Pitkin County Water Conditions

Summary for Pitkin County Vision 2050

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Executive Summary

The Pitkin County Water Conditions report provides an overview of water supply, demand, and water management considerations to inform the County's Comprehensive Plan water policy direction and future implementation efforts.

Pitkin County Water Supply

Pitkin County falls within the Colorado River Basin, which is the headwaters for the Colorado River and one of the largest watersheds in Colorado. Water in this basin is overallocated – there is more water allocated in theory than available – creating unique legal administration and water management conditions. This is compounded by the fact that there are three major transmountain diversions that divert almost 40% of Pitkin County's water each year. While the nature of the County's water supply creates a complex legal situation, almost all (over 99%) of the County's water comes from renewable water sources (i.e., surface water or groundwater that is hydrologically connected to surface water surfaces). These are more reliable than non-renewable sources, where the rate of withdraw often outpaces the rate of recharge.

Pitkin County Water Demand

Pitkin County's water users receive water from a public water system or a well. While there are 50 public water systems, there are 31 systems in the County that provide water year-round to just over 80% of the population. The remaining users mostly receive water from wells. In addition, there are roughly 11,700 acres of irrigated agricultural land in Pitkin County. Currently, these users collectively use an estimated 34,000 and 42,900 acre-feet. Their water use is forecasted to increase 37,100 to 50,700 acre-feet in 2050 due to increasing demand from redevelopment, growth, and climate change.

Table 1. Pitkin County Baseline and Future Water Demand Estimates

	Baseline (2025) Demand Estimate (Acre-Feet)	Future (2050) Demand Estimate (Acre-Feet)
Domestic and Non-Residential Demand	14,100 – 18,400	15,000 – 22,700
Agricultural Demand	19,900 – 24,500	22,100 – 28,000
Total	**34,000 – 42,900**	**37,100 – 50,700**

Pitkin County Water Management Considerations

Given Pitkin County's water supply and demand, *water availability* currently appears sufficient; however, factors such as the abundance and concentration of wells, high household demand, climate change, wildfire impacts, infrastructure quality, water rights seniority, and Colorado River negotiations, raise questions about future *water reliability* within the County.

Through the creation of this report, Brendle Group worked closely with Pitkin County staff to ensure Comprehensive Plan policies consider these factors to promote sustainable growth and water management now and into the future. As a result, the recommended Comprehensive Plan policy direction emphasizes the importance of water availability and reliability, with language promoting water efficiency and conservation, improving water adequacy requirements, and well as increased regional water management.

Introduction

Pitkin County Vision 2050 is a comprehensive approach to updating the County's Comprehensive Plan and revising Land Use and Building and Energy Codes. The approach integrates four core guiding values to set a vision and path ahead for the Pitkin County community for the next 30 years, and provides a roadmap of progress toward a sustainable, and equitable community. The four guiding values are: bold climate action, a balanced economy, rural preservation, and equity and affordability.

The Pitkin County Vision 2050 process launched in 2022, with the Community Growth and Advisory Committee, which led to a **Final Report of Recommendations**. From there, community engagement, technical experts, and more specific data analyses served to set the stage for the Comprehensive Plan update and associated code amendments.

Pitkin County Vision 2050:
Implement bold climate action while balancing our economy, preserving our rural and wild lands, and supporting an equitable and affordable community.

This **Water Conditions Report** provides the technical analysis and support necessary to provide the basis for the Comprehensive Plans' water policy direction and future code amendments. This effort is intended to provide the County with a broad baseline for water supply understanding and be scaled to set up the County for future water planning and implementation of land use and building codes.

In Colorado, in accordance with SB24-174, county comprehensive plans must include a water supply element, and this element must be updated on no less than a 5-year basis. In developing the water supply element, local and regional governments are required to:

- consult and coordinate with local water provider(s),
- include water conservation policies, and
- estimate a range of water supplies and facilities sufficient to meet public and private infrastructure needs to support the potential public and private development described in the comprehensive plan.

To satisfy these requirements, this report was developed in consultation and coordination with local water providers and Pitkin County staff to inform the County Comprehensive Plan's water policies, as well as inventory existing water conditions and demands, and forecasts future water needs.

This report also draws on the Colorado Water Plan, which serves as a framework for statewide collaboration around water planning. The Colorado Water Plan focuses on four action areas: vibrant communities, robust agriculture, thriving watersheds, and resilient planning. The report draws on the Colorado Water Plan for educational context about the state's water conditions and challenges, as well as scenario planning. It also leverages the Colorado Water Plan's identified tools for action, with a focus on the potential actions for partners like Pitkin County, its water providers, and other stakeholders in the Colorado Basin.

Water Sources Overview

This section provides a summary of Pitkin County's water supply sources. It explains the differences between surface and groundwater sources, highlighting details related to planning and management of these sources.

Surface Water

Rivers, streams, lakes, reservoirs, wetlands, and snowpack are surface water sources. Surface water is considered a renewable source of water since it is produced and replenished through precipitation. In Colorado, surface water availability varies seasonally, annually, and regionally, creating the need for surface water storage and distribution solutions. The melting of snow and the flow of rivers and streams is also connected to the replenishment of groundwater – alluvial aquifers, also called tributary groundwater sources, are nature's way of storing water along rivers and streams.

Colorado is considered a headwater state, meaning that major rivers originate here and flow to downstream states on both sides of the Continental Divide (Colorado Water Conservation Board, 2023). Pitkin County is a headwater county to the Colorado River – a river with a complex history of negotiated agreements with other states.

The 1922 Colorado River Compact established the Upper Basin and the Lower Basin. The Compact allocated 7.5 million acre-feet of water annually to the Upper Basin, which includes Colorado, New Mexico, Utah, and Wyoming. The subsequent 1948 Upper Colorado River Compact apportioned 51.75% of that 7.5-million-acre-foot allocation to Colorado. As such, water in Pitkin County is subject to the obligations of these compacts, which shape how surface water can be managed and used.

Today these allocations are challenging, because while the original compact allocated 7.5 million acre-feet per year to the Lower and Upper Basins States (15 million acre-feet total), the Colorado Rivers average annual flow is only around 13.5 million acre-feet. As a result, the Colorado River Interim Guidelines were put in place in 2007 to outline how shortages should be handled. Since then, the Colorado River Basin Drought Contingency Plan was developed in 2019 and most recently, in May of 2023, the Lower Basin States agreed to reduce their intake by 3 million acre-feet through the end of 2026 (roughly 13% of their 7.5 million acre-feet per year allotment).

The Bureau of Reclamation has initiated a NEPA process to update all management processes that are set to expire at the end of 2026. On January 17, 2025, the Bureau of Reclamation published an Alternatives Report in response to operations alternatives released in late 2024. The goal is for a new management process to be in place by the end of 2026. Depending on the selected approach, management of the Colorado River could change, with potential impacts to all of Colorado, including Pitkin County. As the negotiations continue to take place, it is important for the County to track the process, as well as to be prepared in case conditions change (Lytle Water Solutions, LLC, 2023; Water Education Foundation, 2023; Womble, 2023).

Pitkin County is located within the Colorado River Basin, one of the largest watersheds in Colorado (Figure 1). The Colorado Basin Roundtable is one of Colorado's nine roundtables, which collectively represent each of Colorado's eight major river basins, as well as the Denver metropolitan area. Established in 2005 as part of the Colorado Water for the 21st Century Planning Act, the Colorado Basin Roundtable works to solve water-related issues in the Colorado Basin. With 40 members, the roundtable meets monthly to discuss water-related topics across the basin.

One of the roundtable's primary roles is to administer funds through the Water Supply Reserve Fund, for which Pitkin County is eligible to apply. Currently, Pitkin County has one representative on the Colorado Basin Roundtable, with the "Pitkin Municipality" representative seat currently vacant. While not binding, the 2022 Colorado Basin Implementation Plans Volume 1 and Volume 2 guide the roundtable by identifying basin-specific challenges and goals, assessing water demand and water needs, and establishing a list of priority projects to address future water needs.

Volume 2 identifies priority projects by region, and by tier. Tier 1 projects are projects that are ready to be implemented within the next year and have been identified as critical to

advancing basin priorities. The following Tier 1 projects are identified for the Roaring Fork region (which encompasses Pitkin County):

- Aspen Alternative Transfer Method Program
- Aspen Municipal Conservation Projects and Programs
- Wheeler Ditch Non-Diversion Agreement
- Pitkin County Instream Flow
- Capitol Creek Flow Efficiency Improvement Project
- Cancel Conditional Transbasin Diversions in Upper Roaring Fork River and Fryingpan River
- Fryingpan Environmental Flow Management
- Crystal River – Riverfront Park Restoration
- Regional Water Conservation Campaign
- Economic Impacts of River Recreation in the Roaring Fork

Transbasin Diversions

Within the Colorado Basin, and Pitkin County, transbasin diversions move water from one river basin to another (Figure 2). Diversions that specifically move water across the continental divide are called transmountain diversions. Transmountain diversions in Colorado typically move water from the west slope of the Continental Divide (where approximately 80% of the State of Colorado's water resources originate) to the east slope of the Continental Divide (where approximately 80% of the state's population resides).

Of the 27 transmountain diversions in Colorado, three are located in Pitkin County. Collectively, these three transmountain diversions account for roughly 17% of annual transmountain diversion volumes across the state and represent the 5th and 6th largest transmountain diversion by volume (CDNR, 2024d; CDNR, 2024e; CDNR, 2024f). Water diversions, including Pitkin County's three transmountain diversions, are discussed in more detail in the forthcoming Surface Water section.

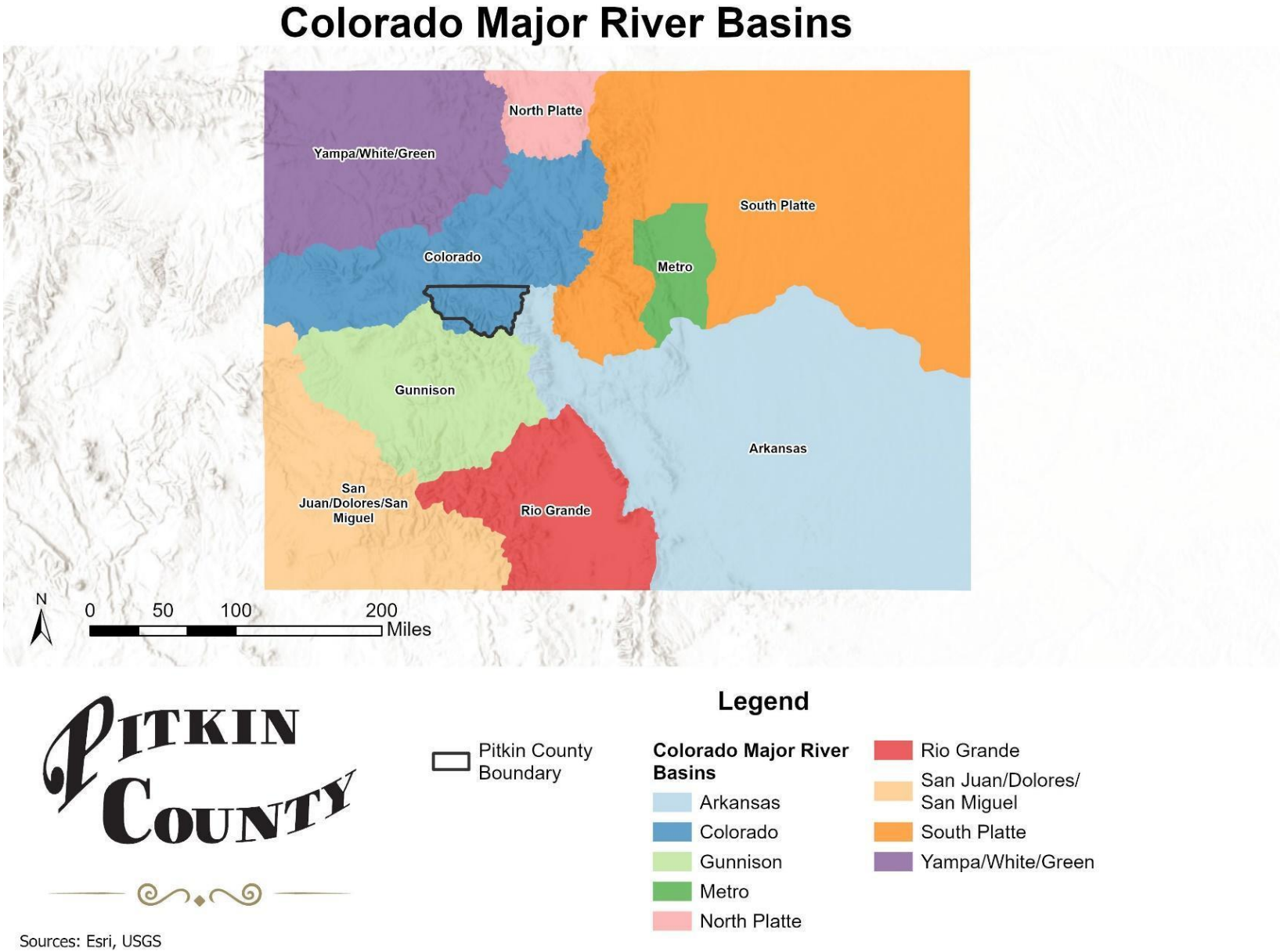

Figure 1. Pitkin County in the Context of Colorado's Major River Basins

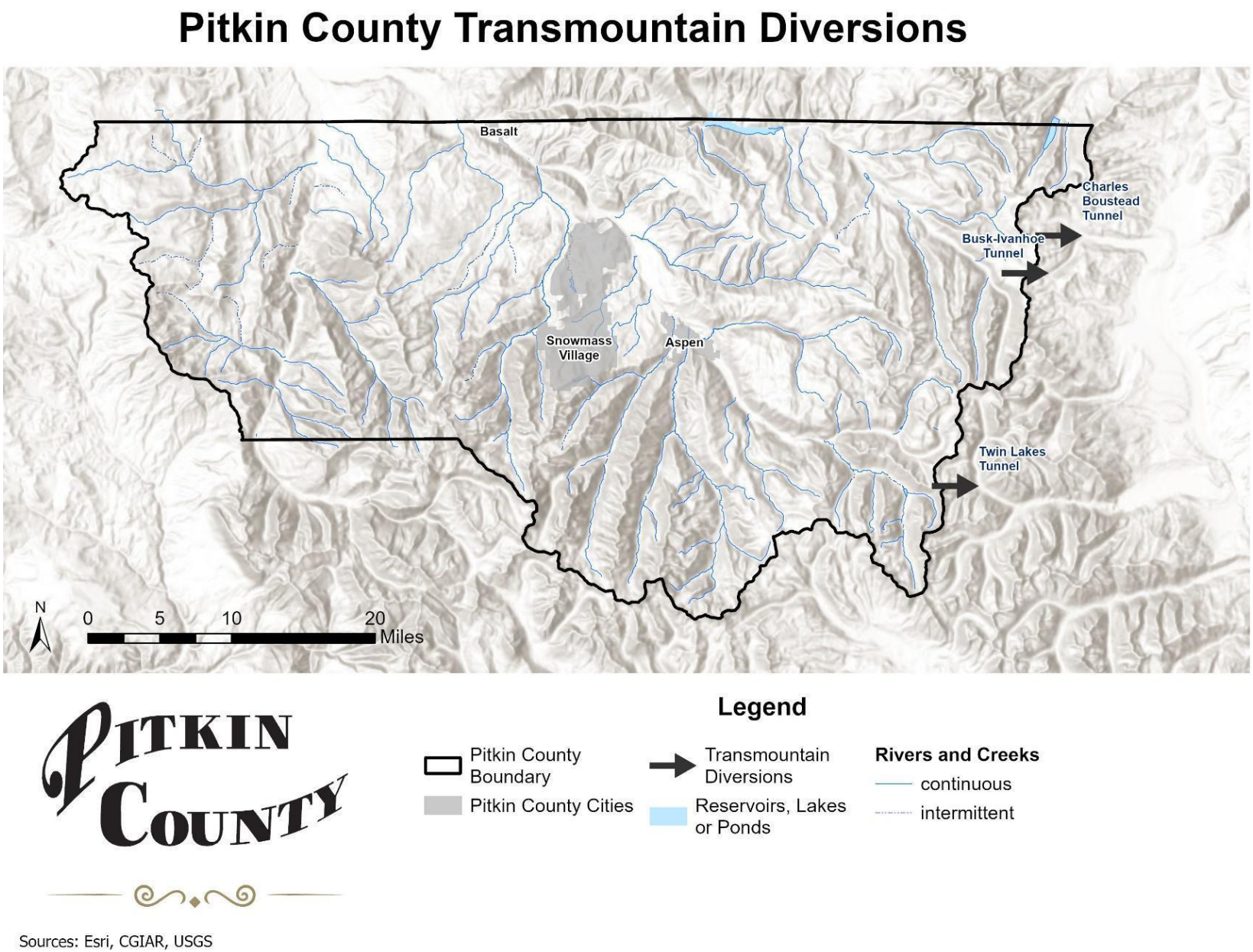

Figure 2. Pitkin County's Three Transmountain/Basin Diversions

Watersheds

The predominant watershed in Pitkin County is the **Roaring Fork River Watershed**. Subbasins of the Roaring Fork are shown in *Figure 3*. The Roaring Fork River Watershed includes the Sawatch, Collegiate, and Elk Mountain ranges and three primary rivers (Roaring Fork, Frying Pan, Crystal) that are tributaries to the Colorado River. With sections in Garfield, Eagle, and Gunnison Counties, the Roaring Fork Watershed encompasses all of Pitkin County's developed areas, including the City of Aspen and Towns of Snowmass Village and Redstone.

The watershed contributes about 856,000 acre-feet (or 279 billion gallons) of water each year to the Colorado River, making it an important watershed not just in the County, but throughout Colorado and the West (RFC, 2025). Within the Roaring Fork Watershed, key reservoirs include:

- **Ruedi Reservoir**: located in the north-central portion of the County, along the border with Eagle County, Ruedi Reservoir stores important augmentation water critical for surface water administration throughout the County.
- **Grizzly Reservoir and Lost Man Reservoir**: Located in the south-east portion of the County, along the border of Lake County, these two reservoirs are a part of the transmountain Twin Lakes Project.
- **Homestake Reservoir:** Located in the northeast portion of Pitkin County, along the Eagle County border, the Homestake Reservoir is part of the Homestake Transmountain Diversion project, which diverts water from Eagle River in Eagle County, to Twin Lake Reservoir in Leadville.
- **Wildcat Reservoir:** Located in the north-central region of the county, Wildcat Reservoir is a small reservoir owned by the Wildcat Ranch Homeowners Association (Wildcat Ranch, 2025).

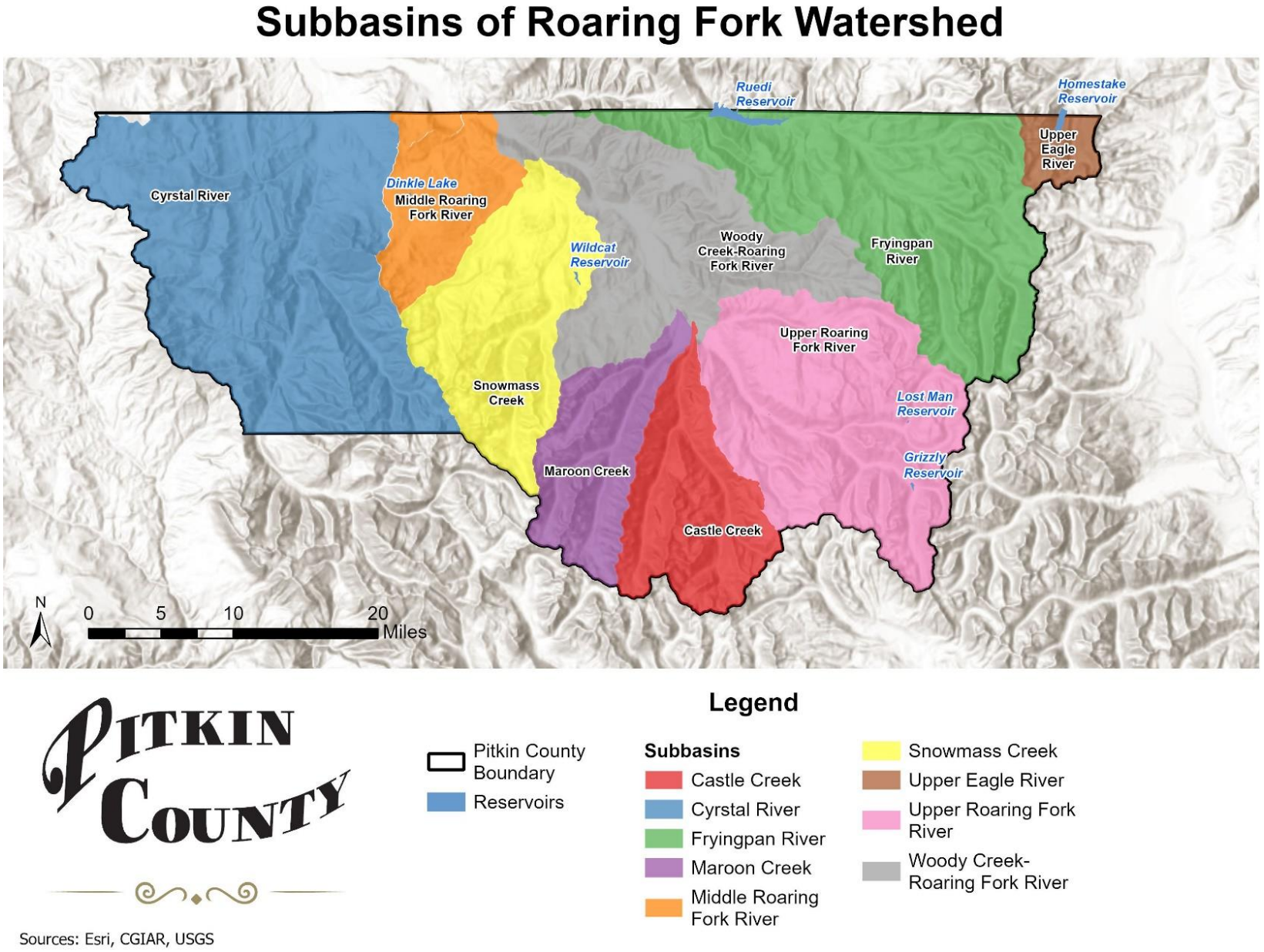

Figure 3. Pitkin County Subbasins of the Roaring Fork Watershed

Groundwater

In Colorado, groundwater is managed depending on whether it is **tributary** or **nontributary.** Tributary groundwater, sometimes called alluvial groundwater, is groundwater that is hydrologically connected to a surface stream and can influence the amount or direction of flow in a surface water source (Colorado State University, 2023). Since it is connected to surface water systems, **tributary groundwater is considered renewable**. Under Colorado water law, all groundwater is assumed to be tributary unless otherwise defined. Tributary groundwater is subject to Colorado's prior appropriation system (see the Water Use section for additional details on the prior appropriation system).

Non-tributary groundwater is sourced from aquifers that are not hydrologically connected to a surface stream. **Non-tributary groundwater sources are considered non-renewable sources of supply** because recharge rates are usually much slower than extraction rates (USGS, 2023).

Across Colorado, tributary groundwater and surface water supply most water users; only 17% of Colorado's water withdrawals originate from non-tributary groundwater (Colorado Water Conservation Board, 2023). Figure 4 provides a summary of nontributary groundwater to surface water withdrawal by county in Colorado. Most nontributary groundwater in Pitkin County is sourced from aquifers that consist of fractured bedrock that require deep wells with low water yields (van der Heijde & Kolm, 2005).

As a result of Pitkin County's hydrogeology, **almost 100% of Pitkin County's water withdrawals are from surface water, or tributary groundwater** connected to surface water.

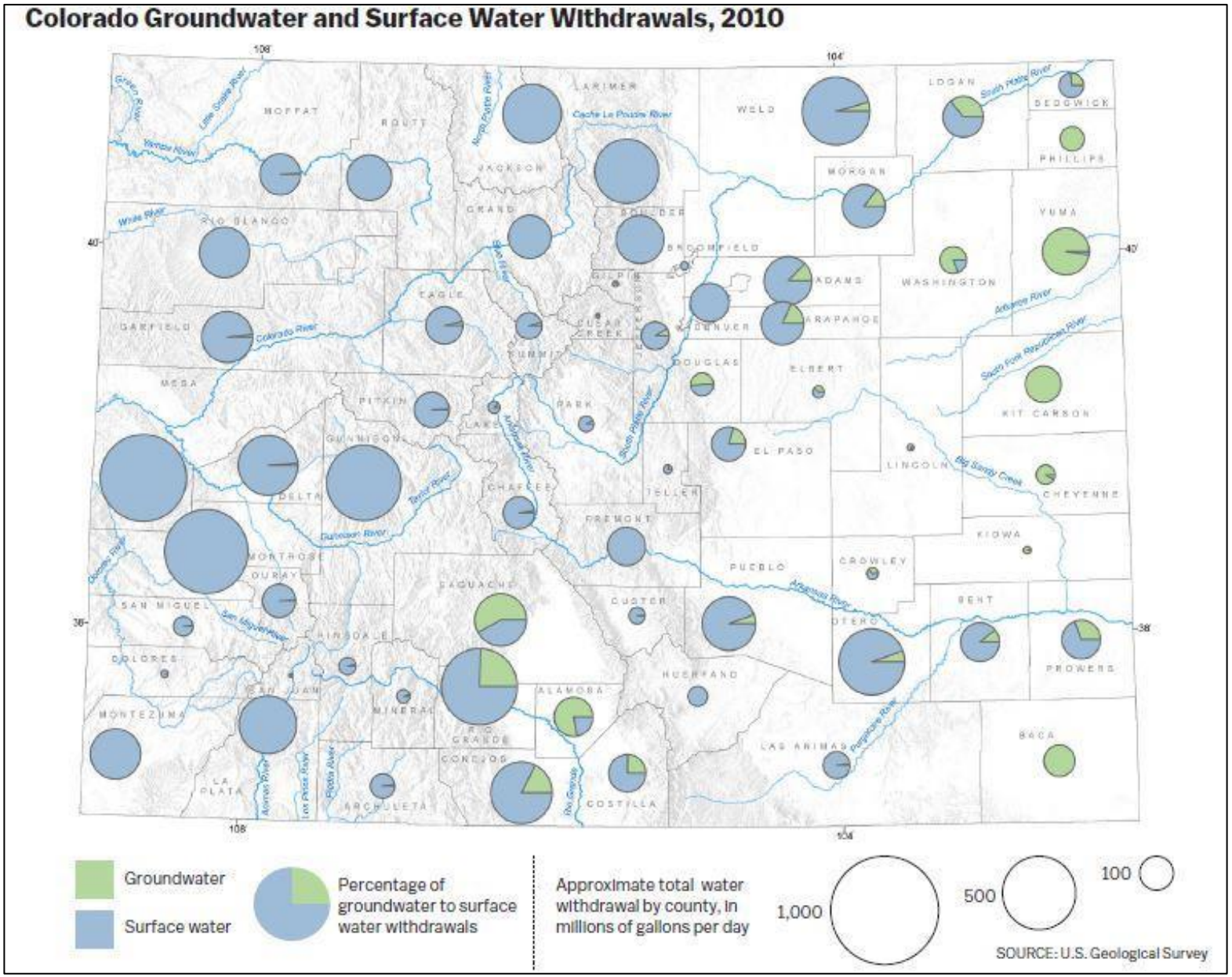

Figure 4. Comparison of Colorado Groundwater and Surface Water Withdrawals in 2010 by County

Water Supply Overview

This section provides a summary of how water is used and who is using water throughout Pitkin County through the lens of water rights and well permit data.

Water Use

Surface water and tributary groundwater are administered under the prior appropriation doctrine and governed by provisions outlined in the 1969 Water Right Determination and Administration Act (C.R.S. 37-92-101 to 602) and the 1965 Ground Water Management Act (C.R.S. 37-90-101 to 104). This doctrine outlines that no entity legally owns any of the surface water systems; however, the doctrine establishes the system of water rights that determines who can use the water, how much water can be used, and how water uses are determined. Every water right has a decreed beneficial use (Table 2) that is legally defined by the 1969 Water Rights Determination and Administration act (C.R.S. 37-90-101). Water right information is maintained by the Colorado Division of Water Resources.

Table 2. Common Beneficial Uses

Augmentation
CWCB Instream Flow and Natural Lake Levels
Commercial
Domestic
Dust Suppression
Evaporation from a Gravel Pit
Fire Protection
Fish and Wildlife Control
Flood Control
Industrial
Irrigation
Mined Land Reclamation
Municipal
Oil and Gas Production
Power Generation
Recreation on Reservoirs
Recreational In-Channel Diversions
Release from Storage for Boating and Fishing
Snowmaking
Stock Watering
Water Storage

Under the prior appropriation system, water rights are based on when they were first established. The first person to appropriate water and apply that water to beneficial use holds the senior water rights; that water right takes priority over other future appropriations (i.e., junior rights).

In addition to complying with water rights requirements, all groundwater wells (tributary and nontributary) in Colorado must have a permit issued by the Colorado Division of Water Resources. Unless they are exempt, tributary groundwater wells are required to have an augmentation plan. Exempt wells and augmentation plans are discussed in greater detail in subsequent sections of this report.

Surface Water

Water rights provide insight into how water is being used in Pitkin County. In the water rights system, there are two types of water rights:

- **Direct flow water rights** allow a user to divert a certain flow rate, usually measured in cubic feet per second (cfs) of water, for a specified beneficial use.
- **Storage water rights** allow a user to store a certain volume of water, usually measured in acre-feet (ac-ft), that is stored in a reservoir for later use.

Additionally, water rights are either considered to be “absolute” or “conditional”:

- **Absolute water right:** a water right that has been approved in water court. The owner may use it in perpetuity, provided they are in accordance with the decree. The only time an absolute water right is cancelled in water court is if the water right has not been used for an extended period (minimum 10 years), after which the water right may be deemed abandoned (Lytle Water Solutions, LLC, 2023; Kurath, 2015). Because absolute water rights have been approved in water court, they are generally considered a more secure and reliable source of supply than conditional water rights.
- **Conditional water right:** a water right for which appropriation has begun but is not complete. The owner has the right to use the water as outlined in the decree but has not actually put the water to beneficial use. To make a conditional water right absolute, water must be put to a beneficial use. Proof of use must be provided to water court (Kurath, 2015). Conditional water rights carry a greater risk than absolute

water rights because they require continuous effort to be secured, as opposed to absolute water rights which are already established and secure.

In 2024, there were a total of 3,652 water rights in Pitkin County (CDNR, 2024c). Of these, 65% were absolute, 20% were conditional, 5% had both a conditional and absolute component, and 10% did not have any associated data. Additionally, 75% were direct flow rights and 25% were storage rights.

Of the direct flow water rights, the majority (68%) were mixed use, followed by irrigation (9%) and augmentation (3%) (CDNR, 2024c; see Figure 5). Of the mixed-use category, the top five beneficial uses were municipal, irrigation, industrial, and commercial. Importantly, volumes and percentages are based on max use decrees and are therefore not necessarily representative of how much water will be diverted each year under any given water right.

Of the storage water rights, almost all were mixed use (i.e., multiple beneficial uses) (95%), with just 4% dedicated to irrigation and 1% to augmentation (CDNR, 2024c; see Figure 6). Of the mixed-use category, the top five beneficial uses were fishery, recreation, irrigation, fire, and other (17%, 16%, 13%, 12%, and 10% respectively). Importantly, like the direct flow rights, volumes and percentages are based on maximum use decrees and are therefore not necessarily representative of how much water will be diverted each year under any given water right. use decrees and are therefore not necessarily representative of how much water will be diverted each year under any given water right.

As mentioned above, Pitkin County resides within the Colorado River Basin. This is significant because the Colorado River is over-appropriated, meaning that there are more decreed water rights than are physically available. As a result, in a given water year, there are usually junior and/or conditional water right holders who may not be permitted to divert water. In years with above-average snowpack precipitation more junior and/or conditional water right holders are able to divert water for use. Looking to the future, the 25% of water rights that have a conditional component will be less secure, as it is less likely they will be able to put water to beneficial use to make them absolute rights.

Instream Flows

Within Pitkin County, instream flow decrees play an important role in maintaining the health of rivers and streams throughout the County. Managed by the Colorado Water Conservation Board, these decrees legally protect minimum streamflow in designated rivers and streams to support environmental and recreational needs. Figure 7 highlights

the instream flow reaches throughout the County. Two specific instream flow initiatives in Pitkin County include:

- **Pitkin County Trust Agreement:** Long-term agreement to loan up to 3.83 cubic feet per second (CFS) of water for instream use in the Maroon Creek and Roaring Fork River.[1]
- **Recreational In-Channel Diversion (RICD) Water Right:** Located in the upper Roaring Fork River, downstream of Highway 82 Upper Bypass Bridge and upstream of the confluence of the Fryingpan and Roaring Fork Rivers, the RICD became an absolute water right in 2020. It protects flows in the Upper Roaring Fork River as well as in the Pitkin County Healthy Rivers Whitewater Park. Rates of flow range between 240 and 1,350 cubic feet per second depending on the time of year.[2]

While water rights highlight how water is being used, water diversions highlight how water "moves" through a basin. The Colorado Department of Water Resources tracks diversions based on defined water Divisions and Districts within each water basin. State Water Divisions mirror the seven major river basins across the State, with smaller districts tracking water transactions on a local scale. Pitkin County falls within Division 5, which has 11 different water districts. Almost all the active diversions tracked in Pitkin County reside in Water District 38 (99%).

Diversion structures are physical infrastructure that divert water for beneficial uses. In 2023, Pitkin County had 88 structures with active diversion records (Figure 8). The majority of these (42%) are off the Roaring Fork River (CDNR, 2024a). For structures with active diversion records, the total volume diverted was just over 600,000 acre-feet of water in 2023 (Figure 9). This is a 47% increase in the volume diverted, compared to 1985 records. Interestingly, while the volume of diversions increased, the number of overall diversions decreased by 45%, compared to 1985. This highlights a shift in how water is being diverted in the County (e.g., larger volumes from fewer diversion points) as well as a potential consolidation in who is managing diversions.

The volume of water being diverted year-to-year is complex and dependent on several factors. Changes in demand, both agricultural and municipal, due to hotter and dryer conditions can increase diversions if water is available in storage. Additionally, in years with

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[1] See the full decree at https://dwr.state.co.us/Tools/ISF/733.

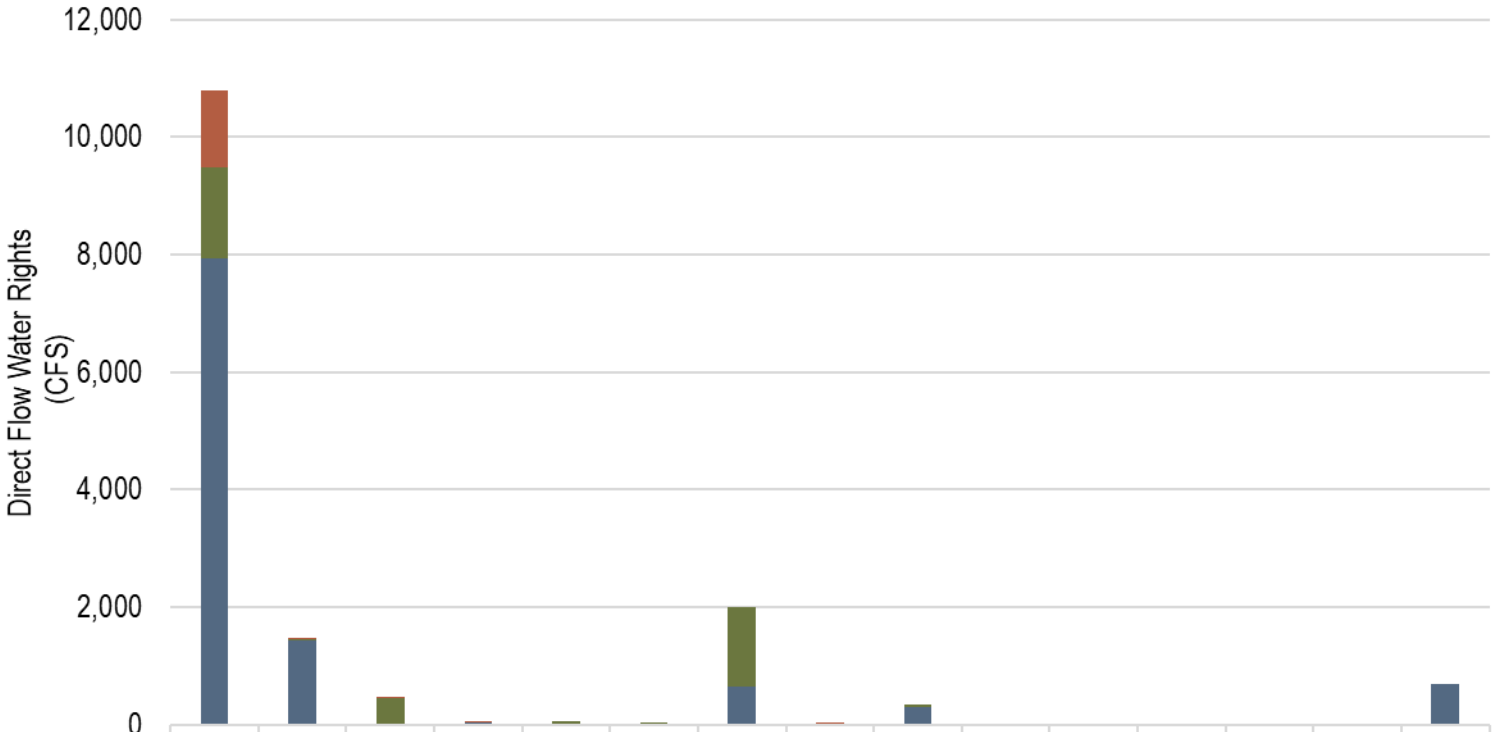
[2] See the full decree at https://www.pitkincountyrivers.com/uploads/1/0/3/1/10319041/ricd-decree_of_the_water_court_20cw3082.pdf.

above average snowpack, diversions may also increase due to the additional water available for storage.

Between 2008 and 2024, the average temperature in Pitkin County increased by 1.5°F (NOAA, 2025a; see Figure 10). Rising temperatures contribute to longer growing seasons and higher evapotranspiration demands, both of which increase irrigation water demand. Higher temperatures also result in a higher proportion of precipitation falling as rain instead of snow, which reduces the duration of the runoff season and impacts water supply.

Compared to temperatures, precipitation patterns in Pitkin County are more variable and do not show a distinct increase or decrease in annual totals over the past 26 years (NOAA, 2025b; see Figure 11). This is consistent with state modeling, which shows unclear projections for precipitation patterns and totals. Despite this variability in precipitation totals, models show that even moderate increases in precipitation are not enough to overcome the impacts from increased temperatures (Colorado Water Conservation Board, 2023).

Snow water equivalent (SWE) is a final climate metric that measures the amount of water that is available in the snowpack. For all of Colorado, but particularly Pitkin County, this is an important measure because it is directly related to the amount of snowmelt and runoff the County will receive. Years with higher SWE result in higher runoff, which is significant for water management and availability. Compared to the 1981 – 2024 average, 2024 was 12% below the historical average (USDA, 2025; see Figure 12). Additionally, when compared to recent years with the lowest diversion records (Figure 9), years with low diversion records align closely with years with low SWE values (e.g., 2012, 2013, 2018, 2021). Like all of Colorado, Pitkin County will need to plan for these impacts, especially as it relates to water availability.



	Mixed Use	Irrigation	Augmentation	Domestic	Geothermal	Fishery	Recreation	Other	Power Generation	Commercial	Storage	Municipal	Fire	Household Use Only	Minimum Streamflow
Both	1,319	10	1	0	0	0	0	1	0	0	0	0	0	0	0
Conditional	1,544	34	436	0	56	0	1,350	8	34	0	0	0	1	0	0
Absolute	7,941	1,427	22	36	0	10	654	11	306	0	0	5	0	1	685

Source: CDNR, 2024c

Figure 5. Direct Flow Water Rights by Beneficial Use in 2024

	Mixed Use	Irrigation	Augmentation	Domestic	Geothermal	Fishery	Recreation	Other	Power Generation
Absolute	178,328	8,621	813	335	84	2	4	1	1
Conditional	28,185	0	1,357	35	0	18	6	0	0
Both	1,561	0	5	20	0	0	3	0	0

Source: CDNR, 2024c

Figure 6. Storage Water Rights by Beneficial Use in 2024

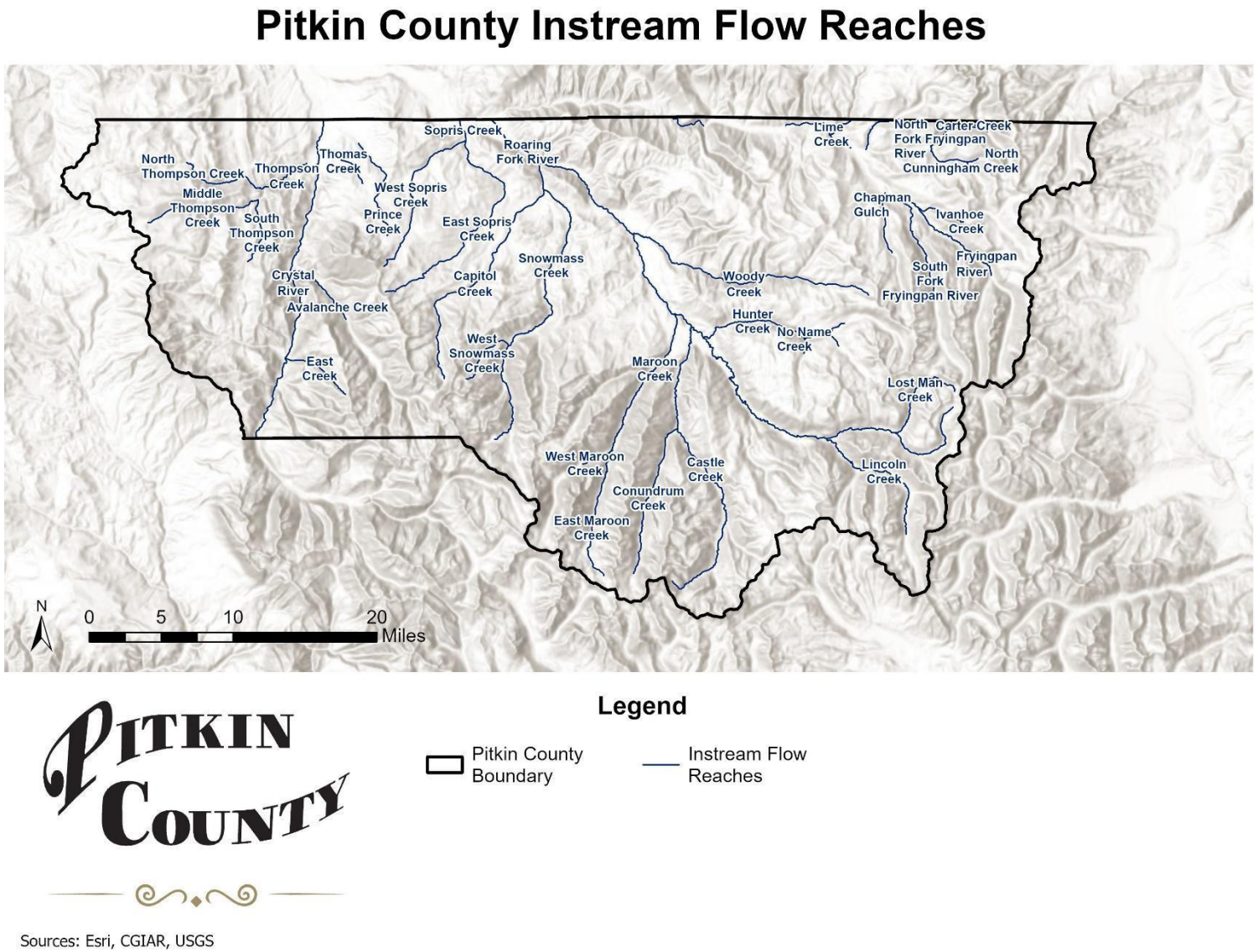
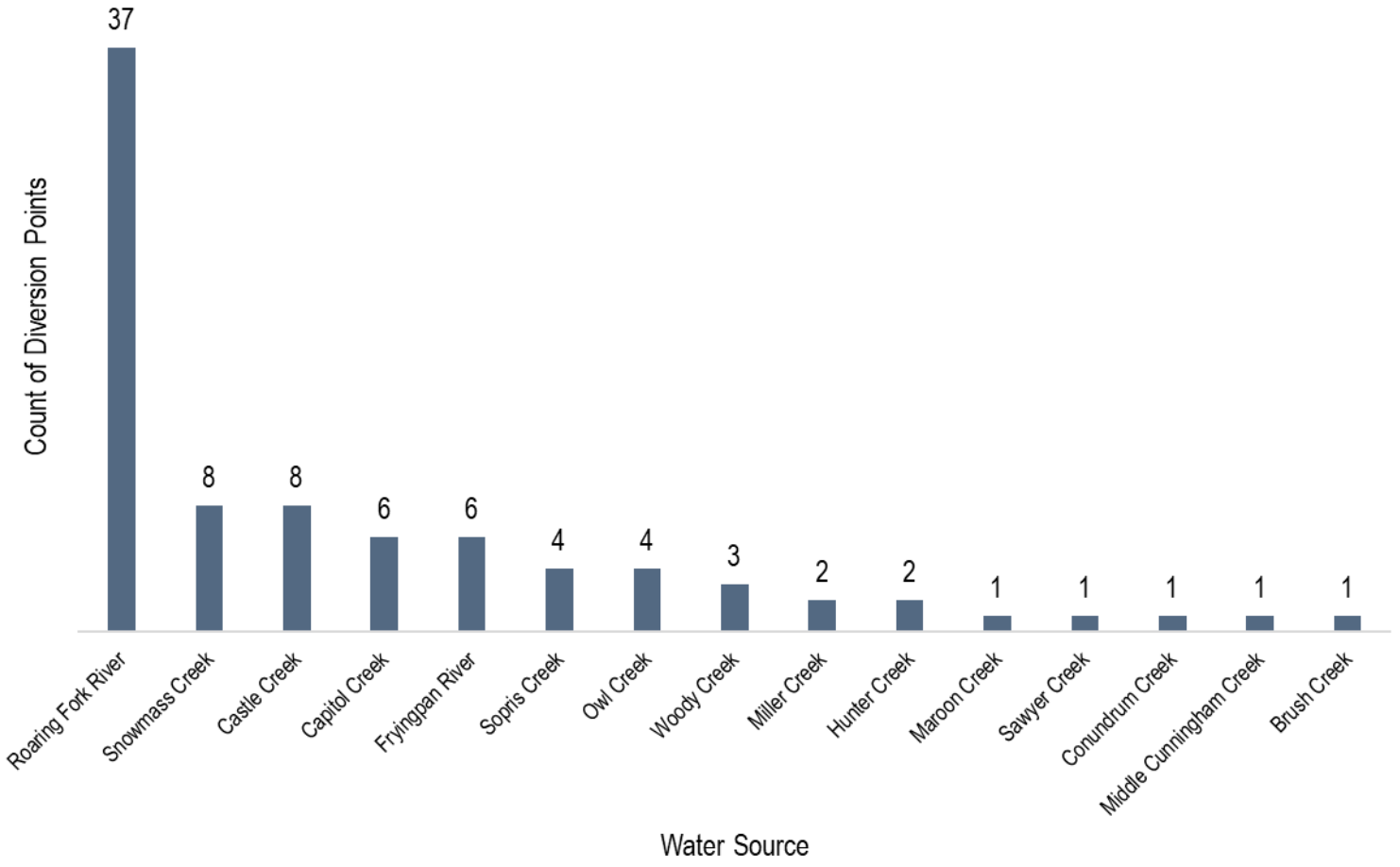
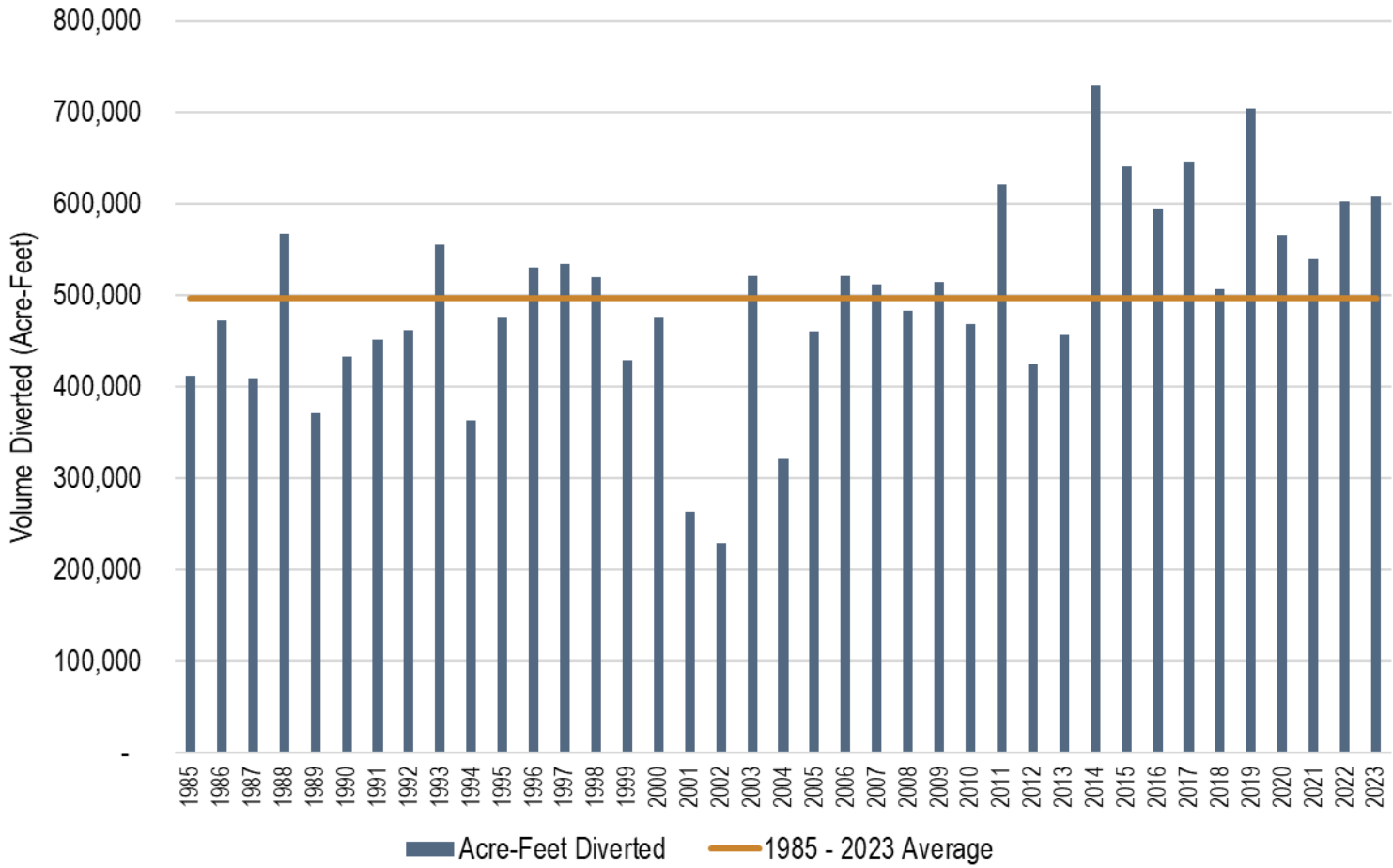


Figure 7. Pitkin County Instream Flow Reaches



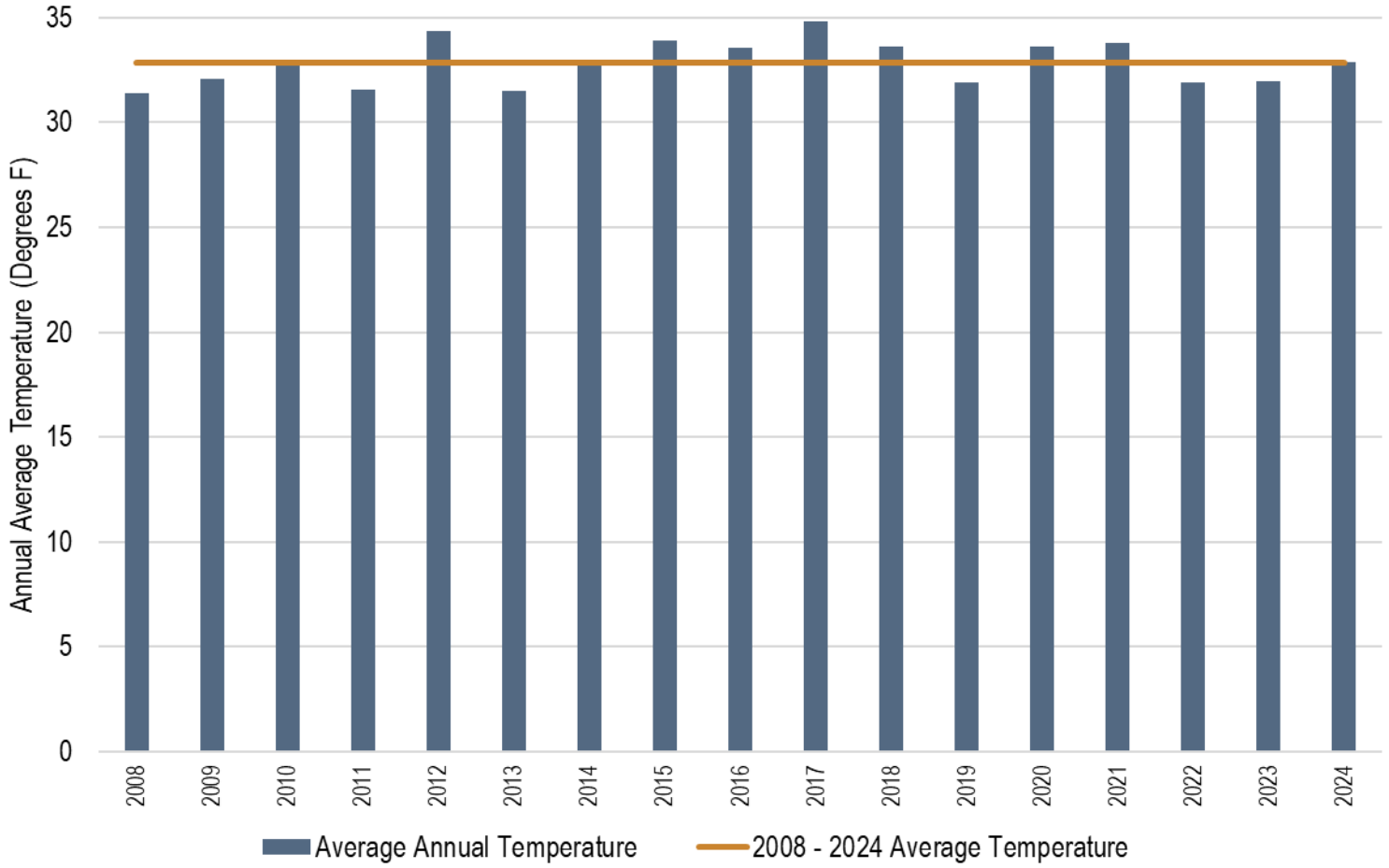
Source: CDNR, 2024a

Figure 8. Diversion Points by Water Source in 2024



Source: CDNR, 2024b

Figure 9. Volume of Total Water Diverted in Pitkin County between 1985 and 2023

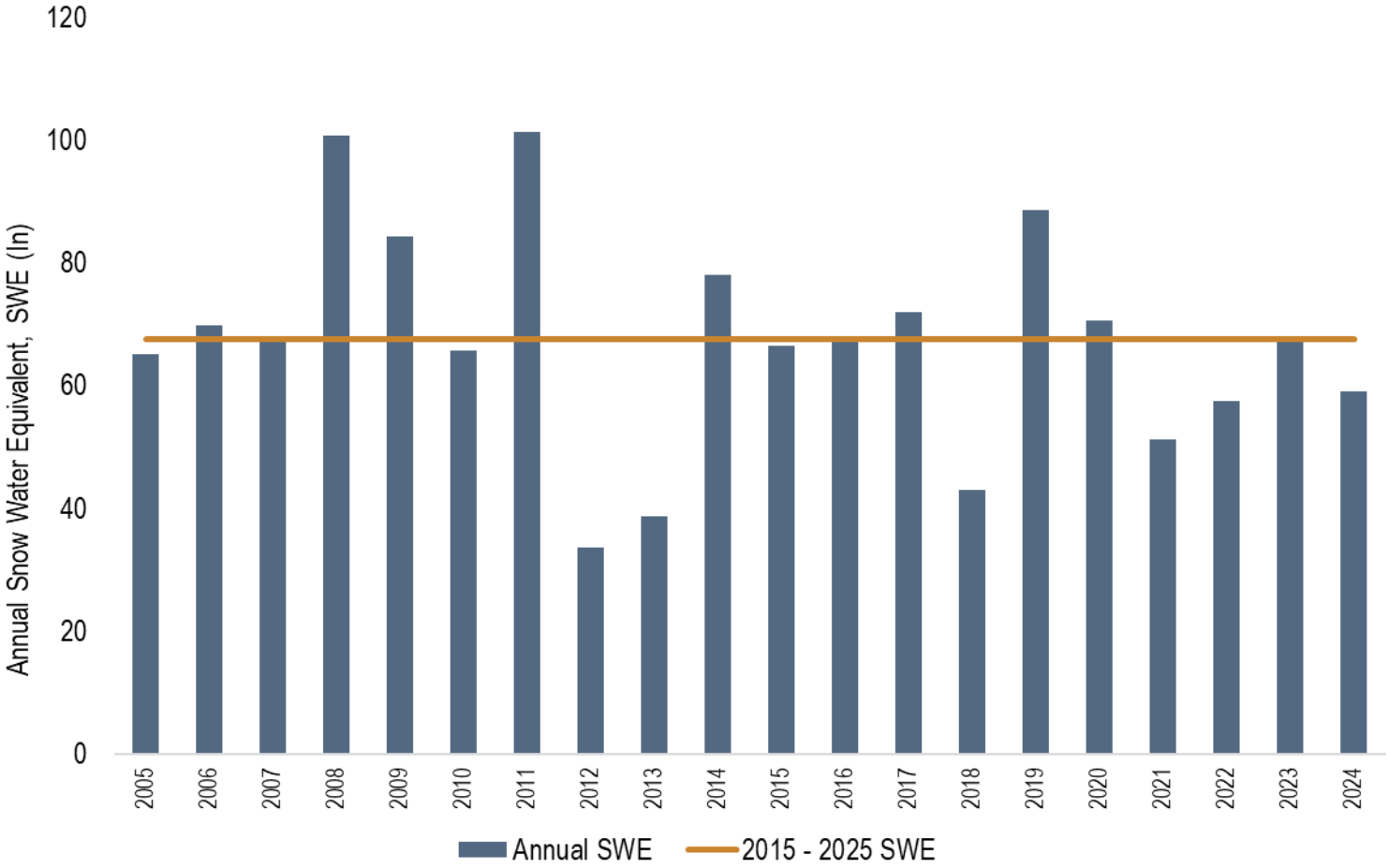


Source: NOAA, 2025a

Figure 10. Average Annual Temperature in Pitkin County (Chapman Tunnel Station USS0006K46S)

Source: NOAA, 2025b

Figure 11. Annual Precipitation in Inches from 1999-2024 (Aspen Airport Station ID USW00093073)



Source: USDA, 2025

Figure 12. Annual Snow Water Equivalent (SWE) 2005 – 2024 (Independence Pass 542 Station)

Transmountain Diversions

Of particular importance to Pitkin County are transmountain diversions that move water from the west to the east slope of the Continental Divide. The three transmountain diversions in Pitkin County (the **Fryingpan-Arkansas Project, Twin Lakes Project, and Busk-Ivanhoe Tunnel**) divert an average of 40% of Pitkin County's waters each year (Roaring Fork Conservancy, n.d.).

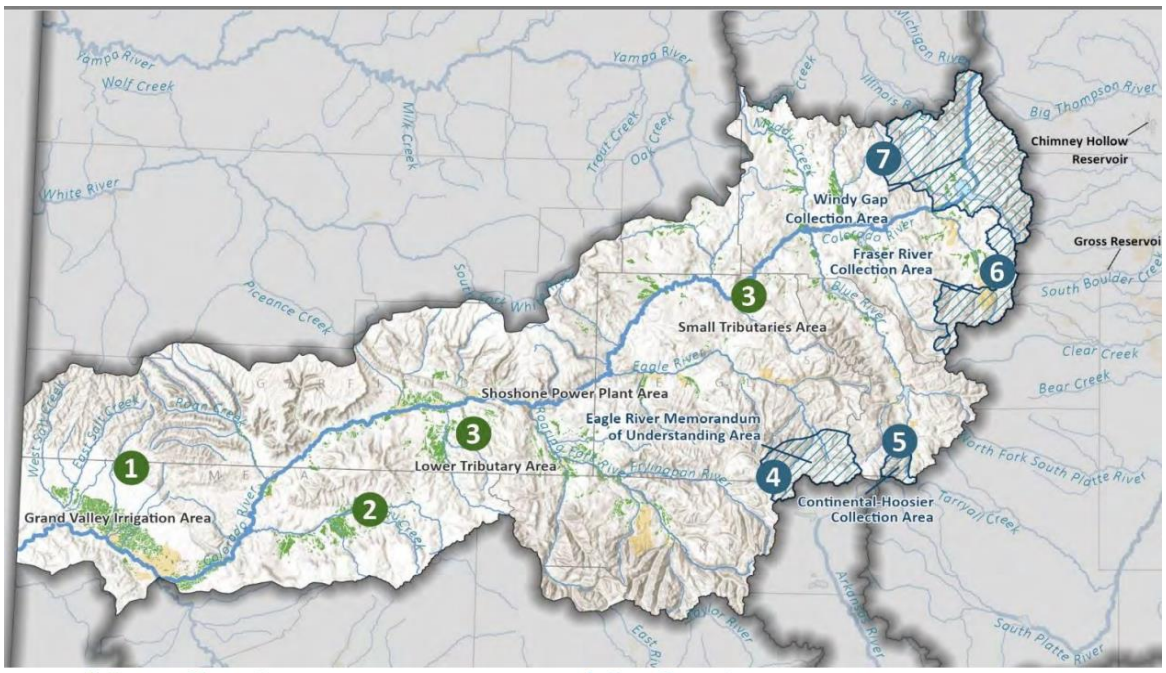
In addition to these three diversions, the Homestake Project crosses through Pitkin County by diverting water from the Eagle River, in Eagle County, to Homestake Reservoir which is in the northeast portion of Pitkin County along the Eagle County border. Water from the Homestake Reservoir moves to Twin Lake Reservoir in Leadville via the Homestake Tunnel.

Within the Colorado River Basin there are four planned additional transmountain diversion projects. These include the expansion of Gross Reservoir, the Windy Gap & Chimney Hallow Reservoir Project, the Continental-Hoosier System Project, and the Eagle River Joint Use Project (respectively located in Boulder, Grand, Summit, Park, and Eagle Counties). These projects aim to improve reliability, flexibility, and increase supply such that water providers can continue to meet the water needs of Front Range communities during droughts and into the future as population increases. While these projects will likely impact water availability throughout the larger Colorado River Basin, Pitkin County is unlikely to be impacted due to its location and the seniority of water rights in the County compared to those new projects (Figure 13) (SGM, 2022). However, those projects are not finalized, and the resulting impacts on Pitkin County may change.

For all these transmountain diversion projects, the total volume diverted in a given year changes due to a complex interplay of multiple factors, including:

- **Infrastructure maintenance and updates:** All transmountain diversions are complex systems with interconnects, tunnels, and pipes that transfer water across the state. As a result, repairs can cause parts of the systems to shut down, impacting the total volume of water diverted.
- **Climate-driven impacts:** Wet versus dry years and the amount of snowpack will impact the amount of water being diverted for all these projects. Years with heavy snowfall may increase diversion volumes due to the availability of water, while drier years may be lower due to diversion rights not being in priority. This can be counterbalanced by demands decreasing in wet years, but increasing in dry years, creating the opposite effect.

- **Water administration and legal requirements:** Each of these projects has specific legal and operational requirements that must be met. Some have annual caps for the amount of water that can be diverted, as well as minimum streamflow requirements that must be met to protect downstream ecosystems.



Potentially Unaffected Areas:

1. Water rights senior to TMDs should not be affected (example: Shoshone Hydroelectric Plant and Grand Valley agricultural water rights).

2. Some tributaries of the Colorado River, such as the Roaring Fork or Divide Creek, should not be affected by the TMDs.

3. Diversion to TMDs will typically occur when streamflow conditions are high and would not impact gaps on smaller tributaries that experience physical shortages.

Potentially Affected Areas:

4. The Eagle River Joint Use Project will deliver 20,000 AF/yr on average for East Slope water users from the upper Eagle River Basin with diversions occurring during average and wet years. The project will provide 10,000 AF/yr of firm yield from the upper Eagle River Basin for West Slope water users in the Eagle River Basin.

5. The Continental-Hoosier System Project will divert, on average, 4,000 AF in average and wet years during spring runoff from the headwaters of the Blue River.

6. The Gross Reservoir Expansion will divert 10,300 AF and 11,800 AF in average and wet years (respectively) during spring runoff from several tributaries to the Fraser River.

7. Adams Tunnel deliveries would increase about 19,100 AF with the Windy Gap Firming Project compared to an increase of about 10,700 AF under the No Action Alternative.

Source: SGM, 2022

Figure 13. Planned Future Transmountain Diversions (TMDs) in the Colorado River Basin

Details about the existing transmountain diversion projects in Pitkin County are provided below.

Fryingpan-Arkansas Project

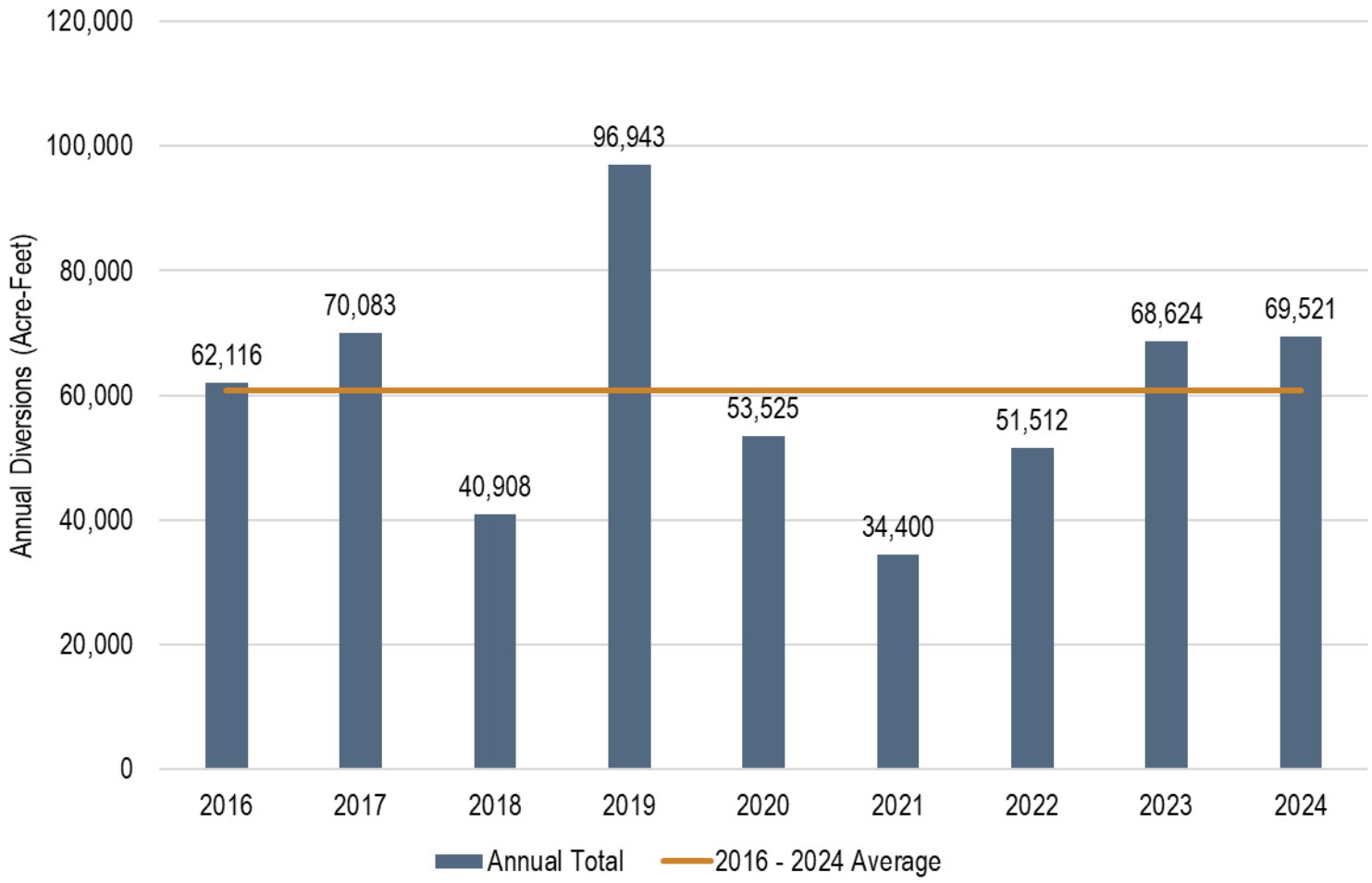
The Fryingpan-Arkansas Project moves water from the Fryingpan River to the Arkansas River Basin. The project is managed by the U.S. Bureau of Reclamation and the Southeastern Colorado Water Conservancy District. Diverted water supports mostly agricultural uses in the Arkansas Basin, as well as municipalities in the Colorado Springs area. The project includes a 5.4-mile tunnel (Boustead Tunnel) that starts at the Ruedi Dam. As part of the project, the Twin Lakes Reservoir was enlarged, and Turquoise Reservoir, Pueblo Reservoir, and Mt. Elbert Power Plant (the largest hydroelectric power plant in Colorado) were created. While construction began in 1965, water was first delivered in 1975 (Water Education Colorado, 2014). Between 2016 and 2024, the average volume diverted was just over 60,000 acre-feet, with the rate of diversion restricted to 900 cubic feet per second and operating principles to divert a maximum of 120,000 acre-feet in any one water year or 69,200 acre-feet annual average over a 34-year period (Figure 14). For this period of record, the two lowest diversion years were 2018 and 2021, both of which had below average snowpack likely contributing to the low diversions. In contrast, 2019 had exceptionally high diversions, potentially due to the above average snowpack (Figure 12).

Twin Lakes Project

The Twin Lakes Project, also called the Independence Pass Transmountain Diversion System, moves water from the Roaring Fork River, Lost Man Creek, Lincoln Creek, Brooklyn Creek, Tabor Creek, New York Creek and Grizzly Creek to the Arkansas River Basin (Roaring Fork Conservancy, 2025). The project is managed by the Twin Lakes Reservoir and Canal Company. Diverted water supports mostly agriculture and municipalities (e.g., Colorado Springs, Pueblo, Aurora). The project diverts water from the Roaring Fork River into Grizzly Reservoir, and over the Continental Divide via the Twin Lakes Tunnel, also called the Independence Pass Tunnel. Water is stored in Twin Lakes, near Leadville, and then released to the Arkansas River and Colorado Canal. The agreement was signed in 1933, and water was first delivered in 1935 (Water Education Colorado, 2014). Between 2016 and 2024, the average volume diverted was just over 36,000 acre-feet; however, the project has rights to divert 46,000 acre-feet a year (Figure 15). For this period of record, the two lowest diversion years were 2018 and 2021, both of which had below average snowpack likely contributing to the low diversions (Figure 12).

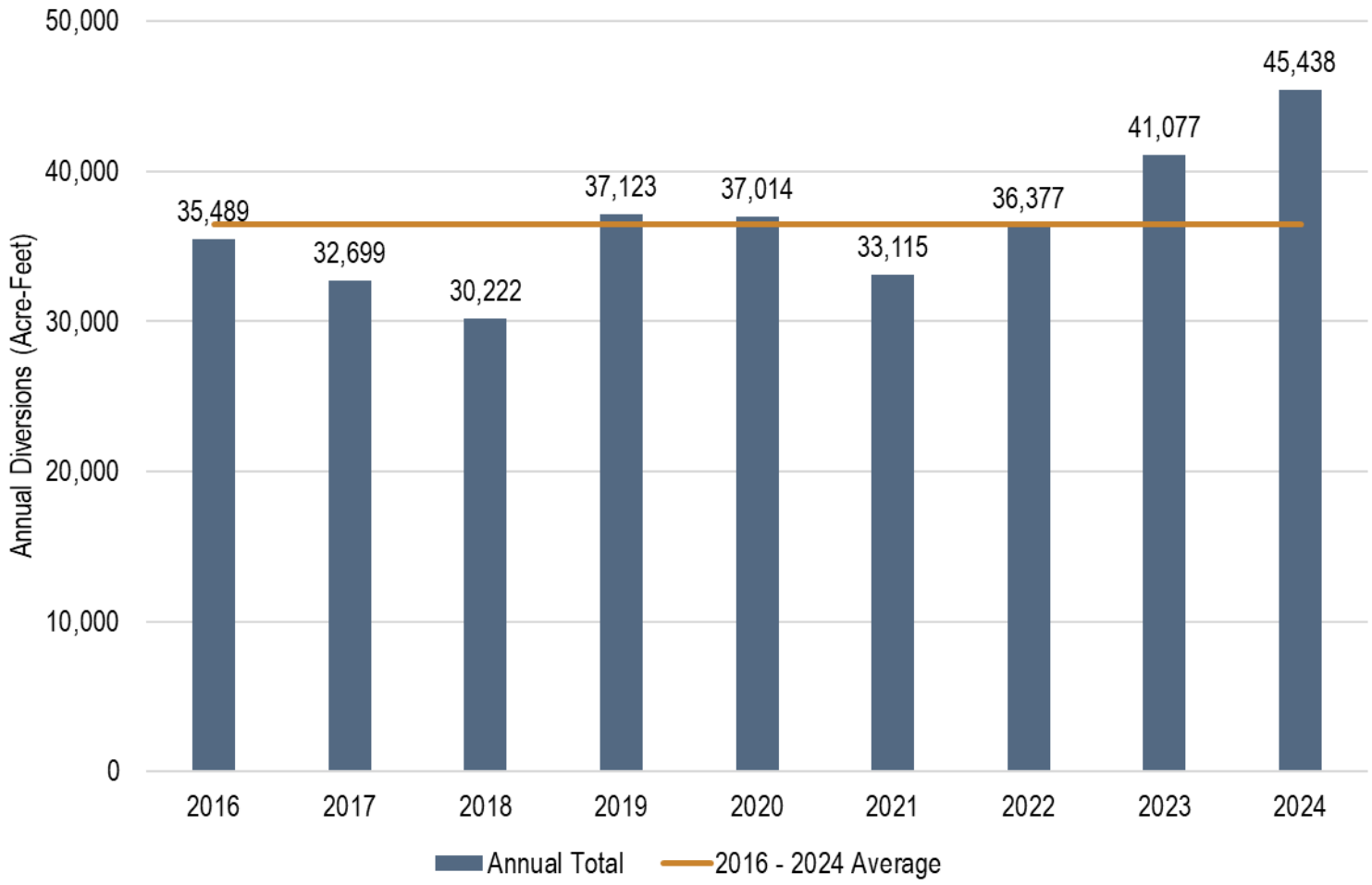
Busk-Ivanhoe Tunnel

Compared to the Fryingpan-Arkansas Project or the Twin Lakes Project, the Busk-Ivanhoe Tunnel is a much smaller transmountain diversion. A historic railroad tunnel, this diversion now supplies water to Aurora and Pueblo by diverting water from Ivanhoe Lake, fed by the Frying Pan River, to Turquoise Reservoir. While historically the tunnel has provided an average of 5,000 acre-feet, between 2016 and 2024, the average volume diverted was just over 3,000 acre-feet (Figure 16). This decrease in diverted volume was due to tunnel collapse that was recently repaired in 2023 (Sackett, 2023).



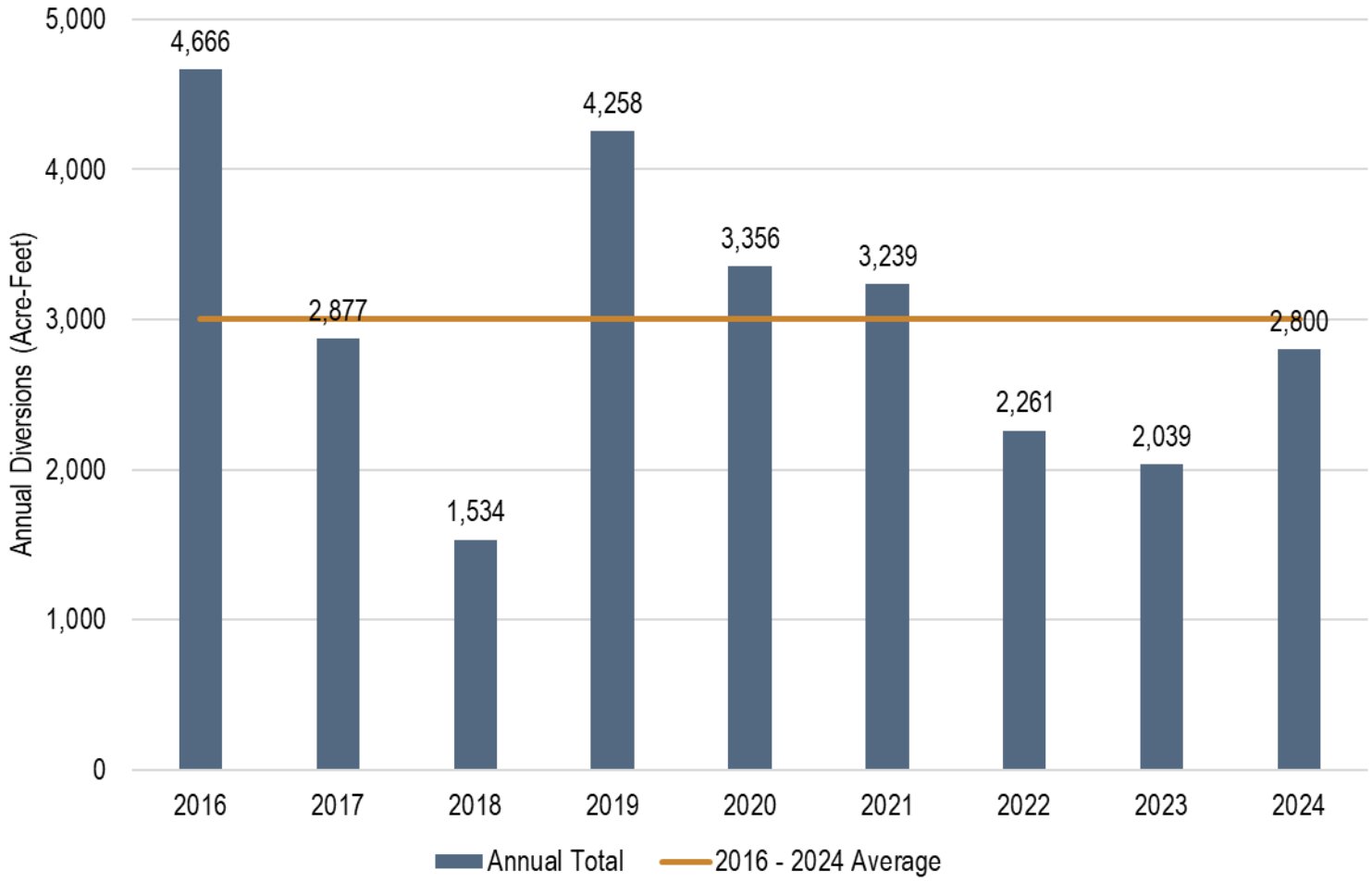
Source: CDNR, 2025e

Figure 14. Annual Diversions, Boustead Tunnel



Source: CDNR, 2025d

Figure 15. Annual Diversions, Twin Lakes Tunnel



Source: CDNR, 2025f

Figure 16. Annual Diversions, Busk-Ivanhoe Tunnel

Groundwater

All new groundwater wells in Colorado are required to have a permit issued by the Colorado Division of Water Resources. The type of well permit required for a groundwater well depends on the location and well type (Water Education Colorado, 2020). At the end of 2024, there were just over 365,000 constructed well permits in Colorado.

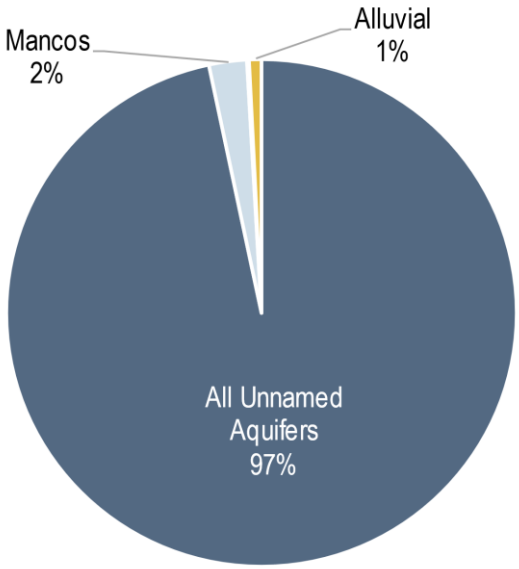
Within Pitkin County, there were **2,306 constructed well permits**, or 0.4% of the State's well permit database as of early 2025. Of these, 74% were for domestic or household purposes, 12% were for monitoring/sampling, and 9% were for mixed use purposes. The remaining 5% of wells were for a variety of uses ranging from commercial to fire. When looking at Pitkin County's domestic well permits over time, there was a high percentage of domestic well permits in the 1970s compared to the 1980s and 1990s. Despite this decrease in the 1980s and 1990s, the percentage of domestic well permits in the 2000s has been over 20% higher than the previous two decades.

Tributary and Non-Tributary Groundwater Wells

Tributary groundwater wells (groundwater that is hydrologically connected to surface streams), are governed by the prior appropriation doctrine and are required to have a water decree and augmentation plan, in addition to well permits (see the Surface Water section for more information). All groundwater is assumed to be tributary unless proven otherwise.

A well permit is required to pump from a non-tributary aquifer; however, unlike surface water or tributary groundwater systems, a water court decree and augmentation plan are not required. Per Colorado's water law, for groundwater to be considered non-tributary, the rate of withdrawal cannot deplete the natural flow of a stream at an annual rate greater than one-tenth of one percent of the annual rate of withdrawal. Groundwater permits are allocated based on overlying land ownership, with permitted volumes calculated using an assumed 100-year aquifer lifespan.

Almost all (over 99%) wells in the County draw from non-tributary sources. More specifically, 97% of the County's wells are permitted as being sourced from an "Unnamed Aquifer" (Figure 17). This description is commonly used for wells located in shallow tributary systems that are not formally a part of a designated aquifer system and/or are associated with an exempt well permit.



Source: CDNR, 2025h

Figure 17. Well Permits by Aquifer Source

Exempt Wells

Wells are either considered “non-exempt” or “exempt.” Exempt wells are small-capacity wells for domestic, stock-watering, and low-intensity commercial uses in less populated regions where other sources of supply are not available (Cech & Jones, *Colorado Water Law for Non-lawyers*, 2009). Exempt wells are typically for individual lots created by exemption and are not permitted in any subdivision platted after June 1, 1972. As a result, exempt wells overlap with the County’s subdivision approval process:

- If a lot is less than 35 acres in size and located in a subdivision, the property may be eligible for an exempt in-house only well permit (see additional detail on household only exempt wells later in this section). If the subdivision was platted prior to June 1, 1972, an exempt in-house well permit may be issued. If the subdivision was platted after June 1, 1972, exempt in-house well permits may not be obtained. Subdivisions platted after June 1, 1972, are required to assess the cumulative impact of all wells within the subdivision (i.e., the combined amount all the wells proposed would

withdraw). This requirement essentially requires the developer to acquire an augmentation plan.

- Lots created by exemption (i.e., not part of the subdivision process) usually qualify for an exempt well permit. If the individual lot created is less than 35 acres, an exempt household well permit is granted. If the lot is over 35 acres, a 35+ acre Exempt Well permit is granted. Importantly, 35+ acre exempt permits can only be used for one well. If the larger area is later divided, the area is still only permitted to have one well.
- In scenarios where an exempt well existed prior to a subdivision or exemption process, but is later developed or divided, two things can occur. If the lot goes through the subdivision process, the exempt status is usually revoked. If the lot goes through the exempt process, the exempt well can keep its status; however, the one well per 35-acre rule still applies to the lot and any neighboring lots. In this scenario, the exempt well is not allowed to supply water to any of the neighboring lots.

Once permitted, exempt wells are not subject to any additional administration, provided they withdraw water in accordance with the uses outlined on their permit. While they use comparatively small amounts of water (usually 15 gallons per minute), exempt wells may have unintended consequences on the overall region and systems when they are grouped in large numbers because they do not have to meet other administrative requirements typical for non-exempt wells.

Of Pitkin County's constructed wells, **1,430 (62%) are small capacity or exempt wells** (CDNR, 2025h). Of these exempt wells, 549 (38%) are located in subdivisions. This is relatively high compared to other areas in the state and reflective of the County's development patterns and more rural systems (Figure 18). Of the exempt wells, the majority fall into one of two permitted use categories:

- **Household Only Exempt Wells**: These are exempt wells that are limited to typical household uses (e.g., washing, bathroom use, etc.), and do not allow any outside water use for irrigation or livestock watering. Most household only exempt wells are only available if:
    - The parcel of land is less than 35 acres, with no other source of water supply, and is not included in a court approved augmentation plan, and
    - The parcel was created by exemption from a traditional subdivision process, or
    - The parcel is located in a subdivision that was created prior to June 1, 1972.

Across all of Pitkin County's wells (i.e., exempt + non-exempt), 20% of all wells are household-only exempt wells. Looking at the percentage of exempt wells that are permitted for household use, 32% of the exempt wells in the County are household only exempt wells (CDNR, 2025h).

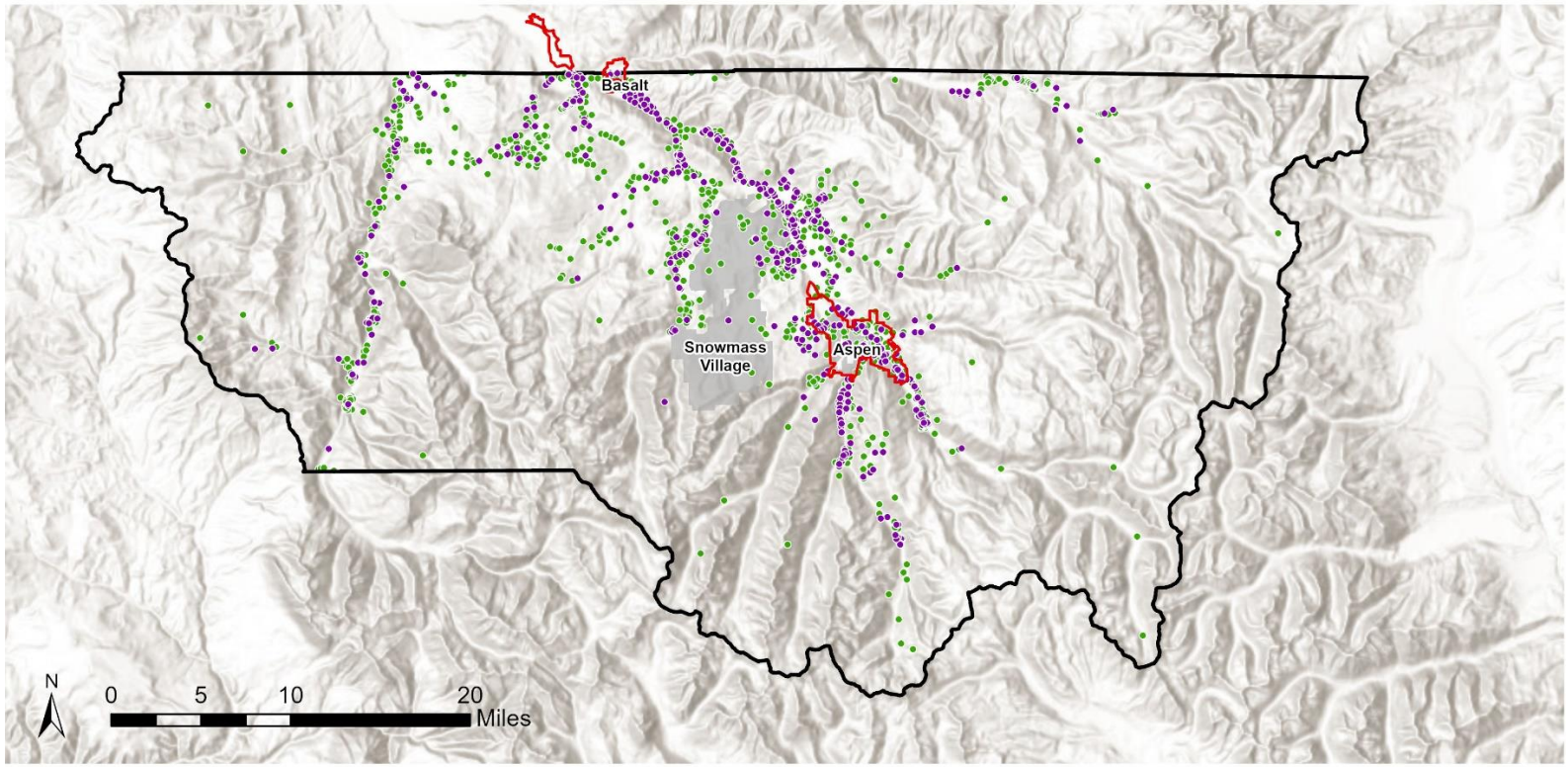
- **Domestic Use Exempt Wells**: These are exempt wells that are limited to typical household uses and limited outside water use for lawn/garden irrigation and livestock watering. Unlike household wells, domestic wells can serve up to three single-family dwelling units. Most domestic well permits are only available if:
    - The parcel of land is 35 acres or larger and is not included in a court approved augmentation plan, and
    - The well will be the only exempt well on the 35 acre or more portion of the parcel.

  Across all of Pitkin County's wells (i.e., exempt + non-exempt), 33% of wells are domestic-use exempt wells. Looking at the percentage of exempt wells that are permitted for domestic use, 54% of exempt wells in the County are domestic use exempt wells (CDNR, 2025h).

In addition, there are **commercial exempt wells.** These wells are limited to light commercial use, and pumping cannot exceed 108,600 gallons per year. While there is no parcel size limitation, higher water use commercial applications, such as breweries, horse-boarding, and commercial businesses with outside use, do not qualify for commercial exempt well permits. Within Pitkin County with just 9 commercial exempt wells (CDNR, 2025h; see Figure 19).

Since March 1992, the State has allowed small capacity **monitoring/sampling** wells to be classified as exempt wells. Monitoring wells are used for locating water, pump or aquifer testing, monitoring groundwater, or collecting water quality samples. Within Pitkin County there are 104 monitoring/sampling exempt wells (CDNR, 2025h; see Figure 19).

Pitkin County Exempt and Non-Exempt Wells



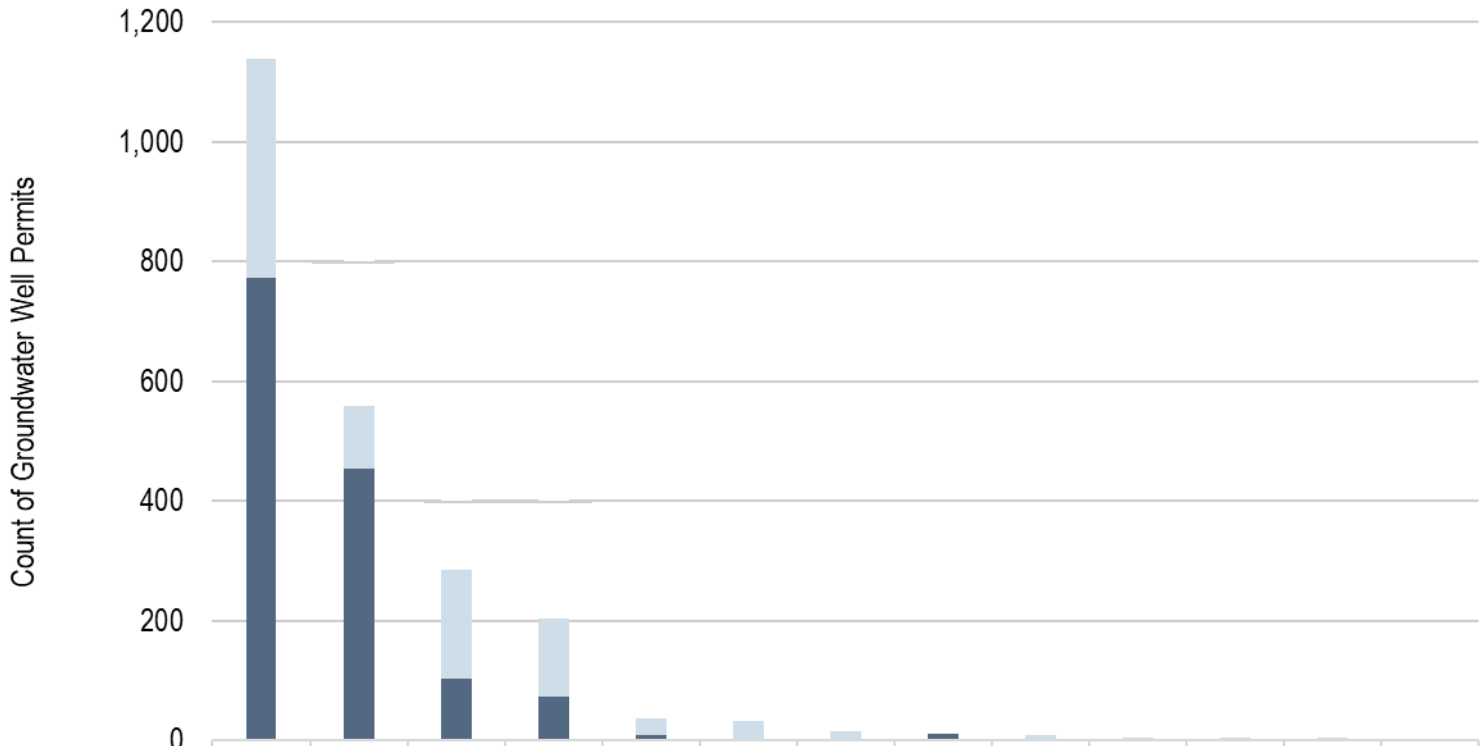
PITKIN COUNTY

Legend

- Pitkin County Boundary
- Urban Growth Boundary
- Pitkin County Cities
- Exempt Wells
- Non-Exempt Wells

Sources: Esri, CGIAR, USGS

Figure 18. Exempt Wells in Pitkin County



	Domestic	Household use only	Monitoring/Sampling	Mixed Use	Commercial	Other	Municipal	Stock	Irrigation	Unknown	Dewatering	Industrial	Fire
Total	1,138	559	286	203	36	32	15	11	10	5	4	4	3
Non-Exempt Wells	366	105	182	129	27	30	15	0	9	5	4	4	0
Exempt Wells	772	454	104	74	9	2	0	11	1	0	0	0	3

Source: CDNR, 2025h

Figure 19. Groundwater Wells in Pitkin County by Well Permit Type

Non-Exempt Wells

Non-exempt wells are subject to water rights priority system administration due to their scale (e.g., subdivisions, irrigated agriculture, most commercial applications, and municipalities). They are subject to augmentation plan requirements to ensure that water remains available to downstream users. Any well that is not exempt (see Exempt Wells section) is considered non-exempt. In Pitkin County, 38% of the 2,306 wells are non-exempt (CDNR, 2025h). Of these, the majority serve domestic and household uses; however, unlike the exempt wells, these properties are either part of a subdivision or did not meet the requirements of an exempt well and therefore had to go through the non-exempt well process (Figure 19).

Augmentation Plans

All non-exempt wells are required to have an augmentation plan. Augmentation plans allow tributary groundwater well users to replace or "augment" surface water that is depleted due to tributary groundwater well pumping so that the well users can pump even when they are not in priority (Water Education Colorado, 2020). Plans are approved in water court and applications must demonstrate where, when, and how water will be used; how much augmentation water is needed to account for the well pumping; and include an engineering analysis demonstrating that senior water rights will not be affected by the well's use (Colorado Division of Water Resources, 2020). Replacement sources of water include irrigation water rights that have been changed to augmentation use, releases from water storage areas, transbasin diversions, and water diverted from infiltration ponds (Water Education Colorado, 2020). Importantly, not all plans provide replacement water at the source of depletion impacting instream flows.

Within Pitkin County, there are 175 records associated with augmentation plans (CDNR, 2024a). Of these, only seven are active (Table 3). More information on each can be found on the State's website. In the future, the larger Roaring Fork region, and therefore Pitkin County, will depend heavily on augmentation water for new development and redevelopment. Many water providers in the region hold junior water rights that will need augmentation water. Basalt Water Conservancy District and the Colorado River Water Conservation District both have water holdings in Ruedi Reservoir to provide augmentation water for future growth (SGM, 2022).

Table 3. Active Augmentation Plans in Pitkin County

WDID	Structure Name	More Information
1107065	ECHO POND AUG PLAN	https://dwr.state.co.us/Tools/Structures/1107065

WDID	Structure Name	More Information
1107086	ECHO POND AUG PLAN II	https://dwr.state.co.us/Tools/Structures/1107086
3807058	ASPEN PRESERVE EXCHANGE	https://dwr.state.co.us/Tools/Structures/3807058
3807067	RUSSELL AUG PLAN	https://dwr.state.co.us/Tools/Structures/3807067
3807093	SUNNY RANCH AUG PLAN	https://dwr.state.co.us/Tools/Structures/3807093
3807501	PATAK RANCH AUG PLAN	https://dwr.state.co.us/Tools/Structures/3807501
3807522 3807331	SMITH/HYDE AUG PLAN	https://dwr.state.co.us/Tools/Structures/3807522
3807331	BASALT WATER CONSERVANCY DISTRICT AUG PLAN	https://dwr.state.co.us/Tools/Structures/3807331

Source: (CDNR, 2024a)

Basalt Water Conservancy District

The Basalt Water Conservancy District (the District) was established in 1963. The District holds a variety of water rights, including storage rights for Ruedi Reservoir and Green Mountain Reservoir, which allow the District to contract with users throughout Pitkin County to provide augmentation water without going through water court. The District is the largest provider of augmentation water in the County and, as a result, plays an important role in supporting future development in the County, which will depend on augmentation water to secure additional water rights.

Within the District there are two defined service areas – "Area A" and "Area B."

- **Area A:** Includes areas along the Fryingpan and Roaring Fork Rivers or tributary creeks that have sufficient water flows to satisfy the requirements of all downstream water rights on those creeks. Area A contracts may qualify for inclusion within the Districts "Umbrella Plan," decreed in 02CW77, which allows contractees to receive augmentation water from the district without going to water court.
- **Area B:** Includes areas where contracted water use may affect downstream water rights. Examples of these streams include Cattle Creek, Snowmass Creek, and Wood Creek. In Area B, contractees must obtain an Individual Augmentation Plan, approved by a water court, to benefit from the District's water rights. The plan may

Water Demand Overview

This section summarizes public, self-supplied, and agricultural water systems and estimates the baseline and future water demand for each.

Ground and surface water are provided to residents, agriculture, and businesses by a combination of the following:

- **Public water systems:** Centralized utilities that deliver water to customers, which typically are residents and businesses. Public water systems must report to the Colorado Department of Health and Environment (CDPHE), and all drinking water standards must comply with the Safe Drinking Water Act. Almost all public water systems in Pitkin County receive their water via tributary wells that require augmentation plans.
- **Self-supplied users:** Residents, businesses, and agricultural users that are not connected to a public water system. In Pitkin County, most self-supplied users rely on tributary groundwater wells, though some may also purchase water from private water haulers/trucks or receive water from an irrigation/ditch company. Self-supplied water must be treated to the water quality standards associated with the water's use. For example, households that rely on wells for indoor use often chlorinate the water retrieved from their groundwater wells, at a minimum.

While the population receives water from one of these two sources, there are two main factors that influence how much water is used:

- **Land use and development patterns:** Pitkin County's land use planning targets urban-level growth and development in Aspen, Snowmass Village, and Basalt. Outside of these areas, land uses in the unincorporated portions of Pitkin County are predominantly single-family residential homes and large swaths of rural and wilderness areas (Pitkin County Staff and Planning Team, 2022). Over time, limited new development in the County is expected, along with continued intensification/redevelopment of existing development.

  In 2020, 40% of building permits issued in unincorporated Pitkin County were associated with a remodel or addition. Over the past five years this has steadily increased, with 69% of issued permits classified as "remodel" or "redevelopment." This increase is significant because Pitkin County housing units tend to have large square footages, with higher-than-average water-using fixtures per dwelling unit.

Brendle Group's analysis of Pitkin County residential property records shows an average of 3.8 bathrooms per residential dwelling unit, an average which has increased steadily from 2.6 bathrooms per dwelling unit for units constructed in 1970 to 5.25 for units constructed in 2023. If this type of water-intensive development continues, domestic demand will continue to rise as large properties are renovated with increasingly water-intensive features (for example, many properties are adding exterior pools/spas/water features and interior steam rooms, humidification systems, additional showers, and more). However, the extent of future water demand will dependend on both the amount and type of redevelopment. For example, if renovations replace like-water use for like-water use the net impact will be negligible; however, if the number of water fixtures and features increase demands could increase significantly.

- **Climate change:** As discussed above, over the past 30 years, weather conditions have been changing in ways that reduce water availability (NOAA Regional Climate Centers, 2022). Between 2008 and 2024, the average maximum daily temperature in Pitkin County increased by 1.5°F (Figure 10). Rising temperatures contribute to longer growing seasons and higher evapotranspiration demands, both of which increase irrigation water demands. Higher temperatures also result in a higher proportion of precipitation falling as rain instead of snow, which reduces the duration of the runoff season and impacts water supply.

  Precipitation patterns in Pitkin County are more variable and do not show a distinct increase or decrease in annual precipitation totals over the past 26 years (Figure 11). This is consistent with state modeling, which shows unclear projections for precipitation patterns and totals. Despite this variability in precipitation totals, models show that even moderate increases in precipitation are not enough to overcome the impacts of increased temperatures (Colorado Water Conservation

Irrigation and Ditch Companies

Irrigation and ditch companies sell non-potable (raw) water to their customers. These are typically public water systems, farmers, ranchers, or large industrial customers. Ditch companies are regulated under C.R.S. 7-42- 101. The number of irrigation and ditch companies per county varies significantly across the state, with regions historically dependent on irrigated agriculture generally having a higher concentration. There are 137 named ditches throughout the County, in addition to various unnamed ditches (see Figure 20). The majority of Pitkin County's irrigation and ditches are managed by the City

Board, 2023). Like all of Colorado, Pitkin County will need to plan for these impacts, especially as it relates to water availability.

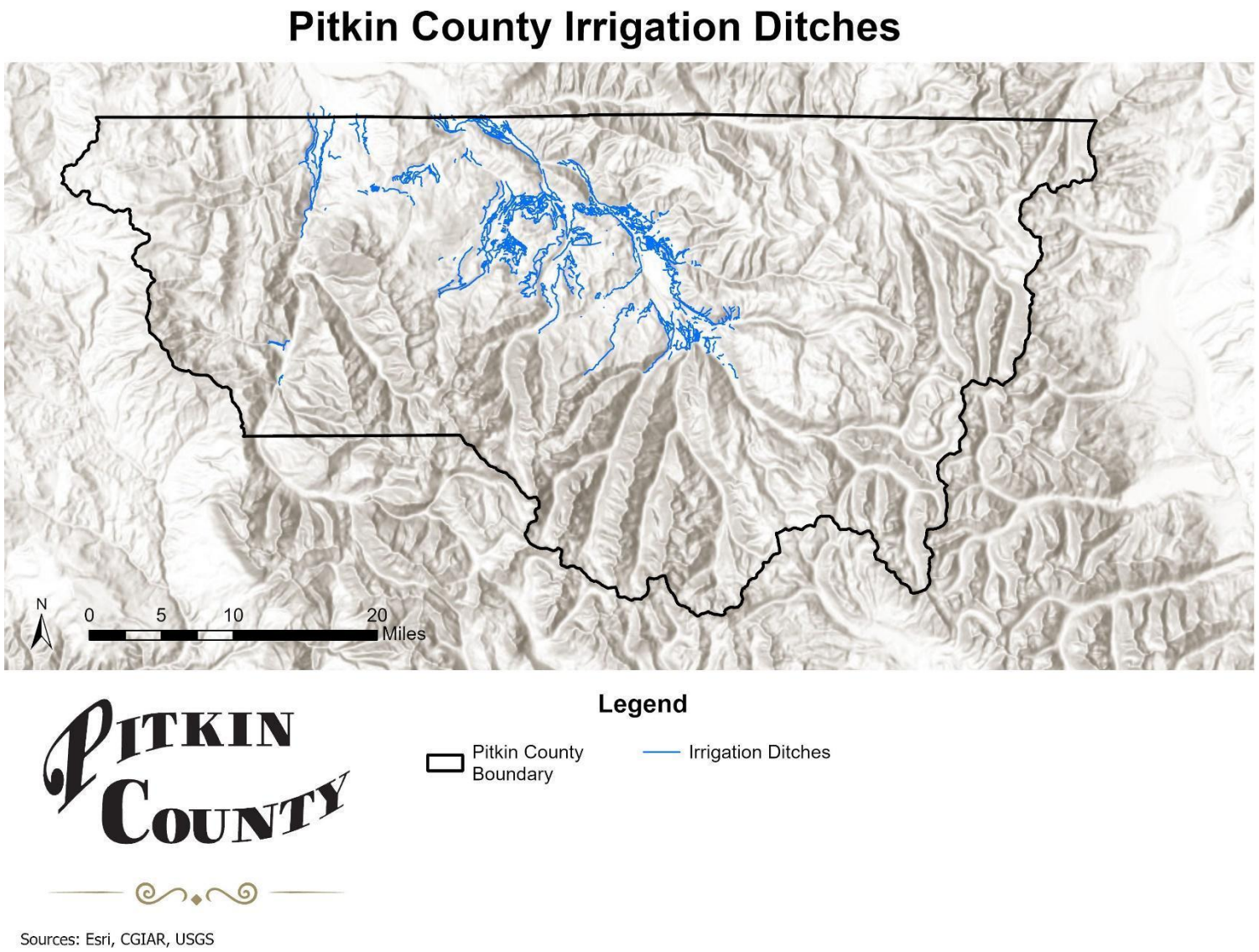


Figure 20. Irrigation Ditches in Pitkin County

Public Water Systems

The CDPHE Water Quality Control Division (WQCD) is Colorado's regulatory body responsible for water monitoring, pollution prevention, and safe drinking water. As such, the WQCD maintains a public water system database for the State of Colorado. As of 2025, there are 2,186 public water systems in Colorado (CDPHE, 2025). In Pitkin County, the database includes 50 public water systems (PWS). These systems serve the public but are not necessarily publicly owned. Of the 64 counties in Colorado, Pitkin County ranks 15th for the greatest number of public water systems in the state.

CDPHE classifies public water systems into one of three groups: community, non-transient/non-community, and transient/non-community. A breakdown of the 50 systems in Pitkin County is summarized in Table 4.

Table 4. Public Water Systems in Pitkin County

Public Water System Type	Description	Number in Pitkin County	Number of Service Connections
Community	Supplies water to the same population year-round (e.g., water providers, metro districts, mobile home parks)	27	6,278
Non-transient, non-community	Regularly serves at least 25 people at least 6 months of the year (e.g., schools)	4	164
Transient, non-community	Serves at least 25 people or 15 connections, open at least 60 days a year but population is characterized as flow-through traffic (e.g., campgrounds, ski areas)	19	41

Figure 21 shows Pitkin County's public water systems (i.e., water providers). Community-based systems supply water to the majority of Pitkin County residents, and as such, are important from a water planning perspective.

Of the 31 public water systems that provide water year-round (i.e., community or non-transient, non-community), three fall within municipal Urban Growth Boundaries (UGBs) and 28 fall outside UGBs. The public water systems located outside of the UGB tend to be

much smaller. On average they have 46 service connections per system and provide water to an average of 2,000 people.

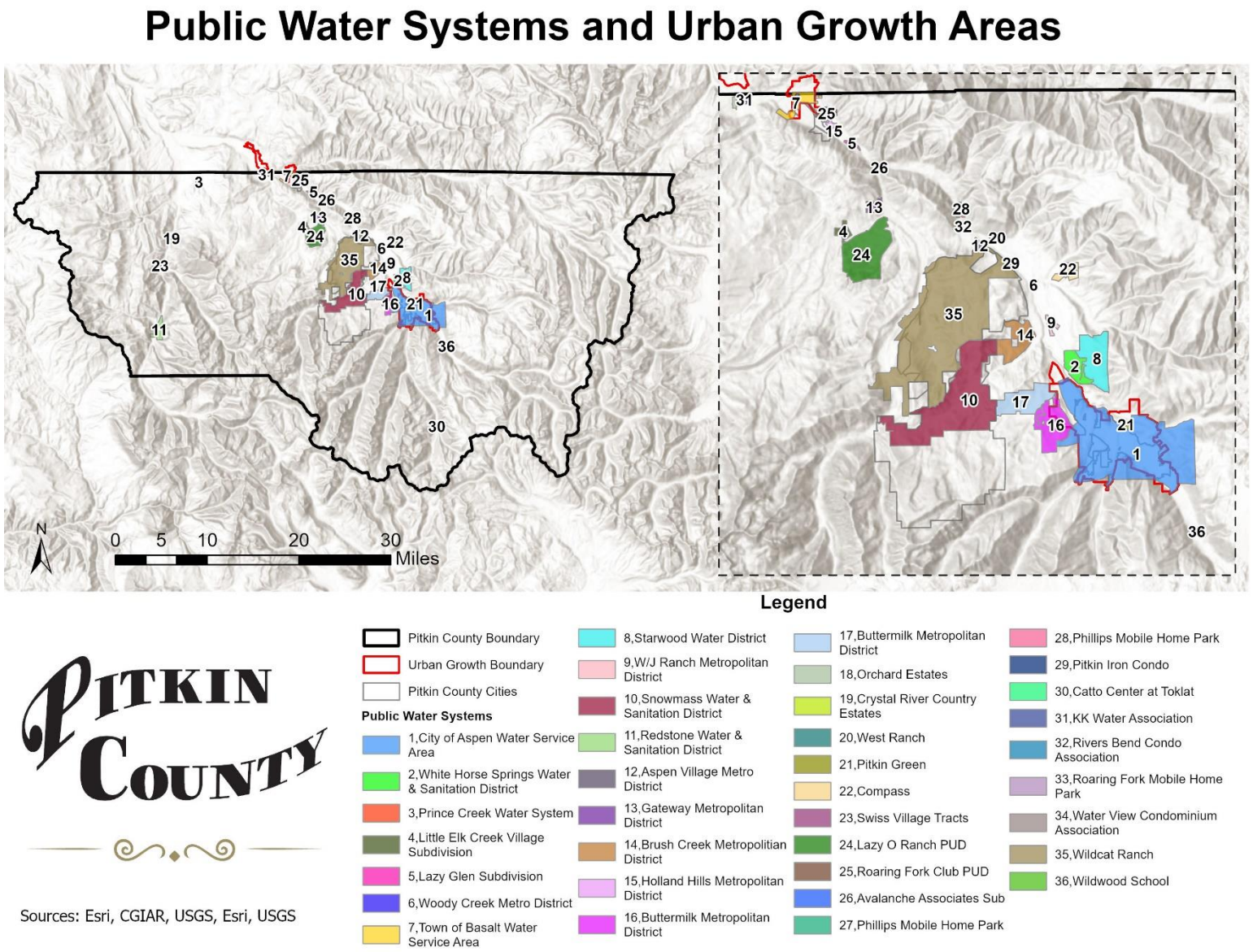


Figure 21. Water Providers in Pitkin County

This dichotomy between large and small providers is important for Pitkin County because the challenges and resources to support them are different. As part of the research for this report, a survey was distributed to all public water systems in the County. Of the 50 public water systems in Pitkin County, 19 responded to the survey. Of these 19, 10 represented systems that provide water year-round (i.e., community or non-transient, non-community). While overall a low percentage of total providers responded, the 10 year-round water providers who responded provide water to 69% of the County's population. Those who did not respond are smaller providers, many run by homeowners' associations (HOAs), with fewer resources who may have lacked staffing capacity to respond to the survey.

Of the respondents, most year-round water providers (90%) indicated they had "sufficient" current water supplies (Figure 22) indicating they are not concerned about water supply to meet current demand. However, 50% indicated they only had "somewhat sufficient" or "insufficient" future infrastructure (Figure 23), and 40% indicated that they had "somewhat sufficient" to "insufficient" future financial means (Figure 24), suggesting that they may have concerns about future water reliability or their ability to serve in the future. **Providers that indicated they had insufficient infrastructure or financial means tended to be smaller providers and metro districts serving individual HOAs.** It is not a stretch to assume that other small providers, who did not respond to the survey, may be facing similar, if not more severe, situations within the County. This is also consistent with other regions in Colorado, where it is common to find that smaller, more rural water providers are facing capacity and infrastructure challenges due to resource limitations.

These smaller systems are also almost entirely reliant on tributary groundwater and augmentation plans. Of the 31 community systems:

- 2 purchase water from a wholesale provider
- 3 receive water from surface water sources
- 19 receive water from a non-exempt tributary well

The remaining providers did not have clear records of their source; however, they are very small (average service population of 50 people). Given their age and locations, it is likely they receive water from tributary groundwater wells.

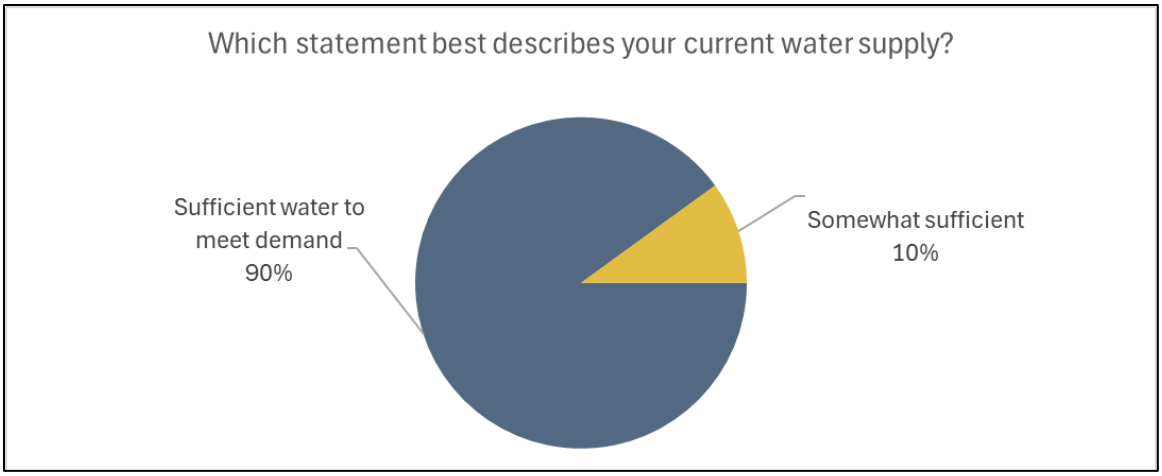


Figure 22. Water Provider Survey Results to Question About Current Water Supply

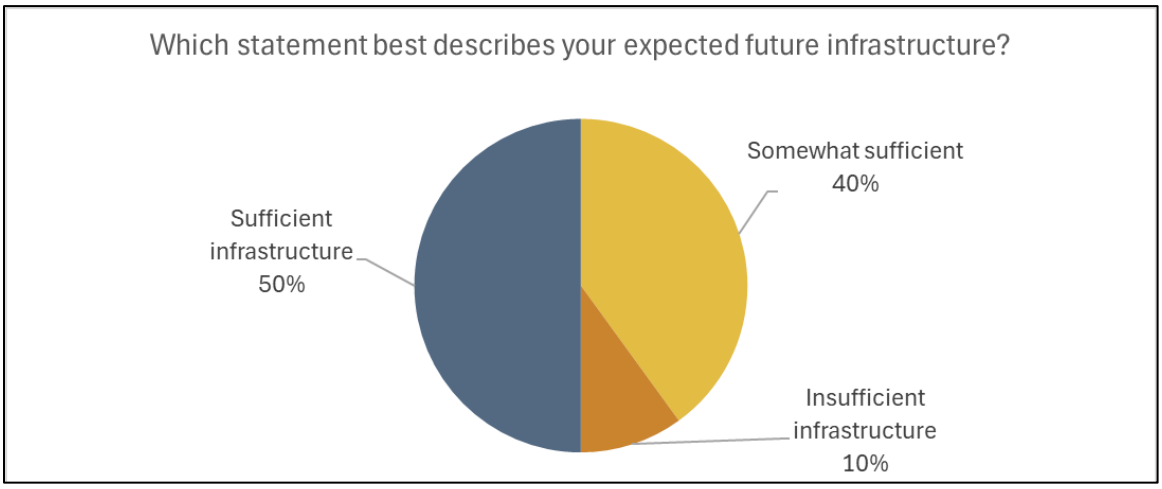


Figure 23. Water Provider Survey Results to Question About Expected Future Infrastructure

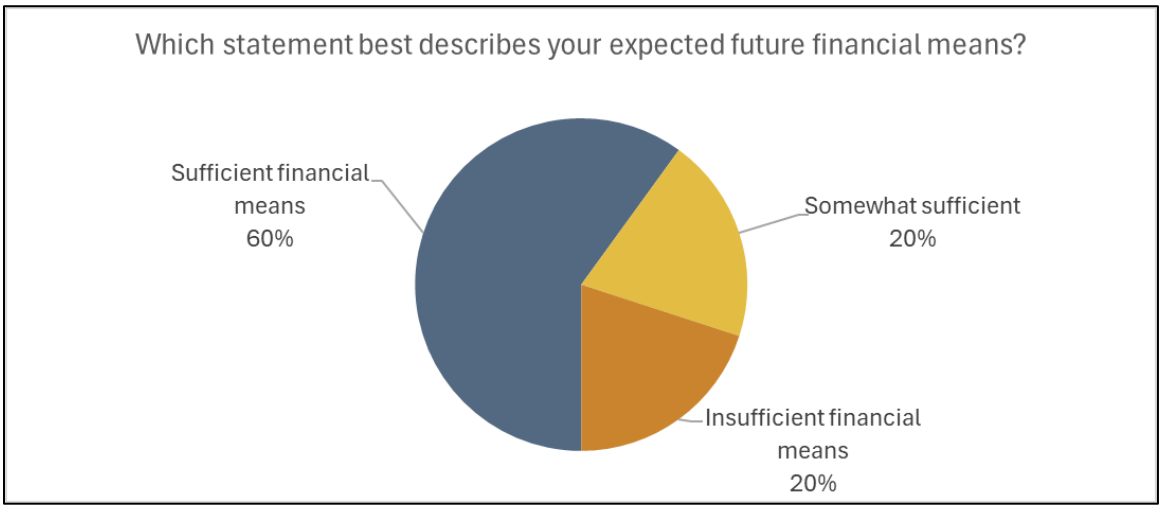


Figure 24. Water Provider Survey Results to Question About Expected Future Financial Means

Public Water Systems Baseline Demands

To estimate baseline demands, Brendle Group combined data collected via the survey with a land use-based approach of estimating water demands based on property assessment classification (e.g., residential vs. commercial). For areas served by a water provider who responded to the survey, demands were assumed to equal the water use reported in the survey. For remaining areas of the County (areas served by a water provider who did not respond to the survey), land use data informed water demand estimates. Specifically, a spatial GIS analysis was carried out in which Pitkin County parcel records were joined with water provider boundaries and well location data, to identify areas served by providers, wells, and their associated land use types. In the appropriate water provider areas, a water use factor was applied based on the land use type (e.g., residential, non-residential, etc.) to estimate water demands.

Public water systems across Pitkin County provide water to roughly 82% of the County's population. While public water systems provide water to most of the County's population, they only cover roughly 5% of the County's land by area. Water providers who responded to the survey reported a combined total use of 11,800 acre-feet of water. This estimate includes potable and non-potable water demands. Remaining public water systems are estimated to use 1,200 to 3,400 acre-feet of water.

Collectively, public water systems provide an estimated 13,000 to 15,200 acre-feet of water per year. While this is an informed estimate that pulls from a variety of data sources, it is important to note that there is some inherent uncertainty associated with estimating demands. Additionally, the range reflects climate variations that cause increases and decreases in water use, particularly due to the volume of water applied for irrigation. In hot and dry years, more water is applied to irrigation than others. For example, the City of Aspen's Water Efficiency Plan highlights that between 2012 and 2019 the total outdoor use for single-family residential accounts averaged 64% of total outdoor water use, with peaks of 67% of total water use in 2017 and 2019 (Element Water Consulting, 2023).

Domestic Self-Supplied Users

Within Pitkin County, domestic self-supplied users most commonly receive water from an exempt tributary groundwater well. Across all of Pitkin County's wells, 74% (1,697) provide water for domestic or household use. Of these wells that provide water for domestic purposes, the majority (72%) of them are exempt.

Compared to households served by a public water system, self-supplied users are at higher risk for reliability issues. Because households are dependent on a single well, there is a lack of redundancy and back-up supply, which increases their vulnerability to changes in water levels due to drawdown, seasonal fluctuation, and climate change. In addition, private wells can be at greater risk for water quality issues, as they are not subject to the same water quality standards as public water systems. Users who receive water from an exempt well are responsible for their own water quality monitoring; therefore, they bear greater risk for water quality issues, since they are not as closely monitored as non-exempt wells.

Domestic Self-Supplied Users Baseline Demands

To estimate baseline demands, Brendle Group used a similar approach to the methodology for public water systems who did not respond to the survey. Using GIS, areas outside of a public water system boundary with one or more structures (per property records) were assumed to be self-supplied users served by a well. A spatial join of self-supplied properties with Department of Water Resource well permit data led to a count of wells by beneficial use type by property. Water use factors were then applied based on land use type to estimate demands.

Self-supplied users across Pitkin County provide water to roughly 18% of the County's total population. It is estimated that these providers cover roughly 6% of the County by land area, highlighting that these users may be on larger parcels than homes that are served by public water systems. **Collectively, these self-supplied users are estimated to use between 1,100 to 3,200 acre-feet of water per year.**

Like the public water systems, while this is an educated estimate that pulls from a variety of data sources, it is important to note there is some inherent uncertainty associated with estimating demands. Additionally, year to year there will be fluctuations in water use, most likely due to changing irrigation patterns from climate variations.

Agricultural Users

Agricultural users often receive water via a well or a ditch. As of the 2022 Agricultural Census, there were 116 farms within Pitkin County that covered 36,630 acres (6% of the County's total acreage). Compared to other counties in Colorado, Pitkin County is a relatively low agricultural producer, ranking 53 of Colorado's 63 counties (USDA, 2022).

According to the Colorado Decision Support System, close to 11,700 acres of agricultural land in Pitkin County were irrigated as of 2020 (Colorado Department of Water Resources, 2025). The Department of Natural Resources (DNR) manages this dataset, and as a result, it

varies slightly from Agricultural Census information. DNR identifies irrigated lands through a combination of remote sensing techniques to process satellite imagery and parcel information. This information is then cross-checked against well and historical diversion record data to verify irrigation applications. Given this report's focus on water use in Colorado, DNR data was leveraged, as opposed to the Agricultural Census, to complete the analyses. DNR groups irrigated lands by the following crop types:[3]

- Alfalfa
- Grass Pasture
- Orchard without Grass Cover
- Bluegrass
- Small Grains

Of Pitkin County's 11,700 acres of irrigated land, the majority (60%) of the land is grass pasture, followed by alfalfa (36%). Of the irrigated lands, 54% are irrigated via flood irrigation and 41% are irrigated by sprinkler systems, with 6% of the irrigated lands having no known form of an irrigation system (Figure 25).

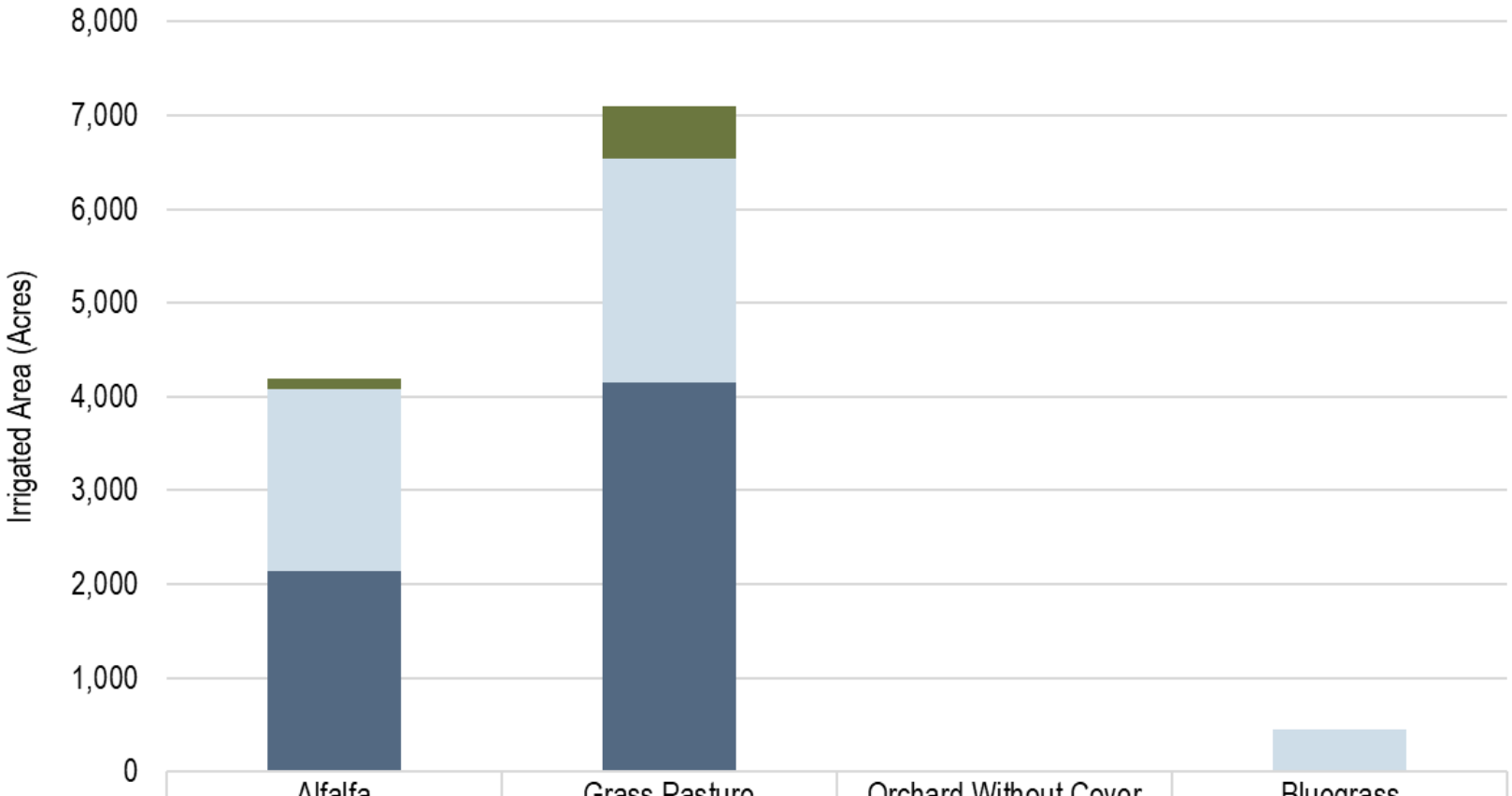
Interestingly, compared to irrigated land in 2000, the total irrigated acres and the ratio of flood to sprinkler systems have remained roughly the same. However, there has been a notable shift from grass pasture to alfalfa (Table 5). Between 2000 and 2020, the acres of agricultural land dedicated to alfalfa increased by over 5,000%. Even if mixed in with other grasses, this shift is significant from a water use perspective because alfalfa has a higher supplemental irrigation requirement.

Table 5. 2000 versus 2020 Irrigated Lands in Pitkin County

Crop Type	2000 Total Acres	2020 Total Acres
Alfalfa	78	4,191
Grass Pasture	11,260	7,094
Orchard without Grass Cover	2	9
Bluegrass	405	448
Small Grains	21	0
Total	**11,766**	**11,742**

Data source: CDNR, 2025g

[3] For the purposes of this analysis, alfalfa and grass pasture are assumed to be separate categories to mirror DNR data and processes; however, it is recognized that in reality, a percentage of the fields in Pitkin County may contain a mixture of grass and alfalfa.



	Alfalfa	Grass Pasture	Orchard Without Cover	Bluegrass
Unknown	103	552	0	0
Sprinkler	1,952	2,390	7	448
Flood	2,136	4,152	2	0

Source: CDNR, 2025g

Figure 25. 2020 Pitkin County Irrigated Lands by Irrigation Type

Agricultural Demands

To estimate baseline demands, Brendle Group used the Colorado Consumptive Use Model (StateCU). Developed by Department of Water Resources, the model was designed to estimate crop consumptive use throughout the state (DWR, 2012). Using this model, a water supply analysis was completed that takes into consideration crop irrigation water requirements based on the State's 2020 irrigated lands dataset for Pitkin County.

Based on the StateCU model and historic weather data, **these agricultural lands are predicted to need an average of 19,900 to 24,500 acre-feet of water per year.**[4] Compared to demands discussed above, agricultural demands are even more impacted by climate and weather variations due to agricultural water needs being so heavily dependent on a year's weather. As a result, the range of estimated demand for a given year is larger when compared to the Public Water System and Self-Supplied User categories.

Summary

Together, it is estimated that Pitkin County uses approximately 34,000 to 42,900 acre-feet[5] of water annually (Table 6). In hotter, drier years, the use will likely fall on the higher range, while in wetter years it may be closer to the lower range.

Table 6. Summary of Baseline (2025) Water Demands

	Estimated Annual Demand (Low) (Acre-Feet)	Estimated Annual Demand (High) (Acre-Feet)
Public Water Systems	13,000	15,200
Self-Supplied Users	1,100	3,200
Agricultural Users	19,900	24,500
Total	**34,000**	**42,900**

[4] For the purposes of estimating agricultural water demands, the StateCU database has a list of assumptions by crop type. For more information on these assumptions visit: https://opencdss.state.co.us/statedmi/5.0.11/doc-user/introduction/introduction/.

[5] Other water planning efforts across the state have estimated current and future demands for Pitkin County. Estimates presented in this report are based on a land use approach, while other efforts were based on a population approach. While both methodologies are valid, they are rooted in different assumptions that can produce slightly different outcomes. Given Pitkin County's limited future population growth, and the ability to do a more detailed analysis than larger regional efforts, the land use approach is likely more applicable for estimating current and future demands in the County.

Future (2050) Demands

As discussed above, the two primary factors that may affect future demands are related to land use and development patterns, as well as climate change. To estimate future demands, future build-out and redevelopment estimates collected for the County's Vision 2050 Comprehensive Plan process were used to estimate potential increases in water demands. While it is harder to predict climate variability, the results are presented as a range to highlight how demands may increase or decrease depending on changes in irrigation needs and water use patterns. This is particularly important and was taken into account when estimating future agricultural demands. For the analysis, future demands for domestic and non-residential uses were aggregated together, as it was not possible to identify exactly where redevelopment/development would occur. As a result, **the future demands estimate groups together all domestic and non-residential use (e.g., use not associated with agriculture), from either a public water system or a self-supplied system.**

Countywide population projections demonstrate that Pitkin County is not expected to experience significant population growth. Compared to 2025, the State Demographer Office estimates that Pitkin County will see a 3.6% population increase compared to a 25% population increase across the state of Colorado.[6] Increases in future demands for domestic and non-residential demands are **primarily expected to be driven by limited single-family development, as well as redevelopment of existing residential properties, potentially into more water-intensive residential development.**

Based on Pitkin County's 2050 build-out estimates, **new residential development could add an additional 500 to 2,100 acre-feet of demand.** These demands may be higher than expected, if fewer units are built as expected, or if units are developed at a lower water intensity or are very water efficient. These demands may be lower than expected if more development occurs than predicted or if the new development is very water intensive. Given the policy direction to focus new development toward urban and urban-adjacent locations, it is assumed that most of this new demand will be located within existing public water system boundaries.

[6] According to the Colorado State Demographer Office Population Estimates as of September 2024

What is likely to have a larger impact on future water demand is how Pitkin County redevelops its existing building stock. To highlight the potential impacts of these redevelopment scenarios, Table 7 summarizes potential impacts based on three different scenarios: : low, medium, and high redevelopment potential.

The low redevelopment scenario represents the most conservative, yet potentially realistic example of modest intensification of water demands associated with modest amounts of redevelopment. The medium scenario assumes a higher percentage of homes are redeveloped, and that most redevelopment projects result in higher water usage. The high scenario assumes very high intensification, with all redevelopment projects resulting in higher water use. While it is unlikely this scenario would happen, it is illustrative of the potential impact significant redevelopment could have in the County.

Table 7. Redevelopment Potential in Pitkin County[7]

Scenario Description	Resulting Increase in Demand (Acre-Feet)	Resulting Percent Increase in Domestic Demands
Baseline (2025) Demand Estimate	14,100 – 18,400	n/a
Low	15,000 – 22,700	6 – 23%
Medium	17,200 – 27,000	22 – 47%
High	20,100 – 31,400	43 – 71%

As seen in the variation of Table 7, the amount and type of redevelopment can result in widely different increases in potential demands. In the high scenario, demands could almost double, while in the low scenario, demands would stay relatively the same.

Of these three scenarios, it is assumed the low scenario is most likely due to the County not expecting an increase in future population, a desire to prevent development sprawl, and a focus on promoting efficient redevelopment. As a result, for the purposes of the aggregate future demand estimate, the low redevelopment scenario was used to estimate future demands across the entire County (Table 8).

When looking at what will drive future agricultural demands, there are two potential factors – changes in total agricultural land area in the County versus changes in precipitation and temperature. Both the Colorado Water Plan and the Colorado Basin

[7] As discussed above, each scenario is presented as a range to reflect the inherent uncertainty in modeling demands, as well as climate and redevelopment impacts. As a result, range of each scenario presented in this table have some overlap.

Implementation Plan cite an expected decrease in agricultural lands across the larger Colorado Basin region (Colorado Water Conservation Board, 2023; SGM, 2022). The Colorado Water Plan predicts that across the entire Colorado Basin over 14,000 acres of irrigated land is expected to be urbanized; however, almost a third of this is expected to occur outside of Pitkin County in the Grand Valley Project and Grand Valley Irrigation Company Service locations (Colorado Water Conservation Board, 2023; SGM, 2022). While reductions in irrigated agricultural land would decrease overall irrigation demand associated with agriculture, changes to precipitation and temperature patterns will likely increase demand, potentially counterbalancing the reduction.

Interestingly, compared to this regional trend, Pitkin County has not seen a large decrease in irrigated agricultural land (Table 5). Additionally, Pitkin County's existing and proposed land use policies and programs support maintaining agricultural lands and emphasize rural preservation to support open space, working lands, and sustainable agriculture. As a result, the future demand analysis did not assume a large decrease in agricultural lands in Pitkin County. Instead, to reflect historical patterns, the future demand estimate reflects a shift to more alfalfa or a mix of alfalfa and grass, as well as adjustments to reflect increased water demand due to changes in temperature and precipitation. These assumptions were aligned with the Hot Growth Scenario of the Colorado Water Plan, which assumes increased agricultural demand due to a hot and dry future. With these parameters in mind, **it is expected that future Pitkin County agricultural demand will be between 22,100 to 28,000 acre-feet in 2050.** Actual demand may be lower than expected if agricultural technology becomes more efficient, more agricultural land is urbanized than expected, or future temperature and precipitation patterns do not call for as much supplemental irrigation use. Actual demand may be higher than expected if land shifts to higher water using crops or temperature and precipitation patterns call for more than expected supplemental irrigation

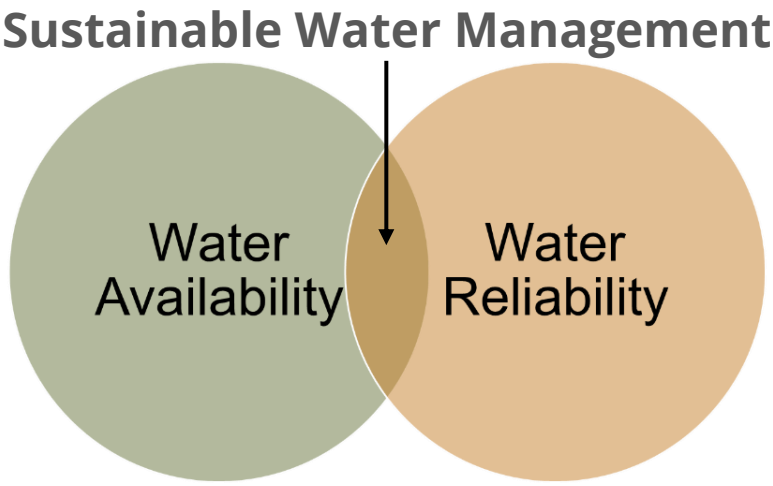
When combining the domestic, non-residential, and agricultural demand estimates together, **Pitkin County may experience a 9 to 18% increase in total water use by 2050,** assuming the low redevelopment scenario (Table 8). As described above, County development and redevelopment, as well as climate change and weather patterns, will influence where Pitkin County falls within this range. Overall, it is expected that Pitkin County will have sufficient supplies to meet this demand.

Table 8. Baseline and Future Demand Estimates

	Baseline (2025) Demand Estimate	Future (2050) Demand Estimates	Percent Change
Domestic and Non-Residential Demands	14,100 – 18,400	15,000 – 22,700	6%-61%
Agricultural Demands	19,900 – 24,500	22,100 – 28,000	11%-41%
Total	**34,000 – 42,900**	**37,100 – 50,700**	**9%-49%**

Water Management Considerations

The Comprehensive Plan presents an opportunity to emphasize and guide policy direction in support of sustainable water management. Water management is a paradigm in which water reliability is considered, in addition to water availability (Figure 26).



Water availability: Is high-quality water consistently available for beneficial use?

Water reliability: Is water physically and legally available for beneficial use?

Figure 26. Sustainable Water Management

This section builds on the analysis conducted and offers preliminary observations and considerations to help inform Pitkin County's water policy direction.

Monitor Water Availability

The County's high dependence on tributary surface water is beneficial because tributary groundwater is a renewable source of supply when compared to non-renewable deep groundwater. The flip side of this is that due to Pitkin County's location in the Colorado River Basin, and the status of water rights in the region, augmentation plans will likely be required to acquire new water supplies, unless a property utilizes an exempt well.

While exempt wells do not require as many administrative hurdles to acquire, their concentration and prevalence in the County means their overall impacts are not well understood or tracked. As the County redevelops, it may be beneficial to further analyze

and understand the status of exempt wells, including the types and sizes of properties they serve and their overall hydrological impact on the County.

While water availability currently appears sufficient, factors such as the abundance and concentration of exempt wells, high household demand, climate change, wildfire impacts, infrastructure quality, water rights seniority, and Colorado River negotiations, raise questions about future water reliability within the County.

Plan for Water Reliability

Sustainable water management includes not only the physical and legal availability of water, but also the reliability of water – whether high-quality water is consistently available for beneficial use. Characteristics of a reliable water system include:

- Multiple sources of supply (e.g., surface water and tributary groundwater, water sourced from different watersheds), back-up systems, and interconnectedness with other systems)
- Senior and absolute water rights
- Adequate storage for demand shifts and emergencies
- Modern and adequate infrastructure (e.g., low water loss)

To this end, public water systems and self-supplied users may be less resilient to drought or climate change, demand fluctuations, and other pressures if they have:

- Smaller providers with less resources
- One source of supply
- Junior or conditional water rights
- Dependence on augmentation plans
- No storage
- No connections to other systems
- Aging infrastructure (e.g., high water loss, risk of shut offs) or insufficient financial means to fix infrastructure

While some public water systems can supply water for development that already exists, many are not anticipating additional unplanned growth or redevelopment. Connecting to existing systems may require infrastructure improvements and support to ensure reliable supply.

Additionally, as noted earlier, 62% of Pitkin County's groundwater wells are "exempt" and therefore less regulated. Exempt wells are concentrated near the Colorado River Alluvial Aquifer and other major waterways; not evenly distributed across the County (see Figure

18). This concentration means that these areas lack the assurances of augmentation plans and regulatory oversight, putting the reliability and consistent availability of water in these areas at risk.

For new development, **connecting to existing public water systems can improve water reliability**. Existing public water systems with a portfolio of senior water rights and/or multiple sources of supply present opportunities for greater reliability, followed by public water systems that rely on junior or augmented water rights. Depending on the system, additional support may also be required to ensure adequate and reliable infrastructure is in place.

New public water systems are more limiting in terms of water reliability for new development; because of their dependence on junior or augmentation water rights, along with less likelihood of connecting to other systems. However, it is assumed that they are more likely to have modern, adequate infrastructure. **The most limiting system – for both new development and surrounding wells and users – is a connection to an exempt well**.

Because the service areas of the existing public water systems in Pitkin County do not align perfectly with incorporated areas or UGBs, **opportunities exist to collaborate with water providers to explore where additional water service capacity may exist** (both within and adjacent to existing service areas). This collaboration starts with building on the information collected through this effort, to work directly providers to identify which and how much capacity is available. In turn, Pitkin County can revisit future land use and zoning maps, in coordination with municipalities and their UGBs, to focus new development in areas with greater potential water reliability – areas within or within reach of existing public water system services that have adequate supply and infrastructure. The subdivision process can remain a tool to limit the proliferation of new exempt wells on properties less than 35 acres. Furthermore, Pitkin County may consider a more proactive role along with regional partners to support water providers that have concerns about the sufficiency of future infrastructure and financial means, before reliability issues arise.water providers that have concerns about the sufficiency of future infrastructure and financial means, before reliability issues arise.

Implications for Land Use Planning and Policy Direction

Pitkin County households, especially those served by non-exempt wells, tend to be larger properties, with higher-than-average numbers of water-using fixtures per dwelling unit.

Looking across the State of Colorado, the metric "gallons per capita per day" (GPCD) is frequently used to compare water use in different areas. Colorado's statewide average is 164 GPCD (Colorado Water Conservation Board, 2023). This metric includes all demands (e.g., residential, non-residential, irrigation, and water loss). Brendle Group calculates Pitkin County's average as 214 GPCD. It is unclear whether these larger homes, which are assumed to have higher than average domestic use, are meeting the terms of household-only exempt well permits, but the ongoing proliferation of large homes served by household-only exempt wells could challenge future reliability.

At the time of this report, it is assumed that additional affordable development in the County will take the form of 2–5-unit multifamily cluster developments or caretaker dwelling units (CDUs). From a water perspective, these are efficient land uses. Factors that impact demand include outdoor irrigated area and landscape requirements, the type and number of fixtures, and number of residents.

Table 9. Estimated Annual Water Demand for Different Housing Types

	2-5 Unit Multi-Family Cluster Development	Caretaker Dwelling Unit (CDU)
Estimated Annual Water Use	18,000 – 29,000 gal/unit	10,000 – 15,000 gal/unit
Summary of Assumptions	1,500 square foot attached dwelling unit with 1,300 square foot outdoor irrigated area with low to medium water use plants	1,000 square foot detached dwelling unit with no outdoor water use

Promotion of these water-efficient development types is a responsible development strategy for the County. In addition, the County could explore several policy directions that encourage water-smart development:

- Ensuring water efficiency and conservation are incorporated into future development and redevelopment. This may include strategies such as updating codes to promote efficient indoor and outdoor water use and reducing non-essential water consumption as well as water waste.
- Exploring new water adequacy requirements that promote water availability and reliability across surface and groundwater systems.
- Promoting increased regional water management through the preservation and enhancement of the Roaring Fork Watershed.

- Protecting riparian and instream habitat by prioritizing instream flows, maintaining and protecting wetland riparian habitat, and other ecological measures.
- Encouraging improvements to agricultural efficiency

Conclusion

Pitkin County Vision 2050 is a comprehensive approach to updating the County's Comprehensive Plan and revising Land Use and Building and Energy Codes. This report aims to inform the comprehensive plan process, along with related implementation strategies, to protect water availability and reliability in the future. While Pitkin County receives almost all its water from renewable water sources, and is not anticipating major water availability issues, its location within the Colorado River Basin, development patterns, topography, and rural nature create important water management considerations.

Within the County, nearly all water is provided by a public water system or an individual well. Public water systems provide water to just over 80% of the County's population, with the majority (90%) of systems providing water outside urban growth boundaries. Many of these systems are small, serving 50 people or less. While public water systems generally provide more reliability than self-supplied users who receive water from a well, some of the smaller providers are at greater risk of facing capacity and infrastructure challenges that may limit their ability to serve additional, unplanned development. It is important for the County to understand public water system capacity as it develops policies and recommendations.

The roughly 20% of residents who do not receive water from a public water system receive water from a well, with many drawing water from an exempt well that is not required to provide an augmentation plan and is limited to serving specific domestic or household uses. These exempt wells are concentrated in certain areas of the County, particularly in major river valleys. Additionally, due to their permitting requirements they are limited in the type of developments they can serve and are often unmonitored.

For all developments, regardless of whether they receives water from a public water system or a well, development trends show a shift towards larger homes with more intensive water needs. Pitkin County's average GPCD is 214, compared to a state average of 164. Overall, the County has relatively minor non-residential demands.

Along with residential demand, the other primary water-using sector in the County is agriculture. Compared to residential demand, agricultural demand makes up over half of

future expected use (55 -60%), highlighting opportunities for the County to encourage efficiency in this sector as well.

Future demands in the County will largely be driven by redevelopment patterns. The County could experience a 9 to 18% increase in total water use by 2050; however, it is expected that there is adequate water supply to meet future demand.

Throughout the creation of this report, Brendle Group worked closely with County staff to ensure Comprehensive Plan policy direction considers these details and emphasizes sustainable water availability and reliability. The Comprehensive Plan should consider details such as if a development will be served by a public water system versus a well, the capacity of public water systems to be able to serve new development, and promotion of efficiency and conservation across all sectors. As a result, specific policy direction includes:

- Ensuring water efficiency and conservation are incorporated into future development and redevelopment. This may include strategies such as updating codes to promote efficient indoor and outdoor water use and reducing non-essential water consumption and water waste.
- Exploring new water adequacy requirements that promote water availability and reliability across surface and groundwater systems.
- Promoting increased regional water management through the preservation and enhancement of the Roaring Fork Watershed.
- Protecting riparian and instream habitat by prioritizing instream flows, maintaining and protecting wetland riparian habitat, and other ecosystem services.
- Encouraging improvements to agricultural efficiency

The Comprehensive Plan policy direction will inform subsequent land use and building and energy code changes to codify this policy direction in support of holistic, sustainable water management.

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