Water and Land Planning: Developing a Water Budget

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For more information, visit Water.utah.gov/water-general-plan

Introduction – water use and preservation element

In 2022, SB 110 was passed, requiring class four and larger municipalities (67 entities) and all counties (29 entities) to include a water use and preservation element in their general plans. This element will be adopted by Dec. 31, 2025.

There are four main components of the water use and preservation element:

1. The effect of permitted development or development patterns on water demand and water infrastructure. This is asking you to develop a water budget.
2. Methods of reducing water demand and per capita water use for existing development.
3. Methods of reducing water demand and per capita water use for future development.
4. Modifications that can be made to a local government's operations to reduce and eliminate wasteful water practices.

The following guide will focus on the first component, which asks counties and cities to develop a water budget.

What is a water budget?

A water budget is a comprehensive planning tool used to assess and project the hydrological costs and demands associated with land use. The water budget evaluates both the current and future status quo of water use and demand,

considering changes in population and land use alterations. The tool quantifies the total water inputs (hydrology, infrastructure, governance) and outputs (including consumption, runoff and secondary/irrigation water, if applicable), providing a detailed forecast of water sustainability under different growth and usage scenarios based on land use types. Overall, a water budget ensures informed decision-making regarding water resources management and future planning.

Creating a water budget

This document outlines two ways planners can develop a water budget. The first method includes coordinating with water providers, zoning and water billing to attach water use to various land use types. The second method includes utilizing equivalent residential units and duty values for secondary water to assign water demand to various land use types.

Water budget – method one overview

There are five steps in the first method of creating a water budget.

1. Understand city or county growth.
2. Determine reliable supply.
3. Determine current demand.
4. Estimate indoor and outdoor water use based on billing and water use data.
5. Compile and finalize a water budget.

1. Understand city or county growth

Understand city or county growth It's essential to understand how the city or county is growing. This means determining projected growth in population, businesses and infrastructure. It's important to assess not only how many people will be added, but also how the city or county will evolve in terms of land use and development.

Even if growth isn't planned in the immediate future, it's important to know what current city or county land use regulations permit. For instance, what types of structures and developments are allowed under existing laws? This step ensures that the water budget is in line with city or county future plans, helping to establish a sustainable and efficient water use strategy.

This first step should result in cities and counties creating an estimate of the types of developments that will occur and how many structures will be created within each land use group. For example, will there be single-family homes, multi-family apartments, townhomes or commercial spaces added to the city or county? Approximately how many of these structures will be added? Understanding this will help determine the water needs of each specific development type later on in both water budget methods.

2. Determine reliable supply

Cities and counties must determine their reliable water supply for a water budget. Reliable supply refers to the amount of water that can be counted on year after year, even when faced with shifting conditions like seasonal changes or extended drought periods. It's important to note that reliable supply is not the same as a city

or county's total water rights. Reliable supply is the amount of water that can be used and accessed under normal and challenging conditions.

To assess this, cities and counties may ask water providers for key data, such as:

- Historical water use data during years of severe drought to understand past water consumption patterns during dry periods.
- Questions related to yield and pumping sustainability to ensure that water extraction can continue without harming the long-term health of the water sources.

By determining reliable supply, cities and counties can plan for sustainable water management and ensure that the water needs of the community are met, even in challenging times. This data can be compared to water and land use data from the water budget to inform city or county planning decisions.

3. Determine current supply and demand

To determine current water demand, planners should collaborate with their public works or water providers. Each water provider reports their annual water usage data to the Division of Water Rights, and this data is publicly available at WaterRights.utah.gov, categorized by residential, commercial, industrial, institutional and other uses (Figure 1).

Figure 1: Water rights data example screenshots

Annual Retail Connection Info (Not Avail: means that at least one of the values needed to calculate ERC is 0) Back To Top

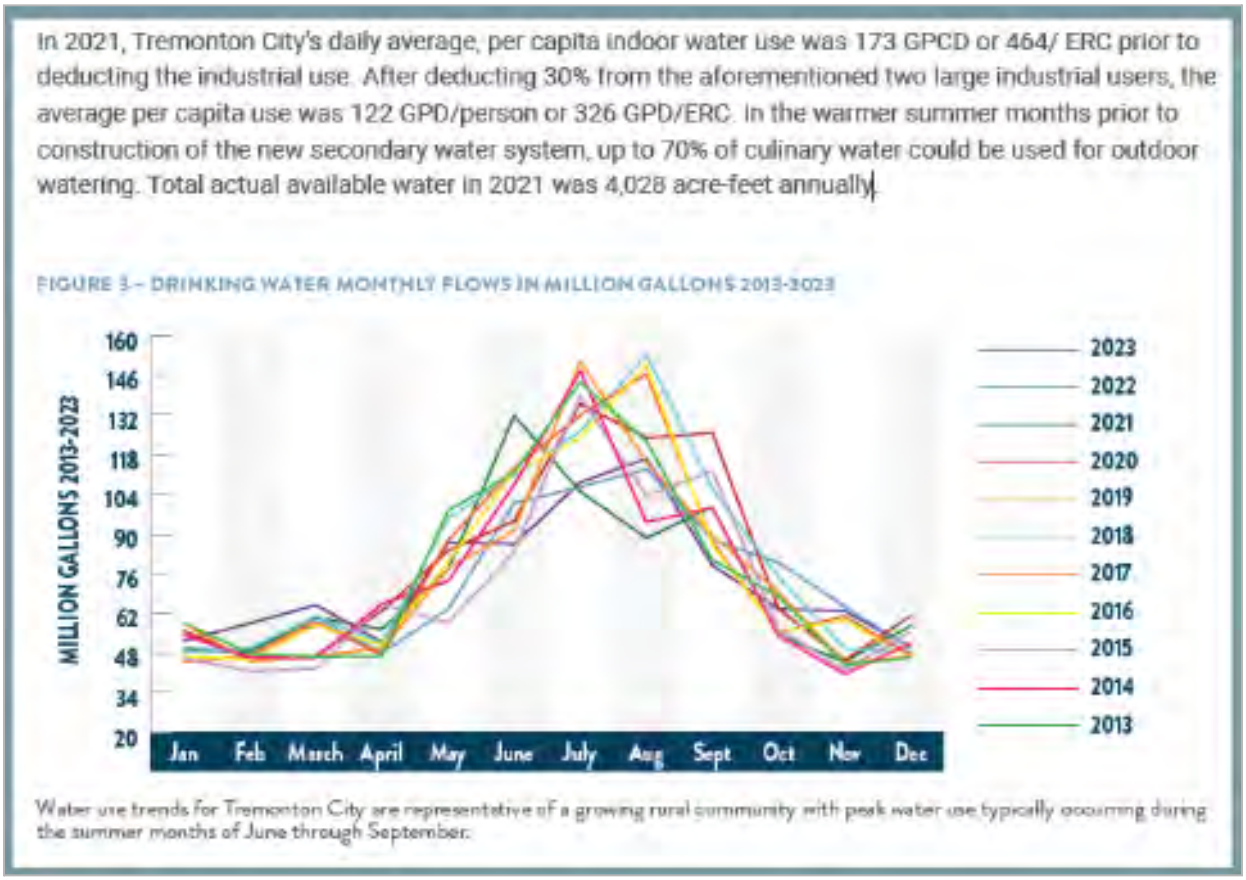
Year	Residential	Commercial	Industrial	Institutional	Stock	Wholesale	Other	Unmetered	Total	ERC Value
2024	366	1	8	6	--	--	--	--	381	414.40
2023	363	1	6	6	--	--	--	--	376	417.69
2022	355	1	6	6	--	--	--	--	368	436.17
2021	347	1	6	6	--	--	--	--	360	394.41

Annual Use Info (Displayed in Acre Feet) Back To Top

Year	Residential	Commercial	Industrial	Institutional	Stock	Wholesale	Other	Unmetered	Total (ACFT)	Method of Measurement
2024	220.04	0.57	11.82	16.71	--	--	--	--	249.14	meter
2023	180.60	0.31	11.38	15.51	--	--	--	--	207.81	meter
2022	205.05	0.30	29.41	17.18	--	--	--	--	251.94	meter
2021	217.96	0.32	14.69	14.77	--	--	--	--	247.73	meter

Planners can use this data to calculate the current total water used by their community. For example, Tremonton used water rights data to find that their total actual available water in 2021 was 4,028 acre-feet (Figure 2).

Figure 2: Tremonton's available water 2013-2023.



Knowing total current water use is key to establishing a baseline measurement for the water budget. By adding the projected water demand from new development to this baseline, planners can effectively determine the city or county's overall future water needs. The next step involves understanding future development patterns and forecasting the water use for new development.

4. Estimate indoor and outdoor water use based on billing and water use data

The fourth step in this process is to establish an estimated indoor and outdoor water use baseline. This baseline will be based on billing and water use data from existing properties to forecast water use for certain types of development.

To do this, first consider how the city or county is growing. This should have already been completed in step 1.

Then, determine city or county properties that reflect typical zoning and density for the city or county that align with this growth. Work with parcel or land survey data to determine city or county properties that reflect typical zoning and density for your community. Planners will want to select at least five properties per zoning type. This could look like selecting five properties under each of these categories: single-family residential, duplex, multi-family, commercial and institutional (Figure 4). The larger the sample size, the more accurate the water budget will be.

Next, collaborate with your water providers, public works or water billing department to determine the annual water usage for each property. This can be calculated by adding together the monthly water usage figures from billing statements or other available metrics.

Next, determine the average annual water consumption for each of your zoning types. Table 1 indicates the annual water usage for a specific type of land use. This example only shows single-family homes, but a complete table would also include other land use types. This average annual water use can be used to forecast water use for that specific type of land use. For example, if the city was planning to add 100 single-family homes in the future, planners could use the average water use calculated in this step to forecast how much water that development would use.

Table 1: Example analysis for determining average annual water use for a single-family home

Land use type	Total annual water demand (gallons)	Irrigation water demand (secondary) (gallons)	Average Annual Water Use (gallons)
Single-family home 1	150,000	-	145,000
Single-family home 2	140,000	-	
Single-family home 3	110,000	-	
Single-family home 4	110,000	-	
Single-family home 5	180,000	-	

If your community uses a secondary water provider or irrigation water, you will need to estimate that annual water use using duty values, unless the system is metered. This estimation process will be described later in step 6 of the second method. Please note that the numbers on Table 1 are examples and do not represent actual water demand for single-family homes.

5. Compile and finalize water budget

Understanding the average annual water usage for different land use types can be crucial for long-range planning efforts.

Table 2 presents a projection of planned land use types, their average annual water use and a comparison of total future water use to reliable water supply. Please note that total future water use should be calculated by adding the current water demand (obtained from water rights data) to the future water use calculated for all land use types. This total can then be compared to your reliable supply and analyzed.

Table 2 is the final step for the first method of creating a water budget and offers a robust water planning tool for your city or county, with a breakdown of water use for different land use types.

Table 2: Finalized water budget

Land use type	Planned or available zoning	Average annual water use per structure (gallons)	Total annual water use (gallons)	Total future water use (gallons)	Reliable supply (gallons)
Single-family home	100 plots	145,000	14,500,000	-	-
Townhome	-	-	-		
Commercial	-	-	-		
Industrial	-	-	-		

Water Budget - Method 2 Overview

The second method of creating a water budget has seven steps. Steps 1 through 3 were discussed in the previous methodology and will not be described in the next example.

1. Understand city or county growth.
2. Determine reliable supply.
3. Determine current demand.
4. Understand equivalent residential units.
5. Estimate indoor water use based on equivalent residential units.
6. Estimate outdoor water use based on irrigation duty values.
7. Compile and finalize a water budget.

4. Understand equivalent residential units

The State Engineer establishes Equivalent Residential Units (ERUs) to standardize water use measurements across different property types and ensure that peak day demand sizing can meet fire and other safety requirements. In Utah, 800 gallons per day (gpd) is the ERU sizing requirement for residential water use.

ERU ratios, which can be found in city or county codes, the Urban Land Institute, the American Planning Association or by completing a water use study, can be used to estimate the indoor water use of different land use types. This is done by applying an ERU ratio based on a single-family home.

Planners can assume, based on the State Engineer's 800 gpd sizing requirement, that a single-family home has an ERU ratio of 1. Given that number, you can use a

ratio to determine water demand for other structures. For instance, a townhome has an ERU ratio of 0.75-1, an apartment has an ERU ratio of 0.3-0.8 and an office building has a ratio of 0.05-0.1 per 1,000 sq. ft.

These ratios make sense because of water efficiency. A townhome is more water-efficient than a single-family home, so it makes sense that the water demand is 75% that of a single-family home.

Table 3 outlines some common ERU ratios from residential land use types, while Table 4 outlines commercial and industrial ERU ratios. Planners may use these ratios in their water elements if they align with city or county water use.

Table 3: Residential ERUs based on land use types

Land use type	ERU ratio	Description
Single-family detached homes	1.0	Baseline unit for ERU calculations
Single-family attached (townhomes)	0.75-1.0	Shared walls lead to lower utility demand compared to detached homes
Multi-family (apartments, condominiums)	0.3-0.8	Higher density leads to lower utility demand per unit
Accessory dwelling unit (ADU)		Smaller units, lower utility usage
Mobile homes		Lower utility demand than traditional homes
Senior housing or assisted living	0.3-0.6	Lower utility demand due to fewer occupants and specialized needs
Group homes	0.4-0.6	Shared living arrangements reduce utility demand
Student housing	0.3-0.7	Smaller units and different consumption patterns

Table 4: Commercial and industrial ERUs based on land use types

Land use type	ERU ratio	Description
Office building	0.05-0.1 per 1,000 sq. ft	Lower utility demand compared to residential units
Retail store (general)	0.1-0.2 per 1,000 sq. ft	Higher utility demand than office spaces due to customer traffic
Restaurant	0.3-0.5 per 1,000 sq. ft	Higher utility demand due to cooking facilities and customer traffic
Hotel	0.2-0.4 per room	Shared amenities and high-scale operations reduce per-room demand
Manufacturing facility	0.1-0.5 per 1,000 sq. ft	Varies widely based on the type of production process
Heavy industry (refinery, mine)	1.0-2.0 per 1,000 sq. ft	High utility demand due to large-scale infrastructure needs
Light industry (assembly plant, warehouse)	0.2-0.5 per 1,000 sq. ft	Lower utility demand than heavy industry, but still significant
Data centers	0.3-0.6 per 1,000 sq. ft	High electricity and cooling demands but lower water use
School	1 ERU per 30 students or 1,000 sq. ft	Higher water use for a larger facility and more students
Church	1 ERU per 125 seats	High utility demand for a larger facility

5. How to use ERU ratios to estimate demand

Now, planners need to use ERU ratios to estimate water demand. After determining an ERU value, planners can estimate total water demand by multiplying the ERU ratio for each land use type by the quantity of that land use in the development

project. For residential uses, the peak day demand per ERU is assumed to be 800 gallons per day (gpd).

Single-family homes example

For example, if a planner has 10 single-family homes with an ERU ratio of 1.0, multiply 10 by the 800 gpd requirement, resulting in 8,000 gpd of water use.

$$10\ units\ \times\ 1.0\ ERU\ =\ 10\ ERU\ per\ unit$$

$$10\ ERU\ per\ unit\ \times\ 800\ gpd\ =\ 8,000\ gpd\ (total\ peak\ water\ demand)$$

Townhomes example

For a townhome, planners need to determine its ERU. For this example, assume a 0.75 ERU ratio per unit. If there are 16 units and your ERU ratio is 0.75, multiply those numbers to get an ERU of 12. Next, multiply the total ERUs, 12, by the peak day demand (800 gpd) to obtain a total of 9,600 gpd of water use.

$$16\ units\ \times\ 0.75\ ERU\ =\ 12\ ERU\ per\ unit$$

$$12\ ERU\ per\ unit\ \times\ 800\ gpd\ =\ 9,600\ gpd\ (total\ peak\ water\ demand)$$

Commercial development example

For commercial development, the size of the building is used in its ERU calculation. In this example, the building is 50,000 square feet. Take the square footage of the building and multiply it by the ERU ratio of 0.1 per 1,000 square feet. This equals 5 ERUs. Next, take that ERU and multiply it by 800 gpd to obtain a total of 4,000 gpd of water use.

$$50,000\ sq.ft.\ \times\ (0.1\ ERU\ \div\ 1,000\ sq.ft.)\ =\ 5\ ERU\ per\ sq.ft.$$

$$5\ ERU\ per\ sq.ft.\ \times\ 800\ gpd\ =\ 4,000\ gpd\ (total\ peak\ water\ demand)$$

6. Estimate outdoor water use based on irrigation duty values

Next, determine an estimate for secondary or irrigation use, if it applies to your city or county. This step should be used in both the first and second methods of creating a water budget.

Utilize the state engineer irrigation appropriations and duty values for this exercise. The Utah duty value map can be used to determine your duty value. Plug in the duty value, along with the acres of turf associated with specific land uses, to determine gpd for irrigation. Do this for each land use type applicable to your water budget:

$$((Duty\ value \times acres) \times 325,851\ gallons)\ \div\ 365\ days\ per\ year\ =\ gpd$$

For example, if there is a single-family home in Zone 55, which has a duty value of 3 and 0.25 acres of irrigated turf, then the following equation can be created:

$$((3 \times 0.25\ acres) \times 325,851\ gallons)\ \div\ 365\ days\ per\ year\ =\ 669\ gpd$$

For help reading the Utah duty value map, please reach out to your designated Division of Water Rights Regional Engineer, listed below:

Table 5: Division of Water Rights regional engineer contact information

Name	Phone	Region
Skyler Buck	435-752-8755	Northern Region – Logan
Ryan Broadbent	801-538-7240	Weber River/Western Region – Salt Lake City
Ryan Hamilton	801-538-7240	Utah Lake/Jordan River Region – Salt Lake City
Andrew Dutson	435-247-1514	Eastern Region – Vernal
Cash Stallings	435-613-3750	Southeastern Region – Price
Terry Monroe	435-896-2557	Sevier River/Southern Region – Richfield
Michael Freeman	435-586-4231	Southwestern Region – Cedar City

7. Compile and finalize a water budget

Table 6 is a version of Table 2 that has been tweaked to account for ERUs. Table 6 presents a projection of planned land use types, their average annual water use, and a comparison of total future water use to reliable water supply. Please note that total future water use should be calculated by adding the current water demand (obtained from water rights data) to the future water use calculated for all land use types. This total can then be compared to your reliable supply and analyzed.

Table 6 is the final step for method two of creating a water budget. This method provides robust water planning for your city or county, with a breakdown of water use for different land use types.

Table 6: Example water budget

Land use type	Planned or available zoning	ERU ratio (per structure)	Total water demand (GPD) (ERUs)	Irrigation demand (GPD)	Total water demand (GPD)	Reliable supply (GPD) (ERUs)
Single-family detached home	100 homes	1.0	80,000 GPD or 100 ERUs	-	-	-
Single-family attached home (townhome)	50 homes	0.8	40,000 gpd or 40 ERUs	-		

Other considerations

When creating water budgets, cities and counties have the flexibility to utilize any data-driven methodology. This report demonstrated two potential approaches to fulfilling the water budget requirement for SB 76 (2023).

For counties or cities facing challenges with procuring specific data, an alternative is to leverage water rights data. This was described in both methods and can provide data for broad land use categories such as residential, commercial and industrial (Figure 1).

No matter what methodology is used, water providers and irrigation companies should review city and county water budgets to assess the reasonableness of the budget to the provided data and to evaluate whether a reliable water supply will meet projected demand.

Comparing water demand to reliable supply

In both methodologies, after the water budget is created, planners should compare the estimated water demand to reliable supply. If water demand exceeds reliable supply, planners should implement water conservation and shift land use ordinances to decrease water use. Tactics found in the Regional Water Conservation Goal Report can be utilized. Other tools, such as model ordinances, rebate programs, and water conservation information, can be found through Utah Water Ways and the Division of Water Resources. While many cities and counties in Utah may not provide their own water, they do regulate land use. Growing water smart is imperative and can be guided through a data-driven methodology like a water budget.