2026 State Water Plan Appendices

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Water Resources

Contents

Appendix A. Water budget trend analysis

The Division of Water Resources conducted a statistical trend analysis to determine the direction and strength of trends for evapotranspiration (Figure A-1), precipitation (Figure A-2), diversions (Figure A-3) and depletions (Figure A-4) in the state for the past 20 to 30 years. The division used state-of-the-art, publicly available datasets for the analysis.

The division assessed evapotranspiration for natural systems throughout the state using satellite data from the Moderate Resolution Imaging Spectroradiometer (MODIS) dataset.[1,2] Natural system evapotranspiration data were obtained from the MODIS Terra Net Evapotranspiration Gap-Filled 8-Day 500-meter product[1] for the entire state from 2001 to 2024 and summed by calendar year. A mask that excluded urban and built-up lands, water bodies, and permanent snow and ice, based on the yearly landcover product from MODIS,[2] was applied to the images prior to calculating the yearly totals so that the final result was an estimate of evapotranspiration from only natural system areas (Figure A-1).

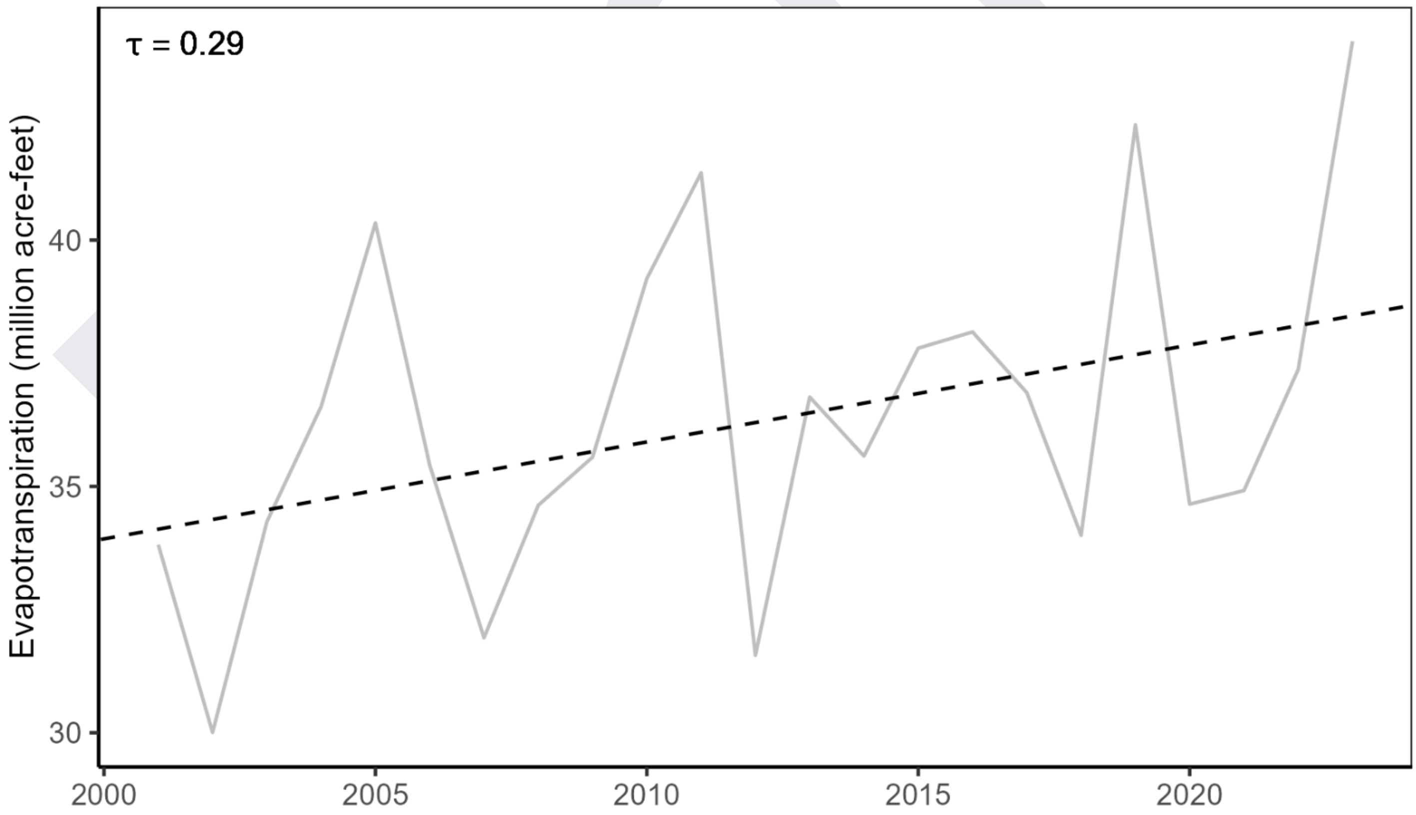
Annual precipitation was assessed using Daymet[3] data for the years 1989 to 2023, and the North American Land Data Assimilation System (NLDAS) dataset for 2024.[4] Note that these were the same data used as input variables for the division's water budget model.[5] Precipitation data were reported by water year (October to September) from 1989 to 2024. Data were grouped by state (within Utah state boundaries), large basins (Utah portions of Great Salt Lake, Colorado River and Sevier Lake Basins), and the division's 11 hydrologic subbasins (Figure A-2).

The division's water budget model estimated annual diversions and depletions for the state.[5] Input data to the model underwent a critical change in 2015 when Division of Water Rights enhanced their municipal and industrial (M&I) reporting and Division of Water Resources updated how secondary water use was estimated. Because this shift affects long-term trend analysis, it is not recommended to analyze M&I diversions prior to 2015. Instead, the trend analysis focuses on broad surface water and groundwater diversions, and looks to M&I depletions (which are less affected by the 2015 reporting change) to understand municipal trends. Additionally, the division recently updated its outdoor M&I depletion rate assumptions, increasing modeled depletion from 40% to 91% (see Appendix A of the model documentation[5]). Because the model is rerun annually for the entire period of record (1989–2024), this update is applied consistently over time and does not disrupt the trend analysis. However, the change in depletion from previous reports does not represent an increase in use but reflects the change in methodology. In the analysis, diversion and depletion data were reported by water year (October to September) from 1989 to 2024. Data were grouped by state (within Utah state boundaries), large basins (Utah portions of Great Salt Lake, Colorado River and Sevier Lake Basins), and the division's 11 hydrologic subbasins (Figures A-3 and A-4).

The division determined trends using Mann Kendall and Sen Slope tests, which are robust statistical tools commonly used in hydrologic science. The tests were conducted in the R programming software using the zyp package. Briefly, data were pre-whitened (using the Zhang method) and then the statistical tests were performed. The division used Kendall's τ and Sen slopes to assess the strength and direction of trends. Trends were considered statistically significant when $p < 0.05$. Generally, this corresponded to $\tau \geq |0.25|$. The division also classified weak trends as $|0.10| \leq \tau > |0.25|$, and no trend as $\tau < |0.10|$.

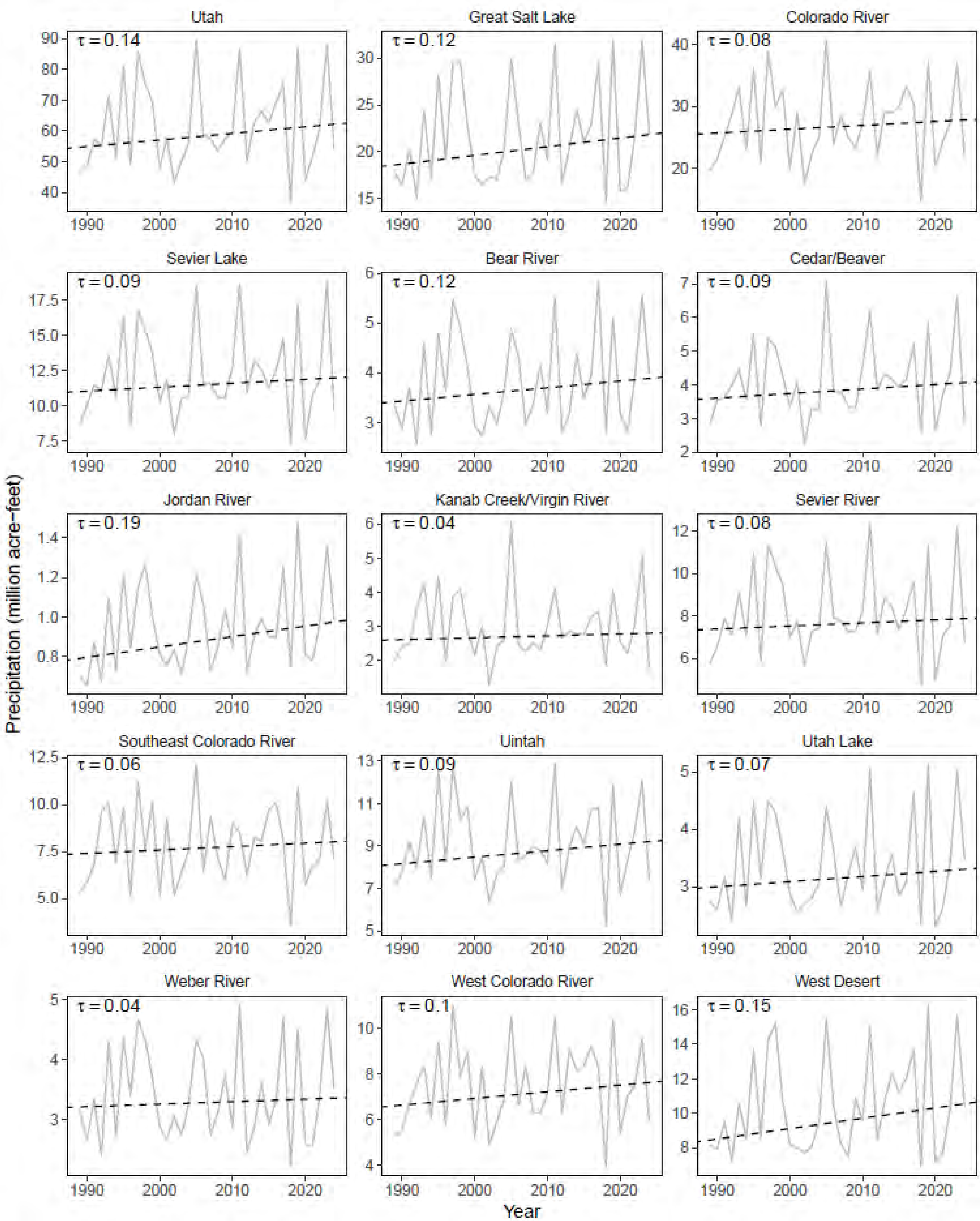
Trend results plotted with the associated time series are shown in the figures below.

Figure A-1. Estimated natural system evapotranspiration in Utah.



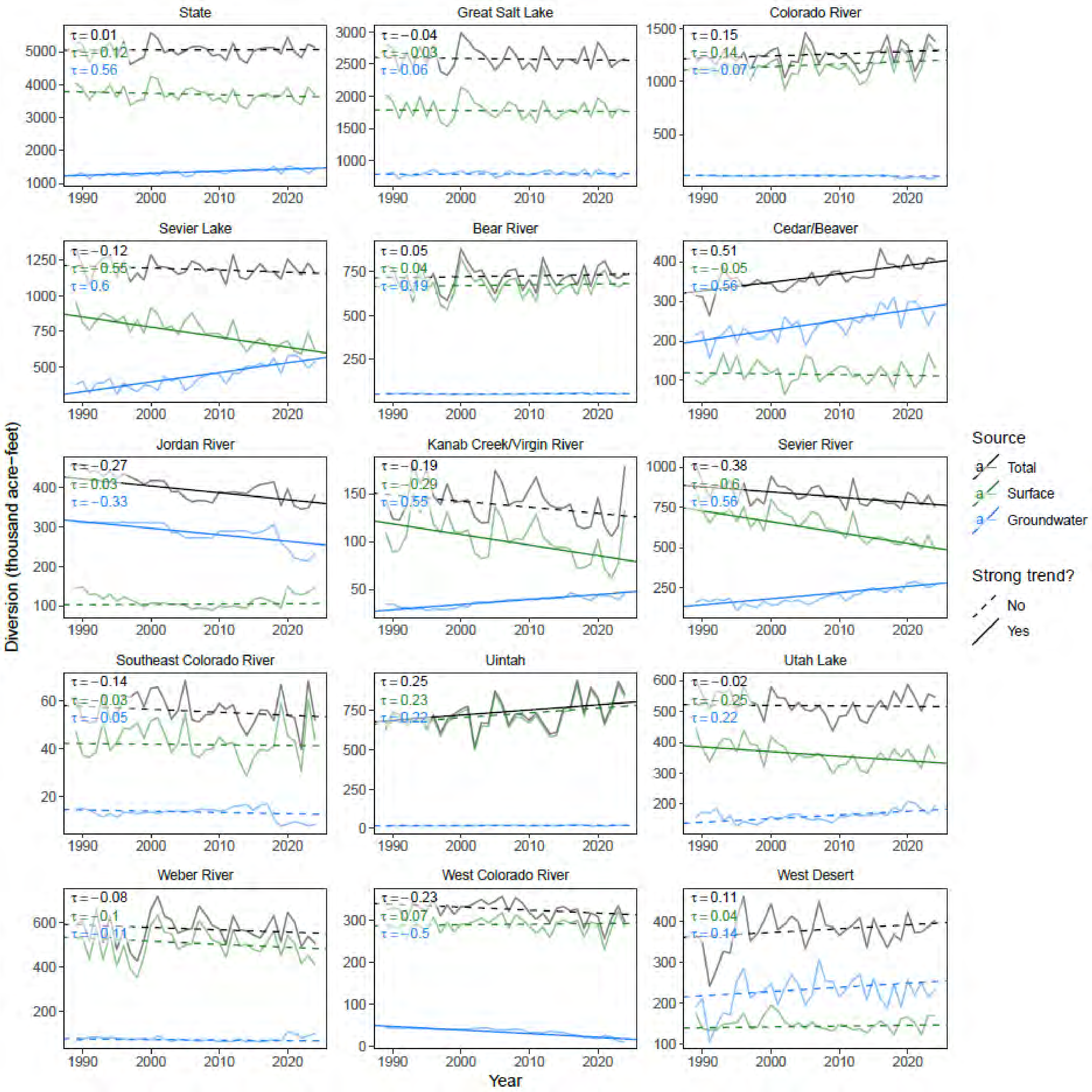
The grey line shows MODIS evapotranspiration data and the black dashed line shows the Sen slope fit, though it is not statistically significant (p = 0.06). Kendall's tau correlation coefficient shows the strength of the relationship.

Figure A-2. Precipitation trends.



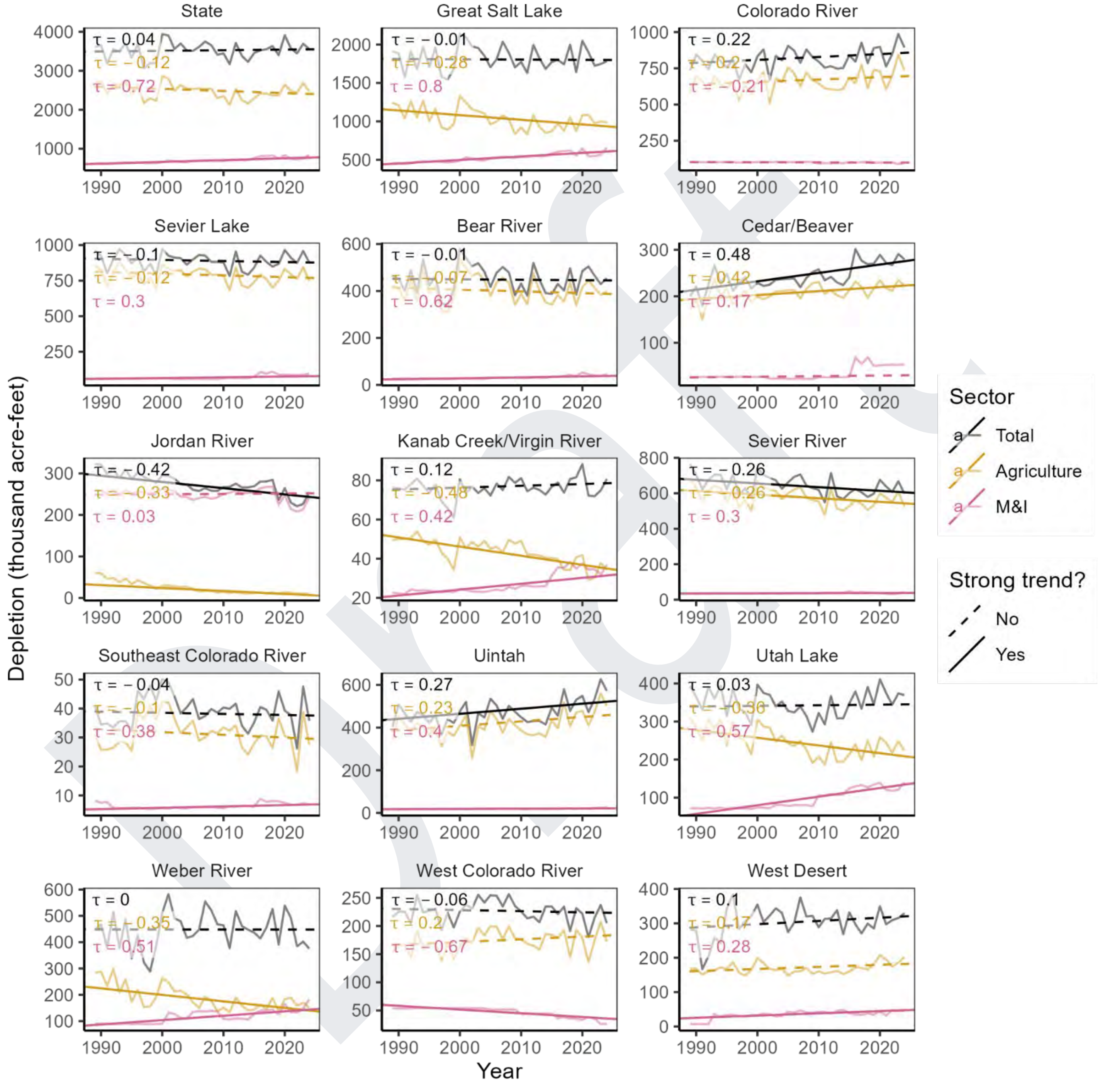
Time series plots of annual (water year) precipitation for the state, large basins, and the 11 hydrologic basins. The grey lines show Daymet (1989-2023) and NLDAS (2024) precipitation data and the black dashed lines show the Sen slope fit, though none are statistically significant (p > 0.05). We also report the strength of the relationship by reporting Kendall's tau in the top left of each plot.

Figure A-3. Surface water and groundwater diversion trends.



Time series plots of annual (water year) surface water, groundwater and total (surface and groundwater) diversions for the state, large basins and 11 hydrologic basins. Squiggly lines show the annual diversion data from the water budget model. Straight lines show the Sen slope fit to the data. Sen slopes are solid when the trend is significant (p < 0.05). Kendall's τ for each trendline is reported in the top left corner, with colors corresponding to the diversion source.

Figure A-4. Annual depletion trends.



Time series plots of annual (water year) surface water, groundwater and total (surface and groundwater) depletions for the state, large basins and 11 hydrologic basins by major sector. Squiggly lines show the annual depletion data from the water budget model. Straight lines show the Sen slope fit to the data. Sen slopes are solid when the trend is significant ($p < 0.05$). Kendall's τ for each trendline is reported in the top left corner, with colors corresponding to the depletion sector.

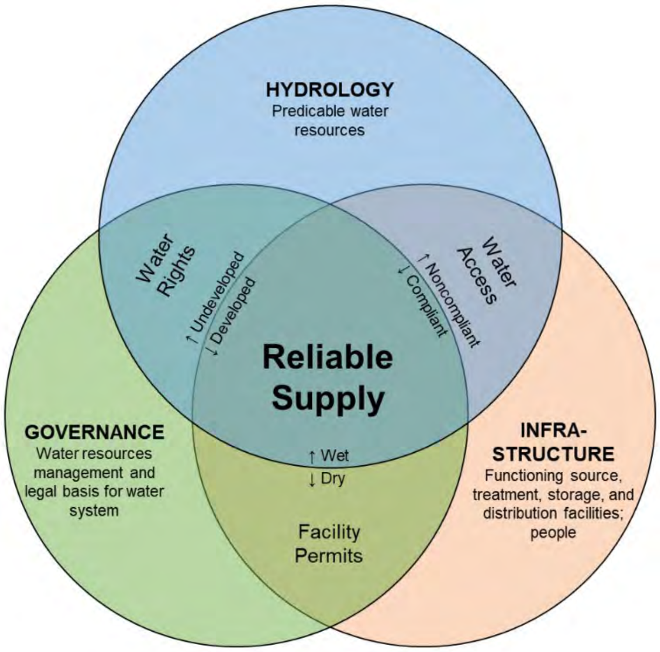
Appendix B. Modeling municipal and industrial water supply and demand

To monitor and project water supply and demand across the state, the Division of Water Resources compiles estimates through data gathering and modeling efforts. Currently, estimates focus on municipal and industrial (M&I) water supply and demand for public water systems.

Reliable supply estimation

Utah's water supply is constrained by hydrology, infrastructure and governance.[6] The hydrology of the system determines when and where there is liquid water. Infrastructure determines whether the physical water supply can be accessible to people. Governance determines if an entity has a legal claim to use the water. Together, these three components determine the reliable supply. Functionally, reliable supply should be defined by the limiting component's capacity.

Figure B-1. Major constraints on reliable supply.



Reliable water supply is limited by three interconnected factors: available water (hydrology), the infrastructure needed to store and deliver it and the legal and institutional framework governing its use. The most limiting factor determines the overall reliable supply.

Using this framework, the division has attempted to estimate current reliable supply for public water systems in the 11 planning basins. The current estimates are based on governance (water rights) and infrastructure components. A similar approach was used in the 2021 Water Resources Plan. These efforts are a work in progress and need further coordination among state agencies and local water suppliers. Additionally, the hydrology (wet water) of the basins must be integrated into the supply estimates to be considered truly reliable.

Municipal water data[7] was analyzed from 2015 to 2024 and divided into well pumping, spring flows, surface diversions, and wholesale supplies (Table B-1). Reliable supply was estimated by the following equation:

Total reliable supply = wells + springs + surface water + wholesale + secondary

where reliable well supply was estimated as two-thirds the maximum annual well flow for any municipality. Reliable spring supply was estimated as the minimum annual spring flow because springs are often unreliable in drought. Average annual use was considered reliable for surface water, net retail supplies (import - export) and secondary (untreated) irrigation water.

Table B-1. Average reliable water supply from 2015 to 2024. Results are reported in acre-feet per year.

Basin	Well Flow (Max × ⅔)	Spring Flow (Min)	Average Retail Import	Average Retail Export	Average Surface	Average Secondary	Total Reliable Supply
Bear River	25,000	24,000	950	-1,200	12	20,000	68,000
Cedar/Beaver	13,000	2,500	60	-420	1,000	4,600	21,000
Jordan River	85,000	1,200	200,000	-110,000	120,000	25,000	320,000
Kanab Creek/Virgin River	31,000	5,200	35,000	-9,900	1,400	16,000	79,000
Sevier River	11,000	9,300	140	-450	56	15,000	35,000
Southeast Colorado River	2,700	990	5	-16	4,500	2,300	11,000
Uintah	2,600	3,600	13,000	-3,700	59,000	4,800	80,000
Utah Lake	82,000	26,000	19,000	-5,100	21,000	65,000	210,000

Basin	Well Flow (Max × ⅔)	Spring Flow (Min)	Average Retail Import	Average Retail Export	Average Surface	Average Secondary	Total Reliable Supply
Weber River	48,000	3,200	51,000	-3,800	7,400	120,000	220,000
West Colorado River	793	4,300	1,400	-1,300	2,600	8,100	16,000
West Desert	17,000	670	200	-65	0	2,600	20,000
State Total	**320,000**	**81,000**	**320,000**	**-130,000**	**220,000**	**280,000**	**1,100,000**

Modeling agricultural water use converted to M&I water use

When agricultural land is converted to M&I uses, the associated water rights may be converted as well. In the M&I sector, this is viewed as a way to increase reliable M&I water supply. The Division of Water Resources models potential water conversion from agricultural use to M&I use for water scenario planning only. The division has substantially updated the modeling approach for the 2026 State Water Plan, and thus the results differ from previous estimates in the 2021 Water Resources Plan.

The division's modeling approach involves a two-step process:

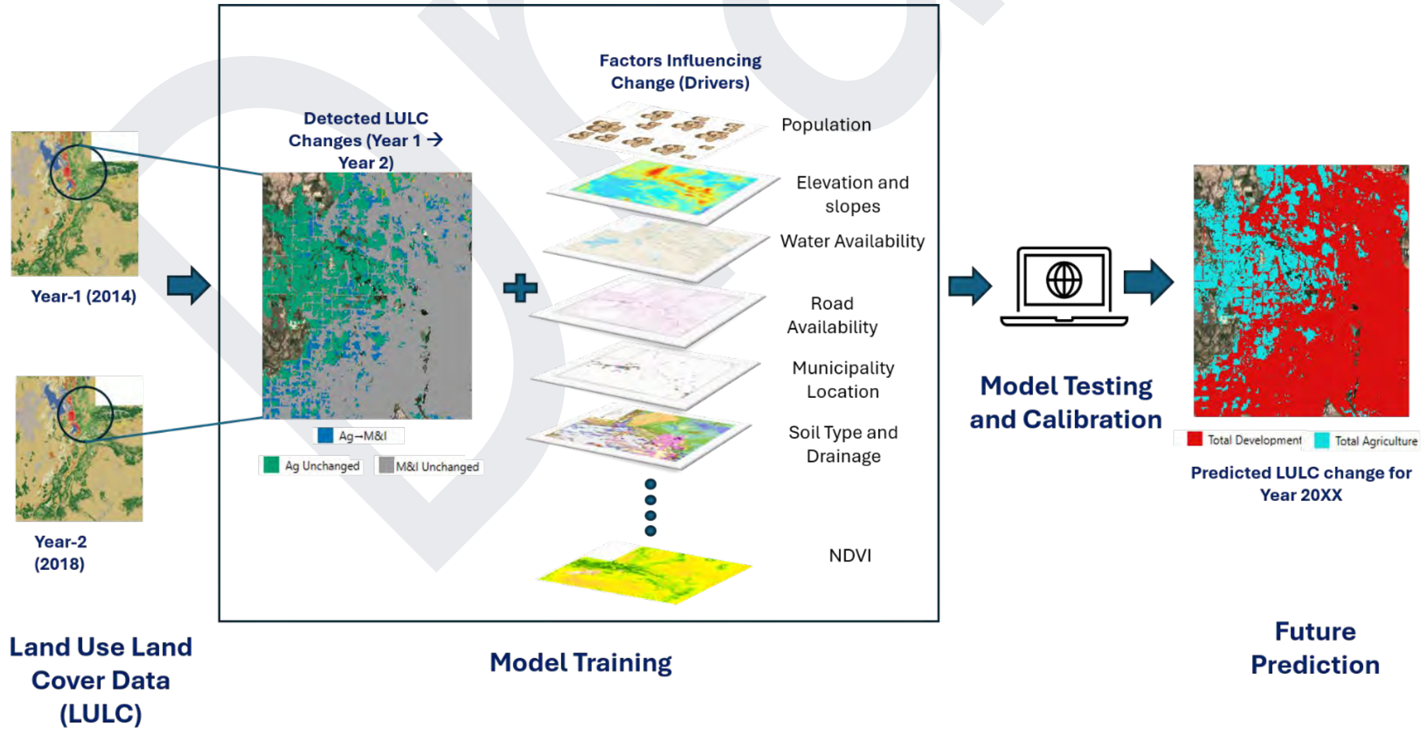
1. Estimate land conversion from agriculture to M&I using historical land use data.
2. Estimate the potential water transfer based on historical consumptive water use.

Step 1: Estimate land use transition from agriculture to M&I

To estimate land conversion from agriculture to M&I, the division used two spatial models: Land Change Modeler in TerrSet and MOLUSCE in QGIS. These models analyzed historic land use and land cover (hereafter land use) and projected land use changes for the future. Using both models allowed comparison and cross-validation to identify which one better captured patterns of local change. Each model trained on multiple land use timesteps (for example, 2015, 2019, and 2023) and spatial drivers such as elevation, slope, distance to roads, and population density. The first two land use timesteps and driver layers were used to train the model using Markov Chain and Artificial Neural Network machine learning algorithms. The model then simulated the third year's land use, which was validated against observed data for the same period. If the simulation closely matched actual land use changes, the model was considered reliable and used to project forward to 2059; if not, it was retrained with refined inputs. All data were processed in raster format, and to improve land cover classification accuracy, the division refined National Land Cover Database[8] classes using the division's Water Related Land Use dataset.[9] The final output was a projected estimate of how much agricultural land is expected to be converted to M&I by 2059, which was rounded up to 2060, assuming negligible differences between the two years.

To produce high and low estimates for agricultural land converted to M&I, the Artificial Neural Network's neighborhood parameter was run at two different settings: 1x1 and 3x3. For the high estimate, the 1x1 setting evaluates each pixel completely on its own, ignoring its surroundings. Because it operates without spatial constraints, it imposes fewer restrictions during the model training process, which generally leads to a higher amount of predicted change scattered across the map. For the low estimate, the 3x3 setting takes both the target pixel and its eight surrounding neighbors into consideration. Because this approach introduces strict spatial constraints, the model plays it safe and generally predicts smaller, more suppressed changes compared to the 1x1 setup.

Figure B-2: Agricultural to M&I land use change modeling process.



The modeling process estimates future agricultural to M&I land conversion by combining historical land use patterns with spatial modeling techniques and then estimates the associated water that could become available based on historical consumptive use.

Step 2: Estimate water conversion

As irrigated agricultural land converts to M&I use, some water previously used for irrigation will be freed for potential M&I use. To estimate the amount of water which could be available for M&I use as a result of the estimated land conversion by 2060, the division calculated an average annual depletion depth for each basin and applied it to the total area of converted land in that basin. Since the Division of Water Rights only allows the consumptive-use portion of agricultural water diversions to be transferred to M&I use, rather than the full diversion amount, the volume of depleted water is a better estimate of the water likely to be legally available for M&I use.

Depletions were calculated using the Division of Water Resources' evapotranspiration program, GridET.[10] GridET uses climate data from NLDAS-2[4,11] with the ASCE Penman-Monteith equation[12] and empirically-determined, crop-specific coefficients[13] to estimate annual evapotranspiration depths for a given crop in a given area. Annual precipitation and winter soil moisture carryover are subtracted from evapotranspiration to provide estimated depletion, or the amount of diverted irrigation water removed from the system through evapotranspiration. The division obtained an average annual depletion depth for each basin from 2018 to 2024 by calculating the average depletion of all crops found in that basin, weighted by the area of the basin covered by each crop during that year as defined by Water-related Land Use data.[9] Then, the division calculated a temporal average of all the years for each basin, and multiplied this historical average depletion value by the total area of irrigated cropland predicted by the land-use change model to be converted from agriculture to M&I use in the high and low scenarios (Table B-2). The results are estimates of the potential annual volume of water which could be re-allocated to M&I use after conversion. This volume is likely less than the annual volume of water historically diverted for those areas, because it represents only water removed from the system through evapotranspiration.

Table B-2. Acreage and water estimates that will likely be converted from agricultural to M&I use between 2024 and 2059.

Basin	Acreage converted - low estimate	Acreage converted - high estimate	Converted water - low estimate (acre-feet)	Converted water - high estimate (acre-feet)
Bear River	14,700	14,700	17,600	17,600
Cedar/Beaver	1,100	1,700	1,800	2,700
Jordan River	1,200	2,100	1,600	2,800

Basin	Acreage converted - low estimate	Acreage converted - high estimate	Converted water - low estimate (acre-feet)	Converted water - high estimate (acre-feet)
Kanab Creek/Virgin River	700	2,800	1,500	6,300
Sevier River	5,300	5,600	8,100	8,500
Southeast Colorado River	100	400	200	600
Uintah	1,800	2,400	3,300	4,200
Utah Lake	24,400	38,500	32,700	51,500
Weber River	13,300	27,400	17,700	36,500
West Colorado River	700	1,400	1,100	2,300
West Desert	4,800	4,900	7,300	7,400
Great Salt Lake Total	**58,400**	**87,600**	**77,000**	**115,700**
Sevier Lake Total	**6,400**	**7,200**	**9,900**	**11,200**
Colorado River Total	**3,300**	**6,900**	**6,100**	**13,500**
State Total	**68,100**	**101,800**	**93,000**	**140,400**

2021 versus 2026 modeling

The division used population projections, historical change-of-use application data, and water duty values to estimate the agriculture-to-urban water use transition for the 2021 Water Resources Plan. Due to insufficient data, the approach did not fully account for the physical drivers of urbanization and relied on simplified growth assumptions. Furthermore, counties with growth projections below 60% between 2015 and 2065 were excluded from the calculation. While MOLUSCE has its own limitations, such as its inability to incorporate economic, policy, and certain socio-economic data, it represents a significant improvement over the 2021 approach, as it is grounded in historic land-use change, coupled with physical drivers of urbanization, and validated before being projected into the future.

Water demand model

The Division of Water Resources has developed a water demand model to create future water demand scenarios for M&I use in public water systems. The model was initially developed in 2016 to support the development of regional conservation goals and was also used for the 2021 Water Resources Plan. The model has since been updated in 2025 to incorporate new data and reflect changes in land use, population and water conservation trends. The model accounts for population change, housing trends, climate change and indoor and outdoor conservation changes. For the 2026 State Water Plan, the division developed two conservation scenarios to model current and future (2060) demand: (1) current trends in conservation and (2) no change in conservation. Details about the model and scenarios are outlined below.

Model overview

The water demand model outputs represent water demand at the user connection and does not represent a depletion or diversion. The model only projects water use for municipal and industrial (M&I) public water systems. Self-supplied industry, independent users with 25 or less connections and agricultural uses are not included.

M&I water use is estimated for these three primary categories:

- Residential outdoor
- Residential indoor
- Commercial, industrial and institutional (CII)

The model performs these calculations at an individual water system, or supplier level, which are then aggregated to a river basin scale. The results are calculated and output in acre-feet per year at decadal timesteps. Table B-3 summarizes the key variables used in the water demand model and what category of use calculation they are connected to:

Table B-3. List of variables, and their descriptions, used in the water demand model.

Variable	Initial Values Description	Projection Adjustment Description	Applicable Categories
Net Evapotranspiration (ET)	Net turfgrass ET as calculated by Division of Water Resources (WRe) GridET model (supplier level).	A climate change factor based on a University of California Merced web tool for estimating future ET demands is applied to each decadal point projected (river basin level).	Residential Outdoor
Persons per Household (PPH)	Kem C. Gardner Policy Institute (GI) estimate (county level). This was used in combination with population to estimate the number of homes.	GI projection (county level).	Residential Outdoor, Residential Indoor
Population	GI projections distributed to supplier boundaries based on WRe methods (supplier level). This was used in combination with PPH to estimate the number of homes and in GPCD calculations.	GI estimates distributed to supplier boundaries based on WRe methods (supplier level).	Residential Outdoor, Residential Indoor, CII
Efficiency	Residential outdoor water use efficiency back calculated from current water use (2019-2024 average) and other current outdoor variables (river basin level).	Secondary metering is expected to improve low performers to higher standards observed in the state and adjustments are mainly applied within the first 10 years (river basin level).	Residential Outdoor

Variable	Initial Values Description	Projection Adjustment Description	Applicable Categories
Single Family Home Percentage (SFH)	Percentage of homes considered to be single family based on American Community Survey distributed to supplier boundaries based on WRe method (supplier level).	Observed building permit trends from US Census Bureau surveys are used to extrapolate trends from the last 10 years and adjust the SFH for each decadal point (county level).	Residential Outdoor, Residential Indoor
Percent Green Space	Average percentage of land on an average parcel that is irrigated based on NDVI processes by WRe (supplier level)	Estimated for different scenarios based on participation in landscape incentives program and county ordinances and applied to each decadal point (county level).	Residential Outdoor
Lot Size	Average residential single family home lot size based on available parcel data from counties and WRe processes (supplier level).	Where available from parcel data and year used to establish trend from last 10 years in parcel size for new residential single-family homes and applied as an adjustment to each decadal point into the future (supplier level).	Residential Outdoor
Multi-Family Home Irrigated Acres	Estimated irrigated acres per household for multi-family housing developed from WRe studies (state level).	Not adjusted in the model.	Residential Outdoor
Multi-Family Residential Indoor GPCD	Estimated indoor use rate for multi-family housing (state level)	Not adjusted in the model.	Residential Indoor

Variable	Initial Values Description	Projection Adjustment Description	Applicable Categories
Current Water Use	Reported water use for each sector is used in the model for establishing starting water use. A winter vs summer method developed by WRe was applied to obtain residential outdoor use (supplier level).	Projections for water use in the CII residential indoor sectors are a simple percentage adjustment to GPCD based on Regional Conservation Goals estimates.	Residential Outdoor, Residential Indoor, CII

The basic procedure for model operation is to adjust a set of current variables for each water system (typically the average depending on the variable) by a fraction, at each future decadal point. These adjustments can be based on an expected trend, or an alternative scenario to explore at the choice of the modeler. The following table illustrates this concept.

Table B-4. Example of fractional adjustment to variables for future years.

Future Years	2030	2040	2050	2060	Additional Notes
Initial Year (2020) Percent Green Space	0.6	0.6	0.6	0.6	Initial year value is used as base for every future year adjustment.
Decadal Adjustment Fraction	-0.1	-0.12	-0.14	-0.15	Positive number means increase, negative means decrease.
Adjusted Percent Green Space	0.54	0.53	0.52	0.51	

After adjustments are made for the decades and variables of interest, the water use for each use category is calculated at each timestep to obtain the projected water use at each modeled decadal point.

Residential outdoor water use

For all single-family homes, outdoor water use is calculated by a simple equation:

$\text{Outdoor Use} = (LS \times GS \times ET \times H) \div Eff$ where:

LS = Average lot size in acres

GS = Average percent green space

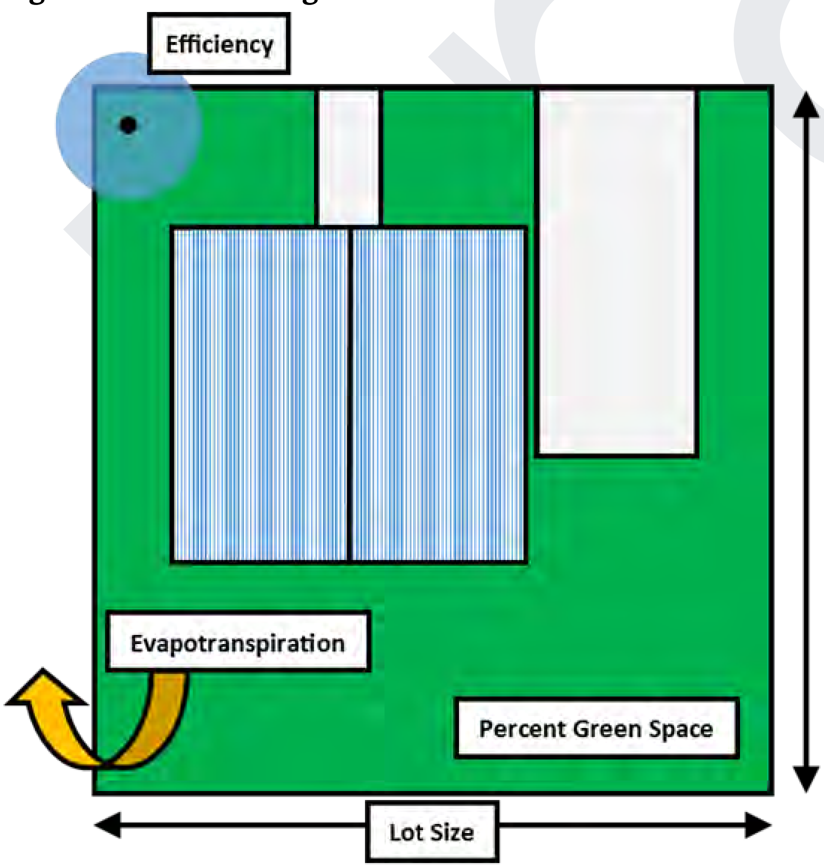
ET = Net Evapotranspiration in feet

H = Number of single family homes

Eff = Application efficiency

Figure B-3 illustrates the concepts of outdoor water use calculations visually. Because outdoor water use is mostly driven by irrigation, this is how the problem is approached in the model. There are other elements of residential outdoor water use that can occur, such as pools or washing, but these would be challenging to separate and are assumed to have little impact on overall results.

Figure B-3. Estimating residential outdoor water demand.



For the component of multi-family housing outdoor water use, the equation is similar with assumptions to simplify the equation and account for outdoor common areas typically found in this type of housing.

Residential indoor water use

The water demand model has the capacity to do more complex calculations for the indoor component of water use, such as a persons-per-household equation, but for the 2026 State Water Plan a simple adjustment to the current use rate was applied. For single family residential it is assumed that the GPCD will follow the Regional Conservation Goals for the region in which the supplier is located. For multi-family homes it is assumed that they will consistently be at an indoor water use rate of 55 GPCD. This has historically been a reasonable low end assumption for indoor water use rates.

Commercial, industrial and institutional water use

M&I water use in the CII category is collected annually and tracked for the systems that supply water to these types of connections. Calculations for CII are similar to the residential indoor approach in that there is a starting use rate obtained from population and historical use data which is adjusted by a conservation rate for each timestep into the future. The same Regional Conservation Goals as for the residential indoor category are applied to commercial and industrial water use into the future. By taking this approach water demand for these two components will track with population and expected conservation. For the institutional element the use rate reductions were set to match the resulting single family home reductions observed from model runs for single family home reductions. This approach for institutional water use projections assumes that behaviors for institutional irrigation systems will mimic residential changes.

Model limitations

The model is limited by input data accuracy and availability. Land availability is also a potential limiting factor when it comes to growth. This phenomenon and how it might affect water use has not been incorporated into the model. There is a possibility that growth may occur more densely than is currently projected. Some areas are more likely to encounter this situation than others. Water restrictions due to drought are becoming more frequent and the model does not capture how these conditions might impact water demand in the future.

Model scenarios

The division developed two conservation scenarios to model current and future M&I water demand for the 2026 State Water Plan. The first scenario, the Current Trends scenario, assumes that conservation will continue to follow current trends towards the Regional Conservation Goals. The second scenario, the

No Change scenario, assumes that conservation will not progress beyond current (2019-2023 average) conservation rates. These scenarios are modeled by using fractional adjustments to the variables as illustrated in Table B-4. More details about the two scenarios are outlined below.

Scenario 1: current trends

- **Population**: no additional population adjustments made beyond what was projected by the Kem C. Gardner Policy Institute and distributed to water system boundaries by the division.
- **Persons per household:** no additional persons per household adjustments made beyond what was projected by the Gardner Institute.
- **Outdoor water efficiency:** state policy regarding secondary water metering is assumed to have a significant impact. All basins, except Jordan River and Virgin/Kanab, will improve their existing efficiencies by 35% (e.g. 40% => 54%) at year 2040. The efficiencies then flatten and stay constant for the remaining years modeled. Jordan River Basin will improve by 9.4% and Virgin/Kanab Basin will improve by 18.6% at year 2040 and also stay constant for the remaining modeled years.
- **Single-family home percent:** reported building permits were used to modify the percentage of single-family homes in future years. This adjustment involved obtaining building permit data by number of units from the US Census Bureau for the last 10 years and applying the average percentage observed in each county to the future growth in single family homes for each water supplier. Any permit for more than four units was assumed to be multi-family type housing.
- **Percent green space**: changes in percent of green space for single family homes were derived from expected impacts of state policies and incentives. The current participation rate in landscape incentives programs was applied to each future year modeled. Recent building restrictions regarding landscapes were also applied in the same manner to each future year modeled. Rural counties are expected to limit green space in new homes to 50%, while urban areas (Salt Lake, Utah, Davis, and Weber Counties) are expected to restrict to a higher percentage at 35%, and Washington County is restricted to 8%. Because most rural areas already average less than 50%, this scenario matched the rural restriction to 35%, the same as more populated areas.
- **Lot size:** future single family home lot sizes were estimated from county parcel data and year of improvements. The 10-year average lot size of homes, classified as single family, was applied to the new homes estimated for each county in future years and then applied to the suppliers in the county.

- **Multi-family homes irrigated area**: and irrigated per unit of multi-family housing was based on a small-scale evaluation performed by the division during 2016 modeling and reapplied to this effort. All areas were assumed to have 0.015 acres of irrigated land per unit of multi-housing.
- **Multi-family indoor water use rate**: indoor water use rates were assumed to be 55 gallons per capita per day (GPCD) at all years modeled. This rate is representative of a standard low end number that can be achieved for indoor use.
- **Indoor water conservation**: the 2019 Regional Conservation Goals[14] provided indoor conservation rates at a county level. These reductions were based on expected changes to indoor fixtures and practices over time. These GPCD estimates, which went out to 2060, were reapplied for this scenario at a basin scale.
- **Commercial water conservation**: the commercial conservation rates were also derived from the 2019 Regional Conservation Goals.[14] They are set at 50% of the residential indoor GPCD rates, which was the same approach from the goals.
- **Industrial water conservation**: for industrial water use no rate reduction was applied. This assumption is made because industrial processes typically require a certain volume of water and only changes in technology will impact reductions, which are difficult to anticipate or predict.
- **Institutional water conservation**: a conservation rate equal in scale to the impacts observed from modeling residential outdoor use was applied at a basin scale. This approach assumes that institutional water use rate reductions will largely follow the pattern of residential outdoor use.
- **Climate change**: evapotranspiration rates were increased based on weather factors reflecting estimated changes in climatic conditions in the future. A tool developed by University of California Merced[15] was used to develop regional change factors that were applied at a basin scale in the model. A representative concentration pathway of 4.5 was used as the emissions scenario.

Scenario 2: no change

This scenario adjusted for population and evapotranspiration changes, but otherwise no future adjustments were made to other variables.

Note: Persons per household are already set to future changes by the Gardner Institute projections, which will impact future use rates. This is because many of the calculations are based on the number of homes.

- **Population**: no additional population adjustments made beyond what was projected by the Gardner Institute and distributed to water system boundaries by the division.
- **Persons per household**: no additional persons per household adjustments made beyond what was projected by the Gardner Institute.
- **Climate change**: evapotranspiration rates were reduced based on weather factors reflecting estimated changes in climatic conditions in the future. A tool developed by University of California Merced[15] was used to develop regional change factors that were applied at a basin scale in the model. A representative concentration pathway of 4.5 was used as the emissions scenario.

System losses

In addition to estimating demand, we also roughly estimated system water losses by basin. For mostly rural basins (Bear River, Cedar/Beaver, Sevier River, Southeast Colorado River, Uintah, West Colorado River and West Desert) we estimated that system loss was 15%. For mostly urban and highly efficient systems (Jordan River and Kanab Creek/Virgin River) we estimated that system loss was 12%. For basins with urban and rural communities (Utah Lake and Weber River) we estimated that system loss was 13.5%.

Table B-5. M&I water demand estimates, including estimated system losses, reported in acre-feet.

Basin	Average present demand (2019-2023)	Current Trends scenario - demand by 2060	No Change scenario - demand by 2060
Bear River	75,600	95,800	136,200
Cedar/Beaver	20,400	26,300	39,400
Jordan River	279,300	365,100	434,800
Kanab Creek/Virgin River	68,400	90,300	190,300
Sevier River	33,100	35,100	45,100
Southeast Colorado River	7,200	8,900	11,600
Uintah	19,900	23,100	27,000

Basin	Average present demand (2019-2023)	Current Trends scenario - demand by 2060	No Change scenario - demand by 2060
Utah Lake	184,700	259,000	402,100
Weber River	222,200	283,100	453,900
West Colorado River	15,500	13,800	17,800
West Desert	16,700	19,100	33,600
Great Salt Lake Total	**778,500**	**1,022,100**	**1,460,500**
Sevier Lake Total	**53,500**	**61,400**	**84,500**
Colorado River Total	**111,100**	**136,000**	**246,800**
State Total	**943,000**	**1,219,500**	**1,791,800**

Appendix C. Supplemental tables for Chapter 5: Healthy Watersheds and Ecosystems

Table C-1. Wetland and Riparian Habitat Types in Utah (acreage is rounded to the nearest thousand). Data source: the National Wetland Inventory.[16]

Resource Type	Acres
Playas and mudflats	882,000
Marsh and meadows	416,000
Aquatic Bed	85,000
Woody Wetlands	61,000
Riverine Wetlands	35,000
Riparian Areas	67,000

Table C-2. Numerous state agencies are involved in managing the Great Salt Lake. The main leaders and management plans are outlined in this table.

Agency/Entity	Primary Responsibilities	Key Contributions to GSL	Management Plans
Office of the Great Salt Lake Commissioner	Coordinate work to restore the GSL to healthy levels	Coordinates GSL work and arranges water lease agreements for the GSL	GSL Strategic Plan
Great Salt Lake Trust	Consolidate funds and arrange water lease agreements for GSL	Arranges water lease agreements for GSL and manages leasing funds	

Great Salt Lake Advisory Council	Advise on the sustainable use, protection, and development of GSL	Provides a balanced forum to discuss GSL issues and funds research and advises on GSL matters	
Great Salt Lake Salinity Advisory Committee	Provide evidence-based recommendations for GSL salinity management	Develops actionable recommendations for long-term salinity management	
Division of Water Resources	Plan, conserve, develop and protect Utah's water	Is developing a GSL Basin water model and manages GSL research related to the modeling effort	GSL Basin Integrated Plan
Division of Forestry, Fire and State Lands	Manage Utah's sovereign lands	Manages mineral leases and co-leads berm management with DWQ	GSL Comprehensive Management Plan and Mineral Leasing Plan
Division of Water Quality	Monitor and assess surface water quality and administer the Clean Water Act and the Utah Water Quality Act	Co-leads berm management with FFSL	GSL Water Quality Strategy
Division of Water Rights	Measurement, appropriation, apportionment and distribution of Utah's water	Regulates water rights within the GSL Basin, including those below the GSL meander line	GSL Distribution Management Plan

Table C-3. State agencies' roles and responsibilities for managing Utah Lake.

Agency/Entity	Primary Responsibilities	Key Contributions to Utah Lake	Management Plans
Utah Lake Authority	Manage and coordinate efforts to restore the lake's ecosystem, and improve recreation opportunities and economic output	Reduces invasive species, improves water quality and boosts the area's economic impact	Utah Lake Management Plan and June Sucker Recovery Implementation Program
Division of Forestry, Fire and State Lands	Manage sovereign lands	Provides habitat restoration, invasive species control (for example, *Phragmites*), and lakebed management and stewardship	Utah Lake Comprehensive Management Plan and S.B. 270 Utah Lake Study
Division of Water Quality	Monitor and assess surface water quality and administer the Clean Water Act and Utah Water Quality Act	Develops nutrient and water quality targets that are protective of beneficial uses and a watershed plan to meet those targets	June Sucker Recovery Implementation Program and Utah Lake Water Quality Study
Division of Wildlife Resources	Manage wildlife, waterfowl management areas; monitor endangered species	Provides habitat conservation, manages fish and wildlife, and regulates recreational access	June Sucker Recovery Implementation Program
Division of Water Rights	Administer measurement, appropriation, apportionment, and distribution of waters entering, being stored in, and leaving Utah Lake	Verifies that water rights associated with Utah Lake are honored in priority, both in terms of receiving water from upstream sources and in regulating withdrawals of water from the lake	

Agency/Entity	Primary Responsibilities	Key Contributions to Utah Lake	Management Plans
Utah State Parks	Operate Utah Lake State Park	Provides recreational infrastructure (for example, boat ramps and campgrounds)	
Division of Outdoor Recreation	Support recreation through grants and programs	Manages off-highway vehicle and boating programs; collaborates on lake projects	

Appendix D. Supplemental tables for Chapter 6: Vibrant Communities

Table D-1. Summary of fully permitted water reuse projects in Utah.

Entity	Reuse Type	Intended Use(s)	Annual Diversion Limit (ac-ft)
Ash Creek Special Service District	II	Agriculture	See note A
Ash Creek – Confluence Par	I	Secondary Irr.	See note A
Bear River	II	Agriculture	See note A
Beaver	II	Agriculture	See note A
Bryce Canyon City	II	Agriculture	See note A
Bryce Canyon National Park (see note B)	II	Silviculture	See note A
Bluffdale Cooling Water Reuse	I	Secondary Irr.	See note A
Casper Ice Cream	II	Agriculture	See note A
Cedar City	II	Agriculture	See note A
Central Valley Water Reclamation Facility	I	Golf Course	829
Corinne	II	Agriculture	See note A
Eagle Mountain	I	Secondary Irr.	See note B
East Zion Special Service District	II	Agriculture	See note A
Elwood	II	Agriculture	See note A
Enterprise City	II	Agriculture	See note A
Ephraim City	II	Agriculture	See note A

Entity	Reuse Type	Intended Use(s)	Annual Diversion Limit (ac-ft)
Eureka City	II	Agriculture	See note A
Francis Town	II	Agriculture	See note A
Gossner Foods	II	Agriculture	See note A
Green River	II	Agriculture	See note A
Heber Valley Special Service District	II	Agriculture	See note A
Hyrum	I	Secondary Irr.	See note A
Lower Foods	II	Agriculture	See note A
Manti City	II	Agriculture	See note A
Orem City (see note B)	II	Agriculture	9,634
Parowan	II	Agriculture	See note A
Payson City	II	Cooling	4,532
Pepperidge Farms	II	Agriculture	See note A
Roosevelt Water Reclamation Facility	II	Agriculture	300
Santaquin City Water Reclamation Facility	I	Secondary Irr.	1,032
Snowbasin	II	Silviculture	See note A
St. George City	I	Golf Course & Agriculture	6,496
Stansbury Park	II	Agriculture	See note A
Swift Beef Company	II	Agriculture	See note A
Tooele City	I	Golf Course	3,455
Washington County WCD	I	Secondary Irr.	700
Wellsville	II	Agriculture	See note A

Entity	Reuse Type	Intended Use(s)	Annual Diversion Limit (ac-ft)
Wolf Creek	I	Golf Course	150
Zion Mountain Local Service District	II	Agriculture	81

Table D-1 does not include all projects with pending permits. Two additional notes for data in this table:

A. These projects are not required to report their use as they were implemented prior to the water right permitting requirements, so estimates of diversion limits or reuse volume are not available.
B. A water rights decision has not yet been rendered.

Table data source: Division of Water Rights, "Reuse Applications" webpage. Retrieved from the internet July 12, 2025: WaterRights.utah.gov/reuse/reuselist.asp.

Table D-2. Summary of permitted aquifer storage and recovery projects by the Division of Water Rights in Utah.

Entity	Permits	Permitted Annual Recharge (ac-ft)	Recovery Restrictions/Reductions
Jordan Valley WCD	Recharge and Recovery	9,113 (See note B)	After 1 year 10% per year
Brigham City Corporation	Recharge and Recovery	2,486	After 1 year 25% per year
Washington County WCD	Recharge and Recovery	15,000	Losses from the aquifer system to the Virgin River greater than the historic discharge of 3 cfs cannot be recovered
Weber Basin WCD	Recharge and Recovery	See note C	After 2 years 50% per year
RLF Deep Creek, LLC	Recharge and Recovery	2,500	100% at end of October

Entity	Permits	Permitted Annual Recharge (ac-ft)	Recovery Restrictions/Reductions
Santaquin City	Recharge (See note A)	550	N/A
Summit Creek Irrigation and Canal Company	Recharge (See note A)	1,500	N/A
Cedar City Corporation	Recharge	2	N/A
Central Iron County WCD	Recharge	6,491 (See note D)	N/A
Sandy City Corporation	Recharge	959	N/A
City of Provo	Recharge	15,661 (See note E)	N/A
Metropolitan WD of Salt Lake & Sandy	Recharge	2,252	N/A

Permitted projects listed in Table D-2 are from the Division of Water Rights. Additional permits (not noted in the table) are required by the Division of Water Quality to ensure groundwater quality is protected.

Five additional notes for data in this table:

A. The recovery permits for these projects have not been approved.
B. 1,430 ac-ft under permit RC001 and 7,683 ac-ft under permit RC002.
C. No quantity is specified, instead flow limitations are prescribed depending on the flow of the Weber River: 8.18 cfs during flood flow, 6.38 cfs during high flow, 3.82 cfs during low flow, or less if the rights are cut by priority.
D. 2,176 ac-ft under permit RC014; 515 ac-ft under permit RC015; and 3,800 ac-ft under permit RC016.
E. 7,250 ac-ft under permit RC019 and 8,411 ac-ft under permit RC024.

Table data source: Division of Water Rights, “Recharge and Recovery Projects” webpage. Retrieved from the internet July 7, 2025: WaterRights.utah.gov/groundwater/asr/ASRlist.asp.

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