Example Engineered Estimate

Please note that while this report is for a multifamily property, not non-residential, the information and structures still serve as a good example for the types of analyses to include in these reports.

If applying for non-residential alternative compliance, the report must align to the alternative compliance application, fcgov.com/wsr and demonstrate:

1. *Estimated water use is at least 20% less than the WSR calculated pursuant City Code Section 149(2)(A).*
2. *How the proposed strategies will be maintained to reduce water use in perpetuity.*

******SOME INFORMATION HAS BEEN OMITTED TO PROTECT CUSTOMER DATA PRIVACY. ******

RE: Water Management and Analysis for Multifamily Project

The outline for this report is as follows:

- Project Synopsis
- Water Management Review
- Domestic Analysis
- Irrigation Analysis
- Conclusion
- Exhibit A

Project Synopsis

Executive Summary

Through analysis of your 197-unit multifamily project located at (or Project), the Project's water and wastewater demands can be greatly reduced. These water savings are based upon 35+ years of experience in water use research, review of water end use studies, recently collected water use data on buildings with similar end-uses, statistical analysis and implementation of the below described water management program. By developing an efficacious water conservation program and accurately projecting the annual usage and peak demands required to service , water capacity reductions can be achieved that should result in reduced development and operational costs. The corresponding net savings can be used for improved facilities and services for tenants at , rather than paying for and reserving unneeded water shares and demand capacity for the Project. As it is presented in this report, this evidence based approach supports the following conclusion: developments that properly manage their water supplies in support of the City of Fort Collin's (City) Water Efficiency Plan (WEP) will have a much smaller impact on the demand placed on the City's Utility systems than what is currently being estimated.

Project Description

According to the information provided to , will consist of one 109-unit building and one 88-unit building, totaling 197 units with 9,865 square feet (SF) of irrigable area. The Project's information and total water fixtures are described below in Figures 1A-1C:

Figure 1A: Building Unit Information at

Building Type	Studio Units	1-Bedroom Units	2-Bedroom Units	Total Bedroom Count	Total Unit Count
Building A	49	36	24	133	109
Building B	49	24	15	103	88
Total	98	60	39	236	197

Figure 1B: Lot Area Information at

Building Coverage (SF)	Driveway and Parking (SF)	Landscape (SF)	Total Lot Area (SF)
39,700	32,500	9,865	88,862

Figure 1C: Building Fixture Information at

Building Type	Water Closet	Lavatory	Shower	Kitchen Sink	Dish Washer	Clothes Washer	Hose Bibb	Mop Sink	Fixture Value
Building A	135	135	133	109	109	109	3	3	2,211.80
Building B	105	105	103	88	88	88	3	3	1,754.10

If this description of is incorrect, please notify immediately as the water management program, annual projections and meter sizing analytics are specifically designed to serve these intended uses.

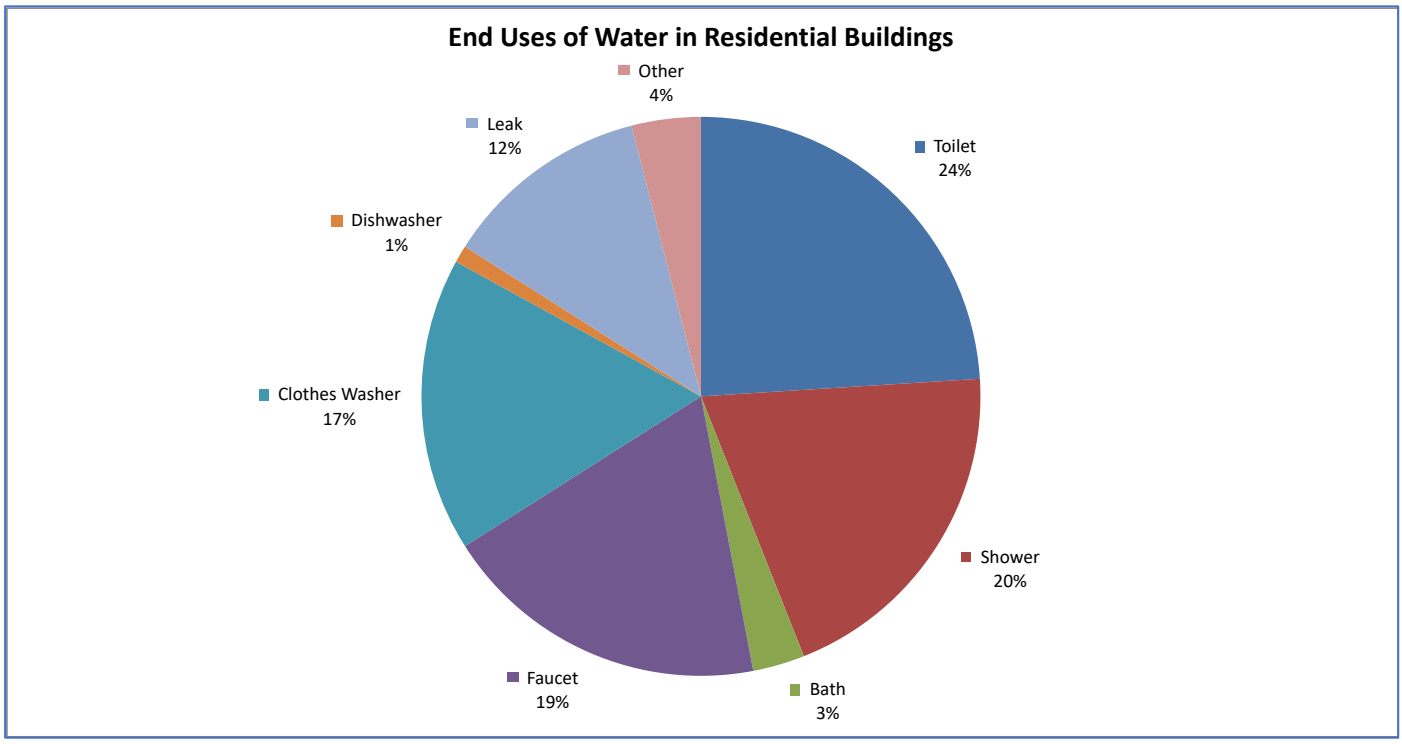
Water Management Review

End Uses of Water and Water Management Program

A very important part of water analysis is accounting for and verifying water savings through empirical water data collection. These empirical data result in the development of a personalized conservation program for that utilizes the best management practices available in today's water technology, fixture and appliance market.

In reviewing water demands of developments similar to , the data collected from the American Water Works Association (AWWA) Research Foundation's *Residential End Uses of Water: Version 2* study,[1] in conjunction with the Environmental Protection Agency (EPA),[2] detail the end uses of water by percentage for different building applications. As it pertains to , the disaggregation of residential end uses can be seen below in Figure 2:

Figure 2: End Uses of Water in Residential Buildings



With this collective information about the end uses of water in residential building applications, can identify the most efficacious conservation practices to reduce water demands through implementation of the following water management program:

[1] DeOreo, William B., et al. *Residential End Uses of Water, Version 2: Executive Report*. Water Research Foundation, 2016.
[2] https://www.epa.gov/watersense/types-facilities

Residential

1. Water closets are tank type and have a maximum 1.28 gallons per full flush.
2. Lavatories have a maximum flow rate of 1.00 GPM or equivalent high efficiency faucet aerator.
3. Shower heads have a maximum flow rate of 2.00 GPM.
4. Kitchen sinks have a maximum flow rate of 1.50 GPM or equivalent high efficiency faucet aerator.
5. Dishwashers have a maximum flow rate of 2.00 GPM, with a maximum of 4.00 gallons per normal cycle.
6. Clothes washers have a maximum flow rate of 3.50 GPM and are certified Tier 1 or Tier 2 by Consortium for Energy Efficiency (CEE).
7. Hot water is available within 15 seconds to any required fixture.
8. Installation of Advanced Metering Infrastructure (AMI) or real-time water flow monitoring that provides leak detection and/or shutoff systems.
9. All water using fixtures and/or aerators have an equal or better rating than *ENERGY STAR* and/or *WaterSense*.

Commercial/Public

1. Water closets are tank type or flushometer-valve and have a maximum of 1.28 gallons per full flush with water sensor shutoff.
2. Lavatories have a maximum flow rate of 1.00 GPM or equivalent high efficiency faucet aerator and water sensor shutoff.
3. Kitchen sinks have a maximum flow rate of 1.50 GPM or equivalent high efficiency faucet aerator.
4. Dishwashers have a maximum flow rate of 2.00 GPM, with a maximum of 4.00 gallons per normal cycle.
5. Hose bibbs are used only during the hours of 8:00am and 5:00pm.
6. Hot water is available within 15 seconds to any required fixture.
7. All water using fixtures and/or aerators have an equal or better rating than *ENERGY STAR* and/or *WaterSense*.
8. All landscape irrigation is scheduled between 11:00pm and 4:00am and/or supplied by a separate irrigation meter and non-potable water if available.

Using the fixtures and management practices specified above (see Exhibit A "*Product Resources*" for several examples), will benefit from a minimum 20% reduction in treated water consumption from standard appliances and fixtures as certified by *WaterSense*.[3] This program not only reflects the Projec't goal of providing obtainable multifamily housing by significantly reducing their water consumption costs, but also supports the City's goal of reducing water demands to levels below their WEP.

[3] https://www.epa.gov/watersense/about-watersense

Domestic Analysis

Residential Domestic Usage

In order to determine accurate domestic water usage rates for using the prescribed water management program, first examined the relationship between domestic water consumption and different home efficiency measures, as well as the influences of occupancy on daily usage. This information is characterized in the 2011 report conducted by and funded by the EPA titled, *Analysis of Water Use in New Single Family Homes*.[4] In this study, domestic water consumption was analyzed in four different single family home types, which included:

1. EPA Retrofit: standard single family residences that were retrofit with high-efficiency appliances and fixtures.

2. REUWS: standard single family residences built in the mid 1990's and monitored in the AWWA Research Foundation's 1999 report, *Residential End Uses of Water*.[5]

3. New Homes: standard single family residences built after January 1, 2001.

4. HE New Homes: standard single family residences built with appliances and fixtures equal to *WaterSense* guidelines applicable in 2011. It should be noted that these appliances and fixtures will be most similar, but still not as efficient as the ones described in water management program, which also includes a leak prevention system.

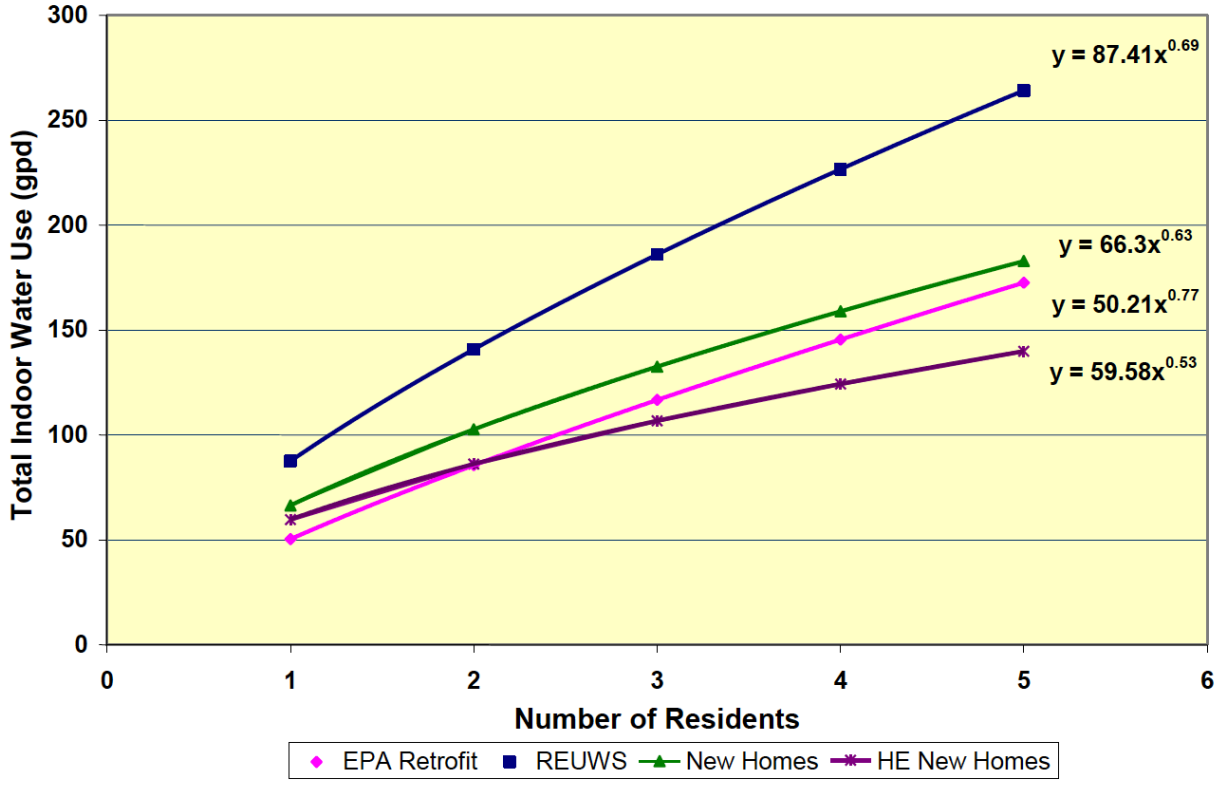
The four home type profiles observed in said study are shown below in Figures 3A and 3B, which disaggregate their daily water usage as it relates to their occupancy. It should also be noted that the end uses of domestic water in single family homes and multifamily homes do not differ significantly, and the values below apply to both residential applications under this capacity:

Figure 3A: Daily Water Usage by Home Type vs. Occupancy

Number of Residents	EPA Retrofit (Gal/Day)	REUWS (Gal/Day)	New Homes (Gal/Day)	HE New Homes (Gal/Day)
1	50.21	87.41	66.30	59.58
2	85.62	141.02	102.60	86.03
3	117.00	186.54	132.46	106.65
4	146.01	227.50	158.79	124.22
5	173.38	265.37	182.75	139.82

[4] DeOreo, William, et al. *Analysis of Water Use in New Single-Family Homes*. Salt Lake City Corporation and US EPA, 2011.
[5] Mayer, Peter W., et al. *Residential End Uses of Water*. AWWA Research Foundation, 1999.

Figure 3B: Daily Water Usage Curves by Home Type vs. Occupancy



Figures 3A and 3B reveal the significant effects that water saving efforts have achieved for residences, such as the 1992 Energy Policy Act and the continued development of high-efficiency water appliances and fixtures. These data also demonstrate the relationship between the gallons per capita per day (GCD) and occupancy, which is displayed below in Figure 3C:

Figure 3C: Daily Water Usage per Capita by Home Type

Number of Residents	EPA Retrofit (GCD)	REUWS (GCD)	New Homes (GCD)	HE New Homes (GCD)
1	50.21	87.41	66.30	59.58
2	42.81	70.51	51.30	43.01
3	39.00	62.18	44.15	35.55
4	36.50	56.88	39.70	31.06
5	34.68	53.07	36.55	27.96

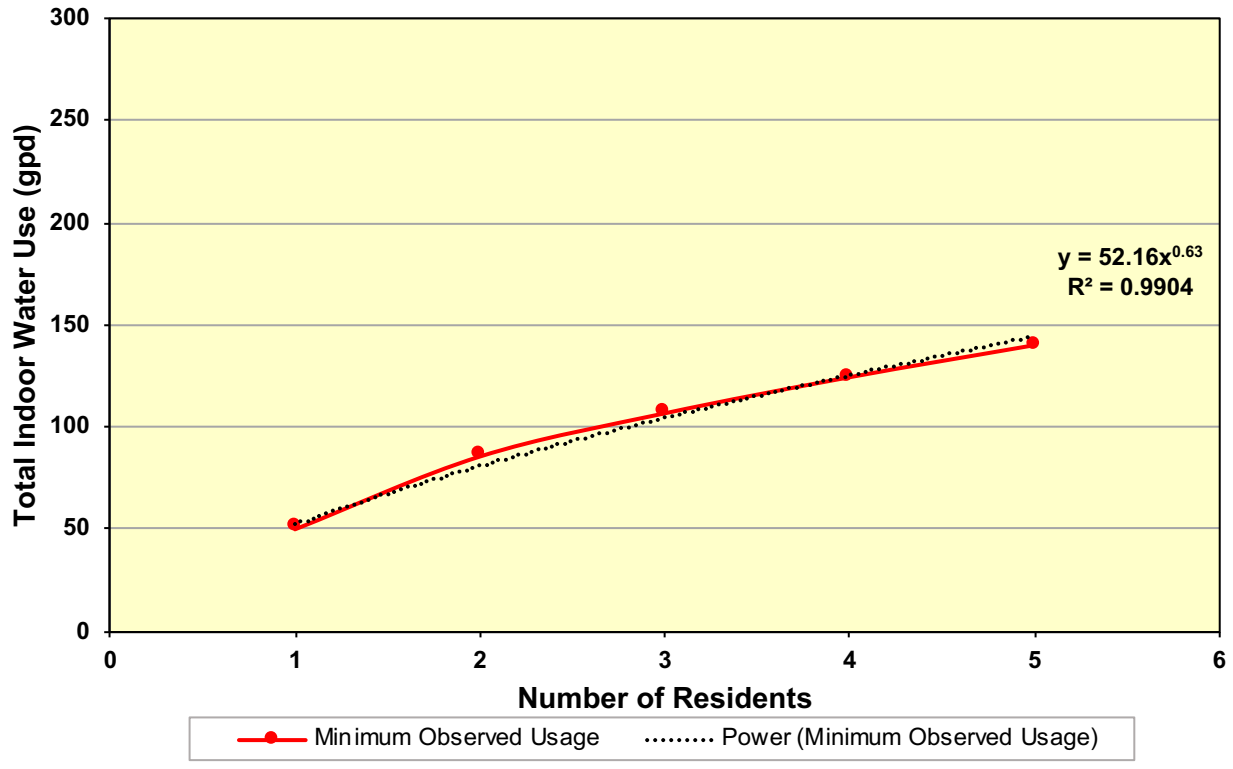
As seen above, each additional capita per single family home results in an overall decrease in the GCD. This correlation is extremely important to understand because it allows to define a more accurate GCD for residences with different occupancy rates, instead of using a generalized value for all units. As it relates to , the *HE New Homes* curve (with equation $y = 59.58x^{0.53}$) provides the most comparable GCD values to the project; however, as mentioned above, the water management plan to be implemented at exceeds the water conservation measures implemented in *HE New Homes*, and a more precise equation is needed. To gauge

an appropriate efficiency curve for , reviewed the minimum observed water consumption for each home type and plotted this against the number of residents to generate a power trend line shown below in Figures 3D and 3E respectively:

Figure 3D: Minimum Observed Daily Water Usage per Day and per Capita

Number of Residents	Minimum Observed Usage (Gal/Day)	Minimum Observed Usage (GCD)	Trend Line Equation	Trend Line R^2
1	52.16	52.16	$52.16x^{0.63}$	0.9904
2	80.72	40.36		
3	104.21	34.74		
4	124.92	31.23		
5	143.78	28.76		

Figure 3E: Minimum Observed Daily Water Usage per Day with Power Trend Line



The new efficiency power curve generated above (with equation $y = 52.16x^{0.63}$) provides a reflective water usage for following its detailed management program. Now that has defined the consumption rates under differing occupancies, the effects of a leak detection system need to be addressed.

Residential Leak Control

Water leakage contributes to a significant amount of the total water used (or more accurately wasted) in residential units, resulting in an average loss of approximately 7.9 GCD.[6] To remedy this large waste of water, water management program includes a leak detection system that can be easily installed on water meter registers or individual service lines. These leak detection devices will monitor gross water usage and alert building management via telemetry when water usage is experiencing high or abnormal flow rates, continuous flows (i.e. leaks), backflows and may also retain the ability to automatically shutoff water to the unit when leakage is occurring. Given the advanced technology featured in this leak detection system, projects that residential leaks at will be reduced to the median value of 4.3 GCD (a reduction of 3.6 GCD) lost to leakage. This leak corrected water usage is shown below in Figure 4:

Figure 4: Projected Daily Water Usage with Leak Control Efforts

Number of Residents	Minimum Observed Usage (Gal/Day)	Minimum Observed Usage (GCD)	Post Leak Correction Water Usage (Gal/Day)	Post Leak Correction Water Usage (GCD)
1	52.16	52.16	48.56	48.56
2	80.72	40.36	73.52	36.76
3	104.21	34.74	93.41	31.14
4	124.92	31.23	110.52	27.63
5	143.78	28.76	125.78	25.16

The new efficiency equation with a leak correction factor equates to $y = 52.16x^{0.63} – x(3.60)$. This domestic water usage calculation is getting closer to the water consumption expected at , but still needs to determine the expected occupancy for the Project (x) to assess the final domestic usage.

Residential Occupancy

Based on current data obtained from the US Census Bureau, there are approximately 2.63 persons per household, which include single family homes, mobile homes, apartments and groups of rooms.[7] This number works well as a general reference, but it does not specify the number of persons per bedroom nor does it disaggregate different residence types, which is essential information when analyzing occupancy and distinguishing between single family and multifamily water consumption.

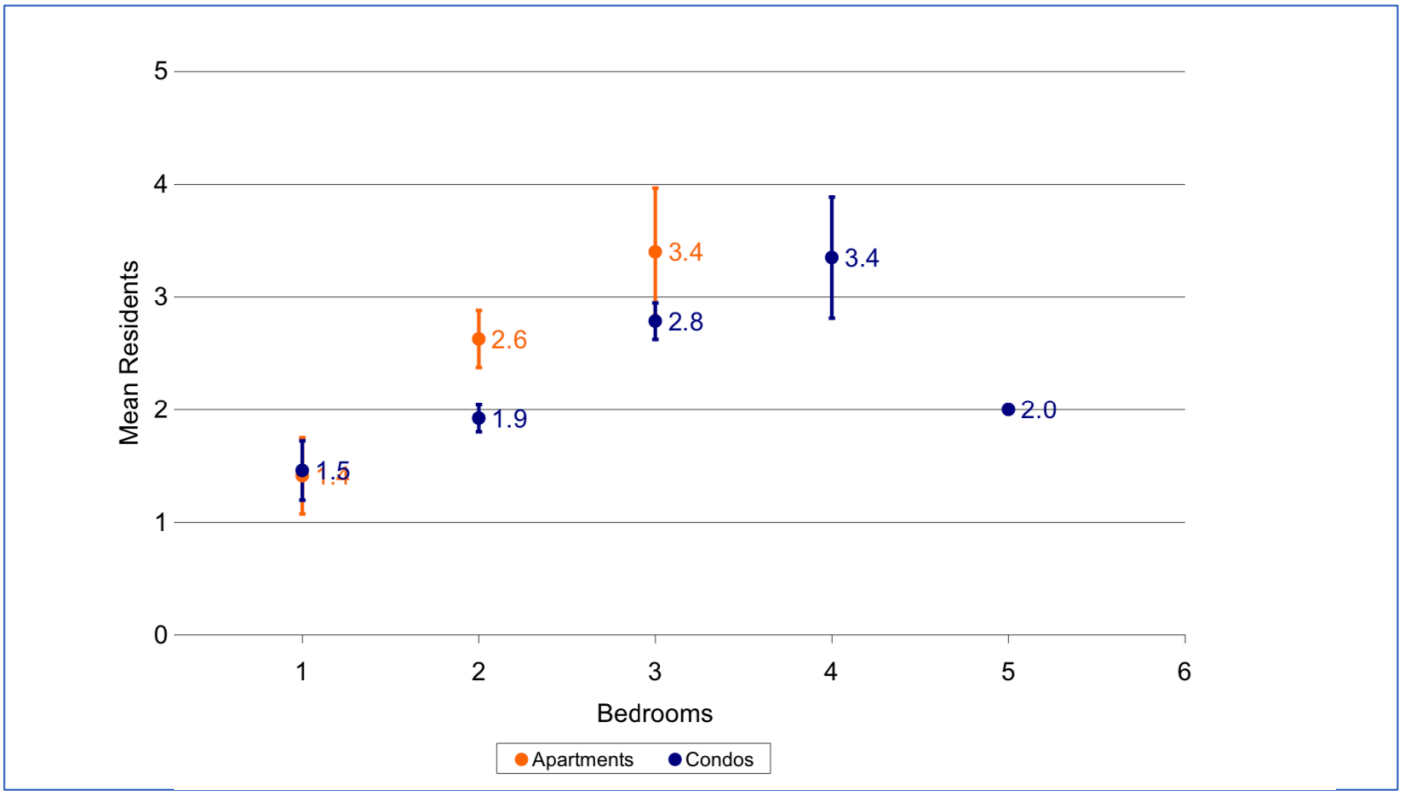
In order to better understand multifamily occupancy rates, reviewed data collected from approximately 700 multifamily residences that provided detailed information on the average bedroom occupancy for apartments and condos.[8] The occupancy data from the referenced study are shown below in Figures 5A and 5B:

Figure 5A: Average Bedroom Occupancy in Multifamily Residences

Type of Residence	Studio / 1-Bedroom Occupancy[9]	2-Bedroom Occupancy	3-Bedroom Occupancy	4-Bedroom Occupancy
Apartments	1.40	2.60	3.40	-
Condos	1.50	1.90	2.80	3.40
Average Multifamily	**1.45**	**2.25**	**3.10**	**3.40**

[6] DeOreo, William B., et al. *Residential End Uses of Water, Version 2: Executive Report*. Water Research Foundation, 2016.
[7] https://www.census.gov/quickfacts/fact/table/US/HSD310217#HSD310217
[8] DeOreo, William, et al. *Analysis of Water Use Patterns in Multi-Family Residences*. Irvine Ranch Water District, 2008.
[9] For calculation purposes, the same occupancy values are used for studios and 1-bedroom units.

Figure 4B: Average Bedroom Occupancy and Standard Error in Multifamily Residences



Applying the average multifamily occupancy rates observed in apartments and condos to the equation determined above gives an objective estimate of the occupancy and subsequent water usage to be expected at . These consumption values are calculated below:

Domestic Water Usage and Occupancy Calculations:

- *Efficiency curve equation with leak detection adjustment: $y = 52.16x^{0.63} – x(3.60)$*
- *y = Daily Usage (gal)*
- *x = Expected Occupancy (capita)*

- *Studio Daily Domestic Usage (gal): $(52.16)*(1.45)^{0.63} – (1.45)*(3.60) = 60.70$ gal/day*
- *Studio Daily Domestic Usage per Capita (GCD): (60.70 gal/day) / (1.45 capita) = **41.86 GCD***

- *1-Bedroom Daily Domestic Usage (gal): $(52.16)*(1.45)^{0.63} – (1.45)*(3.60) = 60.70$ gal/day*
- *1-Bedroom Daily Domestic Usage per Capita (GCD): (60.70 gal/day) / (1.45 capita) = **41.86 GCD***

- *2-Bedroom Daily Domestic Usage (gal): $(52.16)*(2.25)^{0.63} – (2.25)*(3.60) = 78.84$ gal/day*
- *2-Bedroom Daily Domestic Usage per Capita (GCD): (78.84 gal/day) / (2.25 capita) = **35.04 GCD***

The domestic water usage values calculated above are now ready to be applied to the development.

Domestic Projection

Based on the values developed above, can accurately project the annual water usage for under the current build out of 98x studio units, 60x 1-bedroom units and 39x 2-bedroom units. These annual consumption values are calculated below assuming 100.00% occupancy for the year:

Domestic Water Usage Projections:

- *Studio Annual Domestic Usage: (98 units) * (1.45 capita) * (41.86 GCD) * (365 days) =* ***2,171,143 gal***
- *1-Bedroom Annual Domestic Usage: (60 units) * (1.45 capita) * (41.86 GCD) * (365 days) =* ***1,329,271 gal***
- *2-Bedroom Annual Domestic Usage: (39 units) * (2.25 capita) * (35.04 GCD) * (365 days) =* ***1,122,267 gal***

Total Annual Domestic Usage: (2,171,143 gal) + (1,329,271 gal) + (1,122,267 gal) = ***4,622,681 gal***

Domestic Data Validation – Apartments

In order to validate the domestic annual water rates projected for , reviewed one full year of water bills at a similar development in Fort Collins, Apartments, which is a 119-unit multifamily building. Constructed in XXXX, the Apartments' contain 28x studio units, 8x 1-bedroom units, 38x 2-bedroom units and 45x 3-bedroom units, as well as sub metered common areas and retail spaces. The water usage observed at this property serves as an excellent source to verify demands at given their similar locations and high-efficiency fixture applications. The data shown in Figures 6A and 6B demonstrate this domestic water usage at the Apartments below:

Figure 6A: Monthly Domestic Water Usage vs. Occupancy – Apartments

Month	Days in Billing Cycle	Occupancy	Total Volume (Gal)	Gal/Day
Jan 2018	31	90%	296,650	9,569.25
Feb 2018	28	92%	322,200	11,507.14
Mar 2018	31	93%	286,550	9,243.55
Apr 2018	30	93%	297,000	9,900.00
May 2018	31	96%	246,050	7,937.10
Jun 2018	30	99%	225,200	7,506.67
Jul 2018	31	100%	209,750	6,766.13
Aug 2018	31	89%	226,300	7,300.00
Sep 2018	30	91%	282,600	9,420.00
Oct 2018	30	96%	278,000	9,266.67
Nov 2018	31	99%	246,200	7,941.94
Dec 2018	31	99%	211,025	6,807.26
Average	**30.42**	**94.75%**	**260,627**	**8,597.15**
Total	**365**	**N/A**	**3,127,525**	**N/A**

Figure 6B: Monthly Domestic Water Usage vs. Occupancy – Apartments

Using the empirical data obtained from the water bills, is now able to compare our annual water usage projection to the actual usage observed at the Apartments:

Apartments' Recorded Domestic Usage:

- *Observed Annual Domestic Usage:* ***3,127,525 gal***

Projected Domestic Usage Calculations:

- *Studio Annual Domestic Usage: (28 units) * (1.45 capita) * (41.86 GCD) * (365 days) =* ***620,326 gal***
- *1-Bedroom Annual Domestic Usage: (8 units) * (1.45 capita) * (41.86 GCD) * (365 days) =* ***177,236 gal***
- *2-Bedroom Annual Domestic Usage: (38 units) * (2.25 capita) * (35.04 GCD) * (365 days) =* ***1,093,491 gal***
- *3-Bedroom Annual Domestic Usage: (45 units) * (3.10 capita) * (30.72 GCD) * (365 days) =* ***1,564,131 gal***

- *Total Annual Domestic Usage: (620,326 gal) + (177,236 gal) + (1,093,491 gal) + (1,564,131 gal) =* ***3,455,185 gal***
- *Occupancy Adjusted Total Annual Domestic Usage: (3,455,185 gal) * (94.75% occupancy) =* ***3,273,788 gal***

- *Percent Adjustment: [(3,273,788 gal - 3,127,525 gal) / (3,127,525 gal)] * (100%) =* ***4.68%***

After accounting for a marginal occupancy adjustment, projection came in approximately 5% greater than the actual annual usage at the Apartments. Although projection was conservative, this buffer will allow flexibility in their future design and development as it concerns their annual water consumption, especially during dry years. Comparing actual water usage data from the Apartment's with projection validates the correctness of the values to be used for .

Irrigation Analysis

Residential Irrigation Usage

Outdoor water usage at multifamily complexes is primarily based on irrigation design, total landscaped areas and landscape types – for example, a landscape design utilizing xeriscape and drip irrigation has a much different water demand profile than landscapes with bluegrass with sprinkler nozzles. As currently proposed in the site plan, will contain 7,129 SF of mulch/drip irrigation and 2,736 SF of sod/spray irrigation, for a total of 9,865 SF of irrigable area.

This landscape can be generally described as moderate water use vegetation, which has determined to hold an average application rate of 23.80" for the mulch/drip areas and 31.10" for the sod/spray areas according to the GreenCo Literature Review of *Expected Benefits of Landscape Water Conservation Best Management Practices*. These application rates were figured using hybrid landscape scenarios characterized under the *Mix-Drip* and *T-Base1* landscapes, which are defined below:[10]

1. *Mix-Drip*: "This scenario includes a mixture of trees, shrubs and groundcover irrigated by water-efficient drip irrigation system every three days in a silty clay soil, with some MAD allowance in terms of skipping irrigation days. This plant type would be expected to represent a component of both Xeriscape landscape designs, as well as many traditional landscapes. Many existing landscapes water trees, shrubs and groundcover using drip irrigation systems, as indicated by "Drip."" The baseline application rate used for this scenario is 23.80."

2. *T-Base1*: "This scenario represents cool-season turfgrass, irrigated by a sprinkler system on a Monday-Wednesday-Friday fixed schedule, with the owner adjusting the irrigation application rate on a monthly basis (i.e., no irrigation days are skipped, regardless of the soil moisture level). This scenario is considered to represent the "typical irrigator."" The baseline application rate for this scenario is 31.10."

Irrigation Projection

Using the average application rates under the *Mix-Drip* and *T-Base1* landscapes, and the value of one acre-foot (325,851 gal/year), the annual irrigation demands for are calculated below:

Irrigation Water Usage Calculations and Projections:

- *Mulch/Drip Irrigable Area: 7,129 SF = 0.16 acres*
- *Average Application Rate = 23.80" = 1.98'*
- *Annual Irrigation Usage: (0.16 acres) * (1.98') * (325,851 gal/year) =* ***105,768 gal***

- *Sod/Spray Irrigable Area: 2,736 SF = 0.06 acres*
- *Average Application Rate = 31.10" = 2.59'*
- *Annual Irrigation Usage: (0.06 acres) * (2.59') * (325,851 gal/year) =* ***53,043 gal***

- *Total Annual Irrigation Usage: (105,768 gal) + (53,043 gal) =* ***158,811 gal***
- *Total Annual Irrigation Usage in Acre-Feet (AF): (158,811 gal) / (325,851 gal) =* ***0.49 AF***

[10] Clary, Jane, et al. *Expected Benefits of Landscape Water Conservation Best Management Practices: 2015 Update to GreenCO Literature Review*. GreenCO, 2015

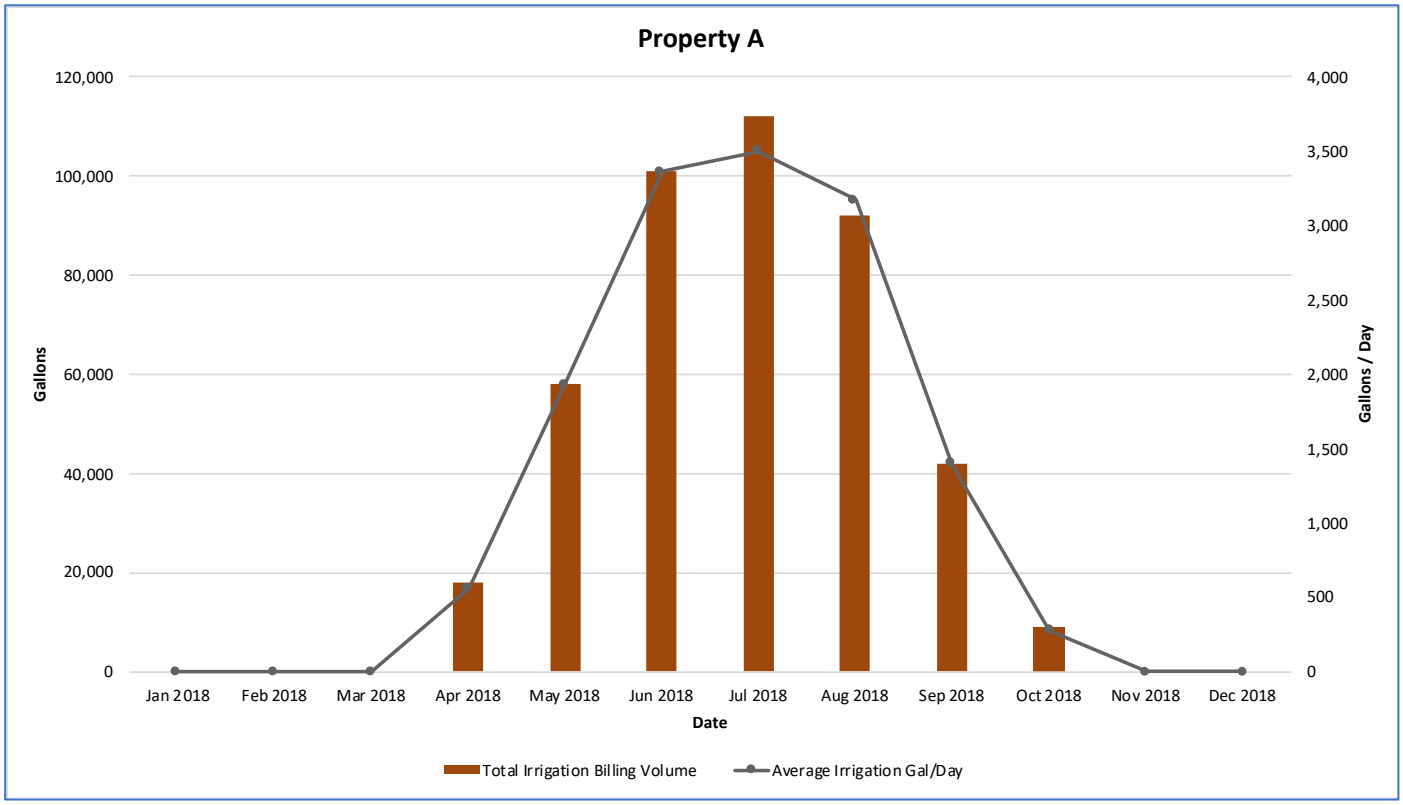
Irrigation Data Validation – Property A

To validate the annual irrigation rates determined above, reviewed one full year of irrigation bills at Property A (named used for anonymity) in Boulder, CO. Property A has 17,402 SF of shrub beds and 10,498 SF of manicured turf, which are very comparable to the two landscape types at . Given their similar description and location, chose Property A as the most comparable irrigation user, whose data is displayed below in Figures 7A and 7B:

Figure 7A: Monthly Irrigation Water Usage – Property A

Month	Days in Billing Cycle	Total Volume (Gal)	Gal/Day
Jan 2018	32	0	0.00
Feb 2018	29	0	0.00
Mar 2018	29	0	0.00
Apr 2018	32	18,000	562.50
May 2018	30	58,000	1,933.33
Jun 2018	30	101,000	3,366.67
Jul 2018	32	112,000	3,500.00
Aug 2018	29	92,000	3,172.41
Sep 2018	30	42,000	1,400.00
Oct 2018	32	9,000	281.25
Nov 2018	30	0	0.00
Dec 2018	30	0	0.00
Average	**30.42**	**36,000**	**1,184.68**
Total	**365**	**432,000**	**N/A**

Figure 7B: Monthly Irrigation Water Usage – Property A



irrigation projection is compared to the empirical data from Property A below: *Property*

A's Recorded Irrigation Usage:

- *Observed Annual Irrigation Usage:* ***432,000 gal***

Projected Irrigation Usage Calculations:

- *Mulch/Drip Irrigable Area: 17,402 SF = 0.40 acres*
- *Average Application Rate = 23.80" = 1.98'*
- *Annual Irrigation Usage: (0.40 acres) * (1.98') * (325,851 gal/year) =* ***258,182 gal***

- *Sod/Spray Irrigable Area: 10,498 SF = 0.24 acres*
- *Average Application Rate = 31.10" = 2.59'*
- *Annual Irrigation Usage: (0.24 acres) * (2.59') * (325,851 gal/year) =* ***203,525 gal***

- *Total Annual Irrigation Usage: (258,182 gal) + (203,525 gal) =* ***461,707 gal***
- *Total Annual Irrigation Usage in Acre-Feet (AF): (461,707 gal) / (325,851 gal) =* ***1.42 AF***

- *Percent Adjustment: [(461,707 gal – 432,000 gal) / (432,000 gal)] * (100%) =* ***6.88%***

projection was within 7% of the actual irrigation usage observed at Property A, which indicates that these values will accurately serve while also accounting for additional irrigation usage in dry years on the Front Range.

Conclusion

In summary, the data collected in this report are used to help developers understand their water demands, manage their water usage using empirical data, implement water reduction methods, and finally, verify the accuracy of the current water service size. The data from this monitoring period was also used to project the comprehensive water demands for the development and demonstrate how this Project will efficiently use its water resources through conservation investments that not only align with the City's WEP, but accelerate its goals. An abstract of the Project demands is shown below in Figure 14:

Figure 14: Abstract for

Water Demand Measurement	Value
Annual Domestic Water Consumption (gal)	4,622,681
Annual Irrigation Water Consumption (gal)	158,811
Total Annual Water Consumption (gal)	4,781,492

Exhibit A

Product Resources

1. Examples of *WaterSense* Approved Fixtures: https://www.epa.gov/watersense/product-search

2. Examples of *ENERGY STAR* Approved Appliances: https://www.energystar.gov/productfinder/

3. Examples of CEE Approved Appliances: https://library.cee1.org/content/qualifying-product-lists-residential-clothes-washers

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Literature

1. DeOreo, William, et al. *Analysis of Water Use in New Single-Family Homes*. Salt Lake City Corporation and US EPA, 2011.

2. DeOreo, William, et al. *Analysis of Water Use Patterns in Multi-Family Residences*. Irvine Ranch Water District, 2008.

3. DeOreo, William, et al. *Residential End Uses of Water, Version 2: Executive Report*. Water Research Foundation, 2016.

4. Clary, Jane, et al. *Expected Benefits of Landscape Water Conservation Best Management Practices: 2015 Update to GreenCO Literature Review*. GreenCO, 2015.

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6. American Water Works Association, *Sizing Water Service Lines and Meters, M22*, 2004.

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