

Pittsburgh 2030 District

Water Baseline + Methodology

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ABOUT THE PITTSBURGH 2030 DISTRICT

The Pittsburgh 2030 District is an internationally recognized, locally driven strategic initiative of Green Building Alliance (GBA) that supports building owners and managers as they strive toward 50% reductions in energy use, water consumption, and transportation emissions by 2030, while improving indoor air quality. New construction & major renovation projects strive for the same water and transportation goals while trying to reach carbon neutrality in energy. The District connects Property Partners with Community and Resource Partners, driving industry-leading performance through peer-to-peer learning, technical trainings, and data benchmarking. The District leads all 22 international 2030 Districts with 86.3 million square feet committed, and has collectively saved \$154.5M in energy and water costs since 2012. The Pittsburgh 2030 District is the first 2030 District to have collected and analyzed indoor air quality data.

In order to measure the Pittsburgh 2030 District’s success in reaching the 50% reduction goals, baselines must first be determined for each reduction category. Whereas energy reduction is measured against a national median average¹, no national average baseline exists for existing building water consumption by building type.

Thus, for every 2030 District nationwide, water reductions are measured against local historic average water consumption baselines by building type. As properties commit to and work towards their 2030 Challenge goals (Figure 1), the individual baselines against which they are measured become very important. This document details the Pittsburgh 2030 District water baseline² for individual buildings, the process by which a building establishes a baseline, and the implications for aggregate District water use and reductions. *This baseline was updated in 2020 with additional information, which will be discussed later.*

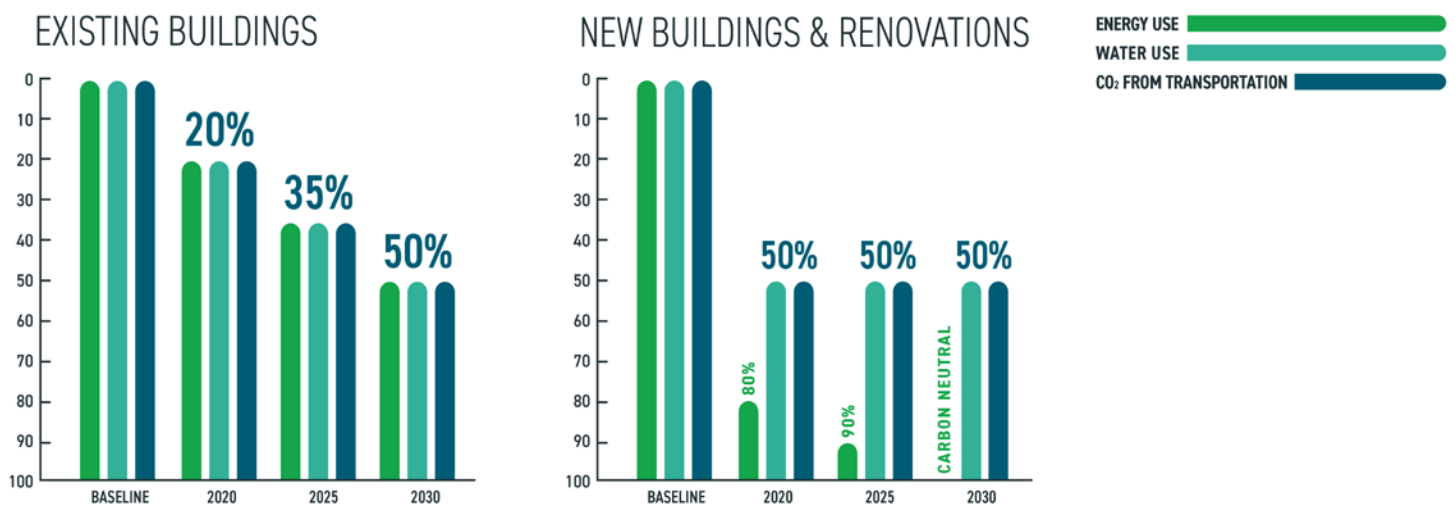


Figure 1: The 2030 Challenge for Planning Reduction Goals for New Buildings, Major Renovations, and Existing Buildings³

¹ Green Building Alliance. (2013). Pittsburgh 2030 District Energy Baseline. November 2013. www.2030districts.org/pittsburgh/news/pittsburgh-2030-district-energy-baseline-finalized.

² Pittsburgh 2030 District original boundary launched on August 21st, 2012

³ Architecture 2030. (2010). The 2030 Challenge. www.architecture2030.org/2030_challenge/the_2030_challenge.

WATER BASELINE METHODOLOGY

The District water baseline is average whole building water use intensity (WUI) in gallons per square foot per year (gallons/ft²/year) for 19 different building use types. This data comes from Pittsburgh Water and Sewer Authority's (PWSA – an important District Resource Partner) records of historic water consumption for Pittsburgh. In partnership with PWSA, Green Building Alliance (GBA) developed the Pittsburgh 2030 District Water Baseline using aggregated, local consumption for buildings in the Pittsburgh 2030 District boundary for data years referencing 2009 through 2012. The results were published in 2015.

This report, created in 2020, updates the baseline by augmenting the original data sets with additional buildings with data from years 2009–2012. Additional use types were added which had data from years 2012–2014. In order to conform to the standard data years of 2009–2012, the newer data set of 2012–2014 was backdated to 2010–2012 using the calculation below.



Figure 2: The Pittsburgh 2030 District Boundary, July 2020

To take into account seasonal and annual variation, actual usage over a four year period, 2009 through 2012, was used for all available buildings, yielding an average water consumption per year from 2009 to 2012. Water consumption data before this time was not available for enough buildings to warrant inclusion. For building use types which did not have enough data during the 2009 – 2012 period, data from years 2012 – 2014 was used and “backdated” to 2010 – 2012 by assuming a 1% performance improvement year over year. Water consumption was then paired with building square footages to yield water use intensity (WUI) in gallons per square foot per year (gallons/ft²/year) for different building use types.

The formula used for backdating information as well as a sample calculation is below.

BACKDATING CALCULATION

Backdating formula:

$$A = P(1 + r)^{(Y_{sample} - Y_{target})}$$

Where

A = Assumed annual gallons used for backdated year Y_{target} (target year)

P = Annual gallons used for $Y_{original}$ (The original year of data)

r = Assumed % performance *improvement* year over year, a positive value when backdating

Y_{sample} = The sample year from which data is being backdated

Y_{target} = The target/baseline year which is desired

Then to find WUI, A is divided by the corresponding square feet, q.

$$WUI = \frac{A}{q}$$

SAMPLE CALCULATION

A group of buildings with the same use type used an average of 12,288,400 gallons in 2014. What would this same group of buildings have used in 2010, with a 1% yearly performance improvement? What was the WUI of this group of buildings in 2010?

P (Average gallons/year in 2014, original year) = 12,288,400 gallons

r (Assumed performance improvement) = 1%

Y_{sample} = 2014

Y_{target} = 2010

q (Total square feet of corresponding buildings) = 2,628,453

$$A = 12,288,400 (1 + 0.01)^{(2014 - 2010)}$$

$$A = 12,288,400 (1.01)^4$$

$$A = 12,787,358 \text{ gallons}$$

$$WUI = \frac{12,787,358 \text{ gallons}}{2,628,453 \text{ sqft}} = 4.86$$

LIMITATIONS

The limitations of these calculations and methodology are the following:

- Data is only as accurate as the meter reading recorded – if there were mistakes in data entry or billing, these cannot be accounted for
- If the original year taken to use in the backdating calculation was unusually high or low due to billing errors, weather patterns, or otherwise, the backdated information will be inaccurate
- Use types in Table 1 which have a higher number in their sample size will generally be more accurate than those with fewer

Water consumption baselines were then generated for the 19 unique building use types shown in **Figure 3** and **Table 1** with the 2020 update. The unique building use types generally do not mirror the U.S. Environmental Protection Agency's (EPA) Energy Star Portfolio Manager. Rather, these building use classifications represent the most common building use types in Pittsburgh, created from the 332 buildings in the original PWSA dataset. Each classification comprises buildings of similar size and function. Generally, a lower WUI indicates less intensive water use, but WUIs vary widely by building use type and should only be compared to buildings with a similar use.

As **Table 1** indicates, building use type is the key factor in determining WUI. Table 1 also provides the details used to calculate the WUI for each building use type: number of buildings, total square footage, and total gallons.

While an attempt was made to match these building use types to building classifications established by Energy Star, parallels were not possible in all cases and not all common use types are represented because classification groups with fewer than 5 buildings were not ideal. Thus, each building use classification refers to a locally-specific, aggregated set of similar use buildings whose total water consumption divided by total square footage creates the WUI for that building use classification.

The values in **Figure 3** and **Table 1** should only be used as baseline estimates in evaluating how a building in Pittsburgh or Southwestern Pennsylvania may or may not be achieving its 2030 District goals. Guidance on determining building-specific baselines is provided below. Use types which have an asterisk (*) have source data from years 2012-2014 which was backdated to 2010-2012.

Figure 2: Pittsburgh 2030 District Water Baseline

WUI by Use Type

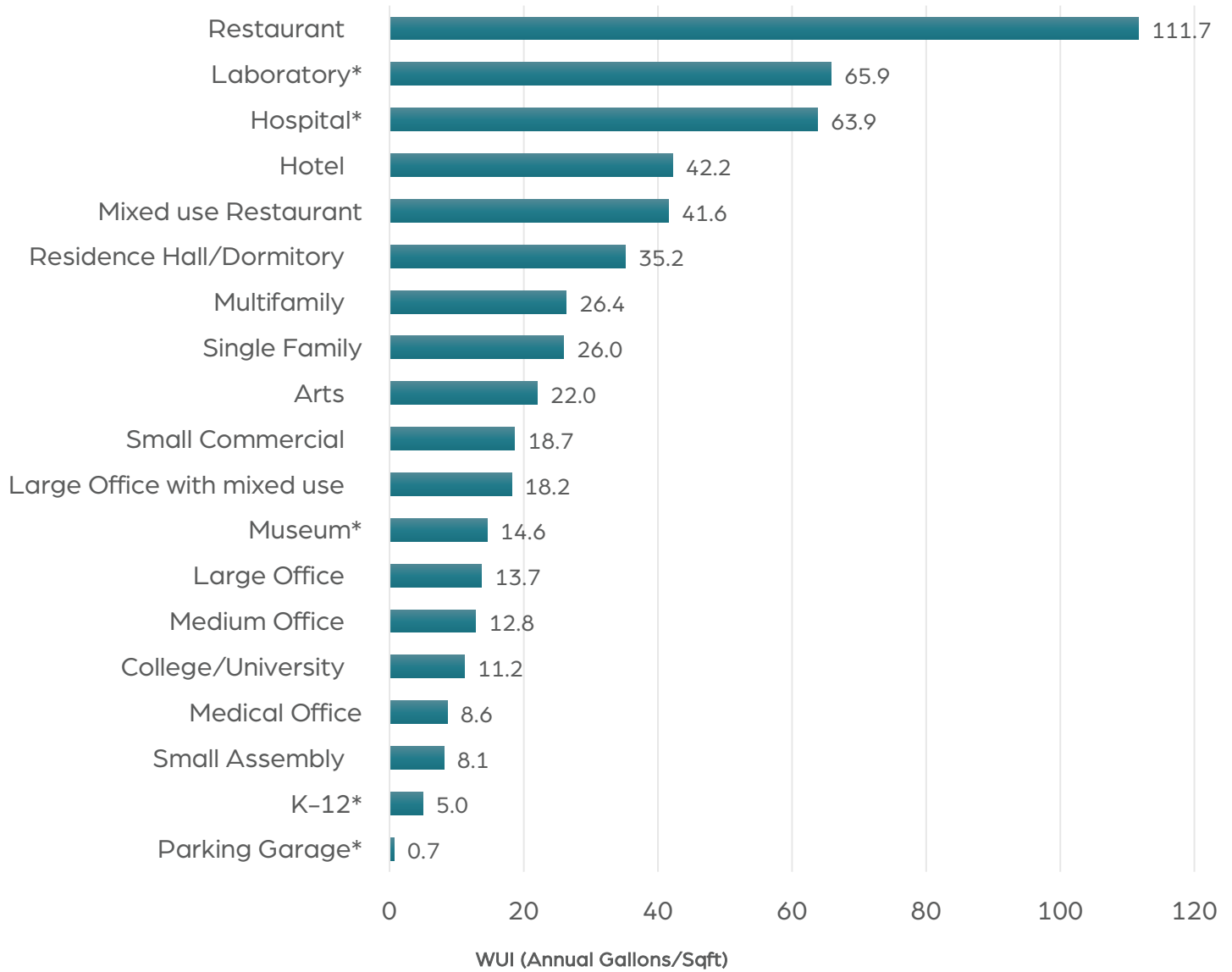


Table 1: Pittsburgh 2030 District Water Baseline Details

Building Use Type	Original Baseline WUI ⁴	Updated Baseline WUI	Original Baseline Annual Water Consumption (Gallons)	Updated Baseline Annual Water Consumption (Gallons)	Original Baseline Total Sqft	Updated Baseline Total Sqft	Original Baseline Number of Buildings	Updated Baseline Number of Buildings
Arts	13.9	22.0	6,398,751	24,756,030	460,641	1,124,520	7	9
College/ University	13.3	11.2	6,268,309	52,827,864	470,770	4,725,477	5	53
Hospital*	-	63.9	-	460,667,932	-	7,213,298	-	7
Hotel	41	42.2	83,761,196	138,187,318	2,043,011	3,276,712	7	11
K-12 School*	-	5.0	-	12,661,169	-	2,551,431	-	14
Laboratory*	-	65.9	-	168,363,643	-	2,556,237	-	14
Large Office with mixed use	18.4	18.2	178,124,147	178,356,230	9,689,889	9,814,017	11	11
Large Office	15.6	13.7	124,473,203	124,687,212	7,981,183	9,079,964	21	25
Medical Office	-	8.6	-	9,182,750	-	1,066,731	-	13
Medium Office	12.5	12.8	18,981,702	21,802,635	1,516,567	1,697,841	38	39
Mixed use Restaurant	-	41.6	-	17,419,333	-	418,863	-	27
Multifamily	36.4	26.4	16,364,381	26,235,258	449,177	995,452	6	12
Museum*	-	14.6	-	19,486,623	-	1,339,138	-	5
Parking Garage*	0.3	0.7	428,229	1,311,616	1,640,852	1,195,517	4	5
Residence Hall/ Dormitory	28.5	35.2	11,647,893	76,216,826	409,182	2,167,236	5	25
Restaurant	134.5	111.7	6,935,913	14,986,570	51,566	134,182	15	36
Single Family	-	26.0	-	1,122,000	-	43,196	-	11
Small Assembly	12.5	8.1	1,071,579	4,916,868	85,480	608,102	4	16
Small Commercial	12.7	18.7	3,490,221	18,845,202	275,899	1,009,864	40	91

Notes:

Data is from years 2009-2012 unless the use type is marked with an asterisk (*). Use types with asterisks have source data from years 2012-2014 which was backdated to assume their performance in 2010-2012 by applying a 1% performance improvement year over year. Data was backdated to ensure all property types have WUI benchmarks that reference the same time period.

“Original Baseline” references the water baselines published in 2015. “Updated Baseline” references additional data published in 2020 which augmented the original baseline.

⁴ https://www.go-gba.org/wp-content/uploads/2015/02/Pittsburgh-2030-District-Water-Baseline-Final-Web-2_23_15.pdf

BUILDING USE TYPE CLASSIFICATIONS + WUI CALCULATION GUIDE

Buildings committed to Pittsburgh 2030 District goals should determine their water baseline using **Table 2**, and their building's use types and corresponding square footage. Water consumption reductions of 50% below this baseline would meet the 2030 Challenge water goal of a 50% reduction by 2030. To better understand which classification and baseline best represent a building, refer to **Table 2 below**.

Table 2: Pittsburgh 2030 District Building Use Type Definitions for Water Baseline

BUILDING USE TYPE	DEFINITION	WUI (Annual Gallons/Sq ft)
Arts	Museums, theaters, and art galleries	22.0
College/University	Academic buildings	11.2
Hospital	General medical and surgical hospitals	63.9
Hotel	Overnight room/suite accommodations including guest facilities and services	42.2
K-12 School	Buildings or campuses used for Kindergarten through 12th grade students	5.0
Laboratory	Buildings which provide controlled conditions for scientific research	65.9
Large Office	Offices larger than 100,000 sq. ft. with no additional uses (with or without integrated parking)	13.7
Large Office w/ Mixed Use	Offices larger than 100,000 sq. ft. with additional restaurant or retail use(s) (with or without integrated parking)	18.2
Medical Office	Buildings which provide medical outpatient care including diagnosis and treatment	8.6
Medium Office	Office buildings less than 100,000 sq. ft.	12.8
Mixed Use Restaurant	Buildings which are primarily restaurants, but may have other use types such as apartments, office space, or member clubs	41.6
Multifamily	Apartments and/or condominiums	26.4
Museum	Buildings that display collections to outside visitors	14.6
Parking Garage	Standalone parking garage	0.7
Residence Hall/Dormitory	Seasonal, full-time student or transitional housing	35.2
Restaurant	Restaurant including associated storage and office space	111.7
Single Family	Standalone building for one family	26.0
Small Assembly	Churches, meeting spaces, and private clubs	8.1
Small Commercial	Retail and services less than 50,000 sq. ft.	18.7

EXAMPLE WUI CALCULATION FOR MULTI-USE BUILDING

Building characteristics:

70,000 gross square feet

10,000 sqft of laboratory space

57,000 sqft of college/university space

3,000 sqft restaurant space

WUI values from Table 1:

65.9 WUI (gallons/sqft) for lab

11.2 WUI (gallons/sqft) for college/university

111.7 WUI (gallons/sqft) for restaurant

To determine this building's WUI baseline value, we must first determine how many gallons it would have used in a year as a baseline-performing building. This is accomplished by taking each individual use type and its corresponding square footage, and multiplying it by its corresponding WUI value in Table 1.

$$\begin{aligned} & \left(10,000 \text{ sqft lab} \times 65.9 \frac{\text{gallons}}{\text{sqft lab}} \right) + \\ & \left(57,000 \text{ sqft college university} \times 11.2 \frac{\text{gallons}}{\text{sqft college univeristy}} \right) + \\ & \left(3,000 \text{ sqft restaurant} \times 111.7 \frac{\text{gallons}}{\text{sqft restaurant}} \right) = 1,632,500 \text{ annual gallons} \end{aligned}$$

The next step is to take the annual gallons above, and divide it by the building's gross square feet to determine its WUI baseline.

$$\frac{1,632,500 \text{ annual gallons}}{70,000 \text{ gross sqft}} = 23.3 \text{ WUI Baseline for this building}$$

This baseline is the mark on how this specific building should be measuring its water performance. If this building is part of the Pittsburgh 2030 District, it should be striving to perform at 50% of this WUI (11.65 WUI).

UNIQUE BUILDINGS: NO CLASSIFICATION

Buildings not covered by the primary use type classifications in this document will require an alternative method to determine the baseline from which to measure their 50% reduction in water use. In such cases, actual, historic water consumption from 2009 through 2012 can be used for the building in question if it is available for the entirety of the building. Buildings that fall into this category may include: Convention Centers, Stadiums, Indoor Arenas and Hospitals.

NEW CONSTRUCTION & MAJOR RENOVATIONS

New construction or major renovations (as defined by Architecture 2030⁵) should design for an immediate 50% reduction from the water baseline (using **Table 1** for reference). Unique building types will receive a custom water baseline by determining the calculated designed space use breakdown, refer to the example calculation.

REPORTING ANNUAL WATER USAGE TO GBA

Once a building determines its water baseline, GBA recommends that existing buildings continue to use the free, online EPA Energy Star Portfolio Manager tool to track monthly water use with PWSA bill information. PWSA also supports direct bill sharing with an account release form.

Providing annual energy and water consumption information (at a minimum) allows every Property Partner to receive accurate annual Pittsburgh 2030 District reports summarizing building performance, progress towards individual and aggregate 2030 District goals, and comparisons to individual, District, and national benchmarks—all while supporting District-wide water reductions.

All building performance information shared with GBA remains individually confidential unless otherwise specified by a Property Partner.

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⁵ Architecture 2030 defines a “major renovation” as the renovation of a building where (a) the total cost of the renovation related to the building envelope or the technical building systems is higher than 25 % of the value of the building (excluding the value of the land upon which the building is situated), or (b) more than 25 % of the surface of the building envelope undergoes renovation. *Source:* Architecture 2030. (2013). “What is Considered a Major Renovation?” FAQ: The 2030 Challenge. www.architecture2030.org/about/design_faq#renovation.