d. Pertinent plan sheets shall include the water demand calculator sizing print out for each point of reference and GPM table. These shall be on the same page as the point of reference and shall include all fixtures that the point of reference is supplying.
  - e. Detailed fixture specifications, including appliance Energy Star listing, shall be included in the plan set.
  - f. Fees for the department review of plans using this alternate standard shall be assessed based on the pipe size after the meter as determined via the empirical sizing method described in s. SPS 382.40(7) Wis. Adm. Code; not the alternate standard method (i.e., WDC v. 2.1). Fees for delegated plumbing and Uniform Dwelling Code municipalities will be assessed in accordance with local ordinance.
7. All plans submitted to the department or the local municipality shall use the WDC v. 2.1 version of the alternate standard.
  8. All water supply and water distribution piping shall conform to s. SPS 384.30(4) Wis. Adm. Code.
  9. All plumbing approved under this alternate standard shall be installed by persons holding the proper license or registration in accordance with Wis. Stats. § 145.
  10. **Water conserving fixtures required.** Plumbing fixtures, fixtured fittings, and appliances shall not exceed the maximum design flow rates displayed in Table 1:

Table 1	
Design Flow Rate for Water Conserving Plumbing Fixtures and Appliances in Residential Occupancies	
Fixture and Appliance	Maximum Design Flow Rate (gpm)
Bar Sink	1.5
Bathtub	5.5
Bidet	2.0
Clothes Washer <sup>a</sup>	3.5
Combination Bath/Shower	5.5
Dishwasher <sup>a</sup>	1.3
Faucet, Kitchen	2.2
Faucet, Laundry (with aerator)	2.0
Faucet, Lavatory	1.5
Shower, per head	2.0
Water Closet, Flush Tank, 1.28 gpf	3.0

a = Clothes washers and dishwashers shall have an Energy Star label. See Technical notations "c" and "d."

**Calculation 1 Example: Meter and Water Service.** To determine the design flow rate for the water meter and building supply, enter the total number of plumbing fixtures and appliances for the building in Column “B” of the Water Demand Calculator and run the calculation. See Table 2:

Table 2				
Water Demand Calculator Example				
(A) Fixture	(B) Enter # of Fixtures	(C) Probability of Simultaneous Use (%)	(D) Enter Fixture Flow Rate (gpm)	(E) Max. Recommended Fixture Flow Rate (gpm)
1. Bar Sink	0	2.0	1.5	1.5
2. Bathtub	0	1.0	5.5	5.5
3. Bidet	0	1.0	2.0	2.0
4. Clothes Washer <sup>a</sup>	1	5.5	3.5	3.5
5. Combination Bath/Shower	1	5.5	5.5	5.5
6. Dishwasher <sup>a</sup>	1	0.5	1.3	1.3
7. Faucet, Kitchen	1	2.0	2.2	2.2
8. Faucet, Laundry (with aerator)	0	2.0	2.0	2.0
9. Faucet, Lavatory	1	2.0	1.5	1.5
10. Shower, per head	0	4.5	2.0	2.0
11. Water Closet, Flush Tank, 1.28 gpf	1	1.0	3.0	3.0
12. Other fixture 1	0	0.0	0.0	6.0
13. Other fixture 2	0	0.0	0.0	6.0
14. Other fixture 3	0	0.0	0.0	6.0
Total # of Fixtures	6		RESET	RUN WATER DEMAND CALCULATOR
99 <sup>th</sup> Percentile Demand Flow (gpm) =	8.5			

<sup>a</sup> = Clothes washers and dishwashers shall have an Energy Star label. See Technical notations “c” and “d.”

**Calculation 2 Example: Sizing of Water Supply Piping:** To determine the design flow rate for water distribution and risers, enter the total number of plumbing fixtures and appliances for the water distribution piping or riser in Column [B] of the Water Demand Calculator and run Calculator. The flow rate for one fixture supply shall not exceed the design flow rate of the fixture according to Table 1.

**Calculation 3 Example: Continuous Supply Demand Fixtures:** Continuous supply demands in gallons per minute (gpm) for lawn sprinklers, air conditioners, hose bibbs, etc., shall be added to the total estimated demand for the building supply as determined by “other fixtures” in Table 2. There will need to be assessed GPM loads per the designer on the flow rate for these “other fixtures.” These can be verified through Table 3:

Table 3	
Water Supply Fixture Units (wsfu's)	Predominately Flush Tank Water Closets or Washdown Urinals (GPM's)
1	1
2	2
3	3
4	4
5	4.5
6	5
7	6
8	6.5
9	7
10	8
20	14
30	20
40	24
50	28
60	32

<sup>a</sup> = Values not specified in the table may be calculated via interpolation.

Where a hose bibb or other similar type flow rate is installed on a fixture branch, the demand of the hose bibb or other similar type fixture shall be added to the design flow rate for the fixture branch as determined by Table 3.

Fixtures not included in Table 1 shall be added in Rows 12 through 14 in the Water Demand Calculator as "Other Fixture". The probability of use and flow rate for Other Fixtures shall be added by selecting a comparable probability of use and flow rate to similar fixtures from Table 4:

Fixture <sup>a</sup>	Probability of Simultaneous Use (%)	Maximum Flow Rate (gpm)
Residential Ice Maker	0.5	0.25
Pot Filler	1.0	4.0
1.6 gpf Water Closet	1.0	3.75
Glass filler	0.5	0.5
Steam Dryer	0.5	0.5
Humidifier	0.5	0.5

a = For fixtures not listed, factors may be assumed by comparing the fixture to a listed fixture which uses water in similar quantities and at similar rates

**Calculation 4 Example: Pressure available for uniform loss methodology.** The determination of minimum pipe sizes shall consider the pressure losses which occur throughout the entire water supply system and the flow velocities within the water distribution system. Calculations for sizing a water distribution system shall include:

- a. The load factor in water supply fixture units or gallons per minute on the piping;
- b. The minimum pressure available from the water main or pressure tank;
- c. The pressure loss due to the differences in elevation from the:
  - I. Water main or pressure tank to the building control valve; and
  - II. Building control valve to the controlling plumbing fixture;
- d. The pressure losses due to flow through water heaters, water treatment devices, water meters and backflow preventers;
- e. The minimum flow pressure needed at the controlling plumbing fixture; and
- f. The pressure losses due to friction loss through piping, fittings, valves and other plumbing appurtenances. This pressure loss may be calculated in terms of equivalent lengths of piping. The equivalent length of piping to a controlling plumbing fixture, including fittings, valves and other appurtenances, may be obtained by multiplying the developed length by 1.5.

Technical notations:

- a. IAPMO Water Demand Calculator (WDC ): <https://www.iapmo.org/we-stand/>
- b. UPC 2021, Appendix M, pgs. 415-420: <https://epubs.iapmo.org/2021/UPC/>
- c. Energy Star clothes washers: <https://www.energystar.gov/productfinder/product/certified-clothes-washers/results>
- d. Energy Star dishwashers: <https://www.energystar.gov/productfinder/product/certified-residential-dishwashers/results>
- e. DSPS Water Calc. Sheet and Instructions: <https://dps.wi.gov/Documents/Programs/Plumbing/SBD6479.pdf>  
<https://dps.wi.gov/Documents/Programs/Plumbing/SBD6479Instructions.pdf>

The department is in no way endorsing this alternate standard or any advertising, and is not responsible for any situation which may result from its use.

Sincerely,

Michael McNally – Section Chief  
Department of Safety and Professional Services  
Bureau of Technical Services  
Division of industry Services  
Phone: 608 228-4531  
Email: [MichaelD.McNally@wisconsin.gov](mailto:MichaelD.McNally@wisconsin.gov)

## **EXAMPLE**

# **Water Demand Calculator for Estimating Peak Water Demand for Indoor Residential Water Use**

Version 2.1

March 2021

### **Authors:**

Steven Buchberger, (PE), PhD - Professor, Civil and Environmental Engineering, University of Cincinnati  
Toritseju Omaghomi, PhD - Environmental Engineering, University of Cincinnati  
Timothy Wolfe (PE) - Director, Plumbing Engineering, TRC Worldwide Engineering – MEP, LLC  
Jason Hewitt (PE) - Seattle Office Manager, CB Engineers - P.E., CPD, LEED AP  
Daniel Cole - Chair - Sr. Director of Technical Services, International Association of Plumbing and Mechanical Officials (IAPMO).

### **Abstract:**

The Water Demand Calculator (WDC) is an application that computes the 99th percentile of the instantaneous water demand expected during the period of peak indoor use in a residential building that is fitted with efficient (water conserving) fixtures. The WDC can be applied to estimate peak demand in residential buildings ranging from single family homes to large multi-family apartments and condominium complexes. The user provides the number and the flow rate for each type of indoor fixture in the residential building. The WDC summarizes the input data and returns an estimate of the corresponding 99th percentile of the instantaneous water demand.

### **Acknowledgments:**

Sponsors - International Association of Plumbing and Mechanical Officials (IAPMO), Water Quality Association (WQA), American Society of Plumbing Engineers (ASPE)  
Code: Developed by Toritseju Omaghomi

### **System Requirements:**

The Water Demand Calculator is a Microsoft Office Excel file and requires a compatible version of Excel 2009 or later to prevent loss of functionality. This file also uses active content (macros). When downloading this file, Microsoft Office has security features causing a message bar to appear warning that the active content may contain viruses and other security hazards that could harm your computer or your organization's network and that the macros have been disabled. This does not mean that viruses have been detected. It only means that active content has been detected and the user is being warned. Since the source file comes from IAPMO, the file can be trusted and the macros can be enabled. You may need to change the settings in the Trust Center on your computer (find this in the Options section of Microsoft Office applications). Once the file is trusted, the warning will no longer appear. You may also need to check with your company's System's Administrator for security permission to download a file with macros.

### **Disclaimer:**

Although care has been taken to ensure the accuracy, completeness and reliability of the Water Demand Calculator ("Calculator"), neither IAPMO nor any other party makes any warranties, express or implied, or representations as to the accuracy of the Calculator. Neither IAPMO nor any other party assumes any liability or responsibility for any error or omissions in the information contained in or output by the Calculator. Neither IAPMO nor any other party assumes any responsibility for the consequences of use of such information, nor for any infringement of third-party intellectual property rights which may result from its use.

Visit IAPMO web site for more information at

<http://www.iapmo.org/WESTand/Pages/WaterDemandCalculator.aspx>

Click to Select Building Type

# Water Demand Calculator (WDC v2.0)

Enter Total Number of Apartments in the Building (integer ≥1)

NOTE: This value does not affect the results in this calculation; however, the Total Number of Apartments in Building must be ≥ the Total Apartments in this Calculation.

PROJECT NAME :  
Click for Drop-down Menu →

Test Case for WDC  
Multi-Family Building

Total Number of Apartments in the Building → 10  
Total Apartments in this Calculation → 8

Tuesday, 2 June, 2020  
9:34 AM

White cells accept input values.  
NOTE: Active cells are highlighted in yellow

FIXTURE GROUPS	FIXTURE	ENTER TOTAL NUMBER OF FIXTURES	PROBABILITY OF USE (%)	ENTER FIXTURE FLOW RATE (GPM)	MAXIMUM RECOMMENDED FIXTURE FLOW RATE (GPM)
Bathroom Fixtures	1 Bathtub (no Shower)	0	0.71	5.5	5.5
	2 Bidet	0	0.65	2.0	2.0
	3 Combination Bath/Shower	16	2.85	5.5	5.5
	4 Faucet, Lavatory	32	1.61	1.5	1.5
	5 Shower, per head (no Bathtub)	16	1.98	2.0	2.0
	6 Water Closet, 1.28 GPF Gravity Tank	32	0.65	3.0	3.0
Kitchen Fixtures	7 Dishwasher	8	0.41	1.3	1.3
	8 Faucet, Kitchen Sink	8	1.61	2.2	2.2
Laundry Room Fixtures	9 Clothes Washer	8	2.80	3.5	3.5
	10 Faucet, Laundry	8	1.61	2.0	2.0
Bar/Prep Fixtures	11 Faucet, Bar Sink	0	1.61	1.5	1.5
Other Fixtures	12 Utility Sink	4	1.50	5.5	6.0
	13 Fixture 2	0	0.00	0.0	6.0
	14 Fixture 3	0	0.00	0.0	6.0

Other types of fixtures.

## COMPUTED RESULTS FOR PEAK PERIOD CONDITIONS

Total No. of Fixtures in Calculation  
n = 128

Enter Number of Apartments Considered in this Calculation. (integer ≥1)

Sum of fixtures entered in the calculator.

99<sup>th</sup> Percentile Demand Flow  
Q = 18.8 GPM

Demand flow in the selected units of measurement.

Hunter Number  
H(n,p) = 2.00

Average number of fixtures in use at any instant.

Stagnation Probability  
Pr[Zero Demand] = 13%

Probability of no fixtures in use at any instant.

Enter 'Other Fixture' Probability of use (0.1 - 6%) in [Column C]  
Enter 'Other Fixture' flow rate in [Column D]

Downloads the current result to a file named WDCResults-DDMMYY-hhmmss.txt in the "Downloads" folder.

DOWNLOAD RESULT

RESET WDC

Click to reset number of fixtures

Select Units for Water Demand

GPM LPM LPS

Select from these units of measurement:  
GPM - Gallons per minute, LPM - Liters per minute, LPS - Liters per second.

RUN WDC

CLICK BUTTON

If visible, fixture combination has changed. Therefore run water demand calculator for a new result.

If visible, there is an entry for "Other fixture". Enter appropriate fixture p-value and flow rate (GPM, LPM, or LPS).



## Water Demand Calculator (WDC v2.1)

PROJECT NAME :  
[Click for Drop-down Menu →](#)

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Single-Family Residence Single-Family Residence

Sunday, April 17, 2022  
 12:24 PM

FIXTURE GROUPS	FIXTURE	ENTER TOTAL NUMBER OF FIXTURES	PROBABILITY OF USE (%)	ENTER FIXTURE FLOW RATE (GPM)	MAXIMUM RECOMMENDED FIXTURE FLOW RATE (GPM)
Bathroom Fixtures	1 Bath tub (no Shower)	0	1.00	5.5	5.5
	2 Bidet	0	1.00	2.0	2.0
	3 Combination Bath/Shower	0	5.50	5.5	5.5
	4 Faucet, Lavatory	0	2.00	1.5	1.5
	5 Shower, per head (no Bathtub)	0	4.50	2.0	2.0
	6 Water Closet, 1.28 GPF Gravity Tank	0	1.00	3.0	3.0
Kitchen Fixtures	7 Dishwasher	0	0.50	1.3	1.3
	8 Faucet, Kitchen Sink	0	2.00	2.2	2.2
Laundry Room Fixtures	9 Clothes Washer	0	5.50	3.5	3.5
	10 Faucet, Laundry	0	2.00	2.0	2.0
Bar/Prep Fixtures	11 Faucet, Bar Sink	0	2.00	1.5	1.5
Other Fixtures	12 Fixture 1	0	0.00	0.0	6.0
	13 Fixture 2	0	0.00	0.0	6.0
	14 Fixture 3	0	0.00	0.0	6.0

**COMPUTED RESULTS FOR PEAK PERIOD CONDITIONS**

**Total No. of Fixtures in Calculation**

**99<sup>th</sup> Percentile Demand Flow**

**Hunter Number**

**Stagnation Probability**

DOWNLOAD RESULT

RESET WDC

↓ Select Units for Water Demand ↓  
**GPM**

**LPM**

**LPS**

**RUN WDC**

←  
 CLICK BUTTON  
 ←