Agenda Item

Date: January 6, 2025 at 3:00 p.m.

To: Douglas County Board of County Commissioners

Through: Douglas J. DeBord, County Manager

From: Kati Carter, AICP, Assistant Director of Planning Resources KC

CC: Lauren Pulver, Planning Supervisor

Subject: **Draft 2050 Douglas County Water Plan and Next Steps**

SUMMARY

On December 31, 2025, staff received the attached draft 2050 Douglas County Water Plan (Water Plan). The intent of Forsgren Associates, Inc (Forsgren) is for this to be a working draft, developed prior to public outreach initiatives, such as focus groups, and to be workshopped by the Water Commission. Input from these groups will further refine the policy recommendations included in Chapter 10 of the draft to take into account local context and applicability to Douglas County.

At the January 26 meeting, the Water Commission will begin reviewing and commenting on the draft Water Plan during an initial 2-hour workshop.

NEXT STEPS

In the first quarter of 2026, Forsgren will begin public outreach to be incorporated into the Water Plan. The first public outreach initiative will be through targeted focus groups with groundwater well users, water providers, and developers and economic development organizations. Focus groups will help to fill information gaps in the draft plan and refine policy recommendations.

In Spring 2026, a public engagement webpage will be launched to inform County residents and stakeholders of the draft Water Plan and allow for public comment. Following this, Forsgren will work with the Board of County Commissioners (Board), County staff, and the Water Commission to host a public Open House to provide an overview of the draft Water Plan and gather feedback to be incorporated into the final Water Plan.

Staff will provide updates to the Board during this process, with the intent for the Board to adopt the Water Plan at a future public hearing in 2026.

FORSGREN
AN APEX COMPANY

2050 DOUGLAS COUNTY WATER PLAN

December 2025 - Working Draft

ACKNOWLEDGEMENTS

ABBREVIATIONS

AF:	acre-feet
AFD:	acre-feet per day
AFY:	acre-feet per year
BOCC:	Board of County Commissioners
CCF:	hundred cubic feet
CDPHE:	Colorado Department of Public Health and Environment
CIP:	Capital improvement plan
CWCB:	Colorado Water Conservation Board
DOLA:	Department of Local Affairs
DWR:	Division of Water Resources (Office of State Engineer)
FT:	feet
FT-MSL:	feet, mean sea level
GAL:	gallons
GPCD:	gallons per capita per day
GPD:	gallons per day
GPM:	gallons per minute
HP:	horsepower
IPR:	indirect potable reuse
LIRF:	lawn irrigation return flows
KGAL:	one thousand gallons
MAF:	million acre-feet
MCL:	maximum contaminant level
MD:	Metropolitan District
MGAL:	one million gallons
MGD:	million gallons per day
MWC:	Mutual Water Company
NNT:	not nontributary
NT:	nontributary
PUD:	Planned Unit Development
SDO:	State Demography Office
SEO:	State Engineer's Office (Office of the State Engineer)
SFE:	single family equivalent
SMWSA:	South Metro Water Supply Authority
WCP:	Water Conservation Plan
WD:	Water District
WISE:	Water Infrastructure and Supply Efficiency Partnership
WMP:	Water Management Plan
WRF:	Water Reclamation Facility
WSD:	Water and Sanitation District
WSMP:	Water Supply Master Plan
WTP:	Water Treatment Plant
WWA:	Water and Wastewater Authority

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Executive Summary (To be added)

CHAPTER 1
INTRODUCTION

CHAPTER 1 - INTRODUCTION

1.1 General

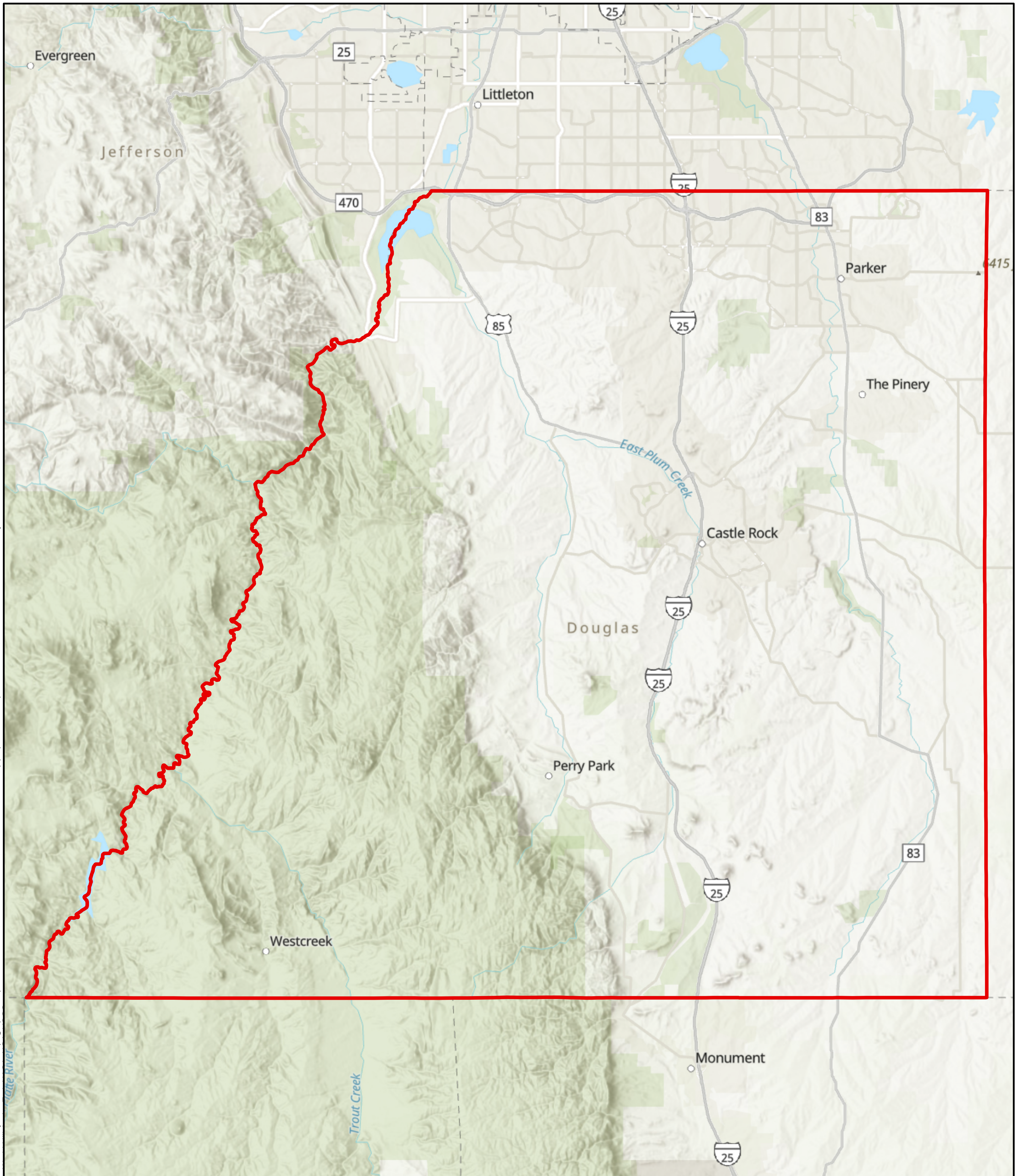
Douglas County covers nearly 844 square miles consisting of mountains, foothills and plains along the I-25 corridor between Denver and Colorado Springs. The county ranks 47th in Colorado in land area, and sixth in Colorado for its population of approximately 400,000. It is bounded on the north by Arapahoe County, east by Elbert County, south by El Paso County, southwest by Teller County, and on the west by Jefferson County.

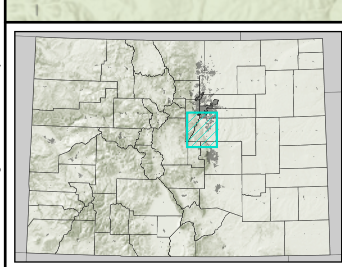
Urban areas include unincorporated Highlands Ranch, the City of Lone Tree, the City of Castle Pines, and the Towns of Castle Rock (county seat), Parker and Larkspur. The population is largely concentrated in the north with higher density areas in Highlands Ranch, Lone Tree and Parker. To the south, population is concentrated in communities along Interstate-25 including Castle Rock and Larkspur. Areas to the southeast and southwest of the county are largely rural with a smaller share of the county's population. Please see map on the following page for reference.

1.2 Purpose

With burgeoning growth from the expanding Denver metropolitan area, there is great interest in the long-term sufficiency of water supplies across the county. The County initiated this Water Master Plan (WMP) to review projected water demands and supplies, and update the goals, policies, and strategies related to water resource management. The purpose is simply to promote a sustainable future for water, the county's most precious resource.

Although the County is not a water provider, it has a vital interest in water resource management throughout. The County is also in position to promote land-use decisions based on balancing efficient use of water supplies. This WMP is expected to promote cooperation with the water supply entities in their respective water planning efforts, as well as provide the basis for reviewing proposed water supplies for new development at a formative stage in the development process.





Douglas County

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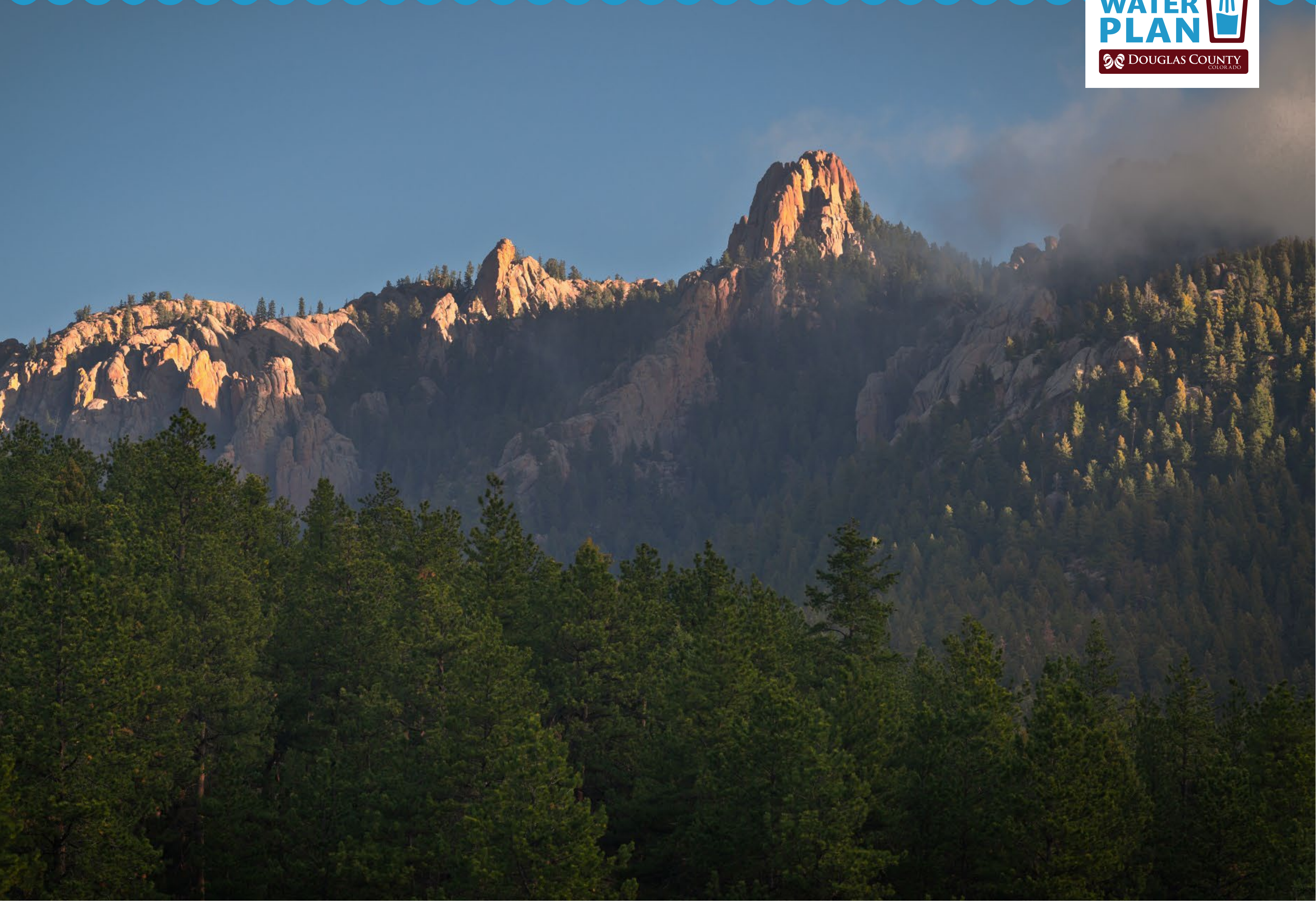
DOUGLAS COUNTY REFERENCE MAP

SPHEROS ENVIRONMENTAL



CHAPTER 2
PUBLIC ENGAGEMENT

CHAPTER 2 – PUBLIC ENGAGEMENT

2.1 General

[Will be completed at a later date.]

CHAPTER 3
LAND USE


CHAPTER 3 - LAND USE

3.1 Critical Nexus

For Douglas County, a sustainable water supply over the next 25 years (and beyond) will be connected to the amount, form, and locations of future growth. The County's regulations, policies, and programs relating to water usage and land use will determine whether it can fully accommodate its forecasted growth.

As the County's population, number of jobs, and footprint of developed land increases, the demand for a reliable water supply, and the need for more efficient management of water resources can be expected to expand and intensify.

Through this WMP, Douglas County is proactively planning for water needs to support the entire county in their reliance on water as a critical resource.

Figure 1. Land use planning and development directly affect water demand

Further complicating this situation is the historic disconnect between land use development decisions and water-supply decisions. At a time when a significant number of land use decisions will be made to accommodate future growth, it will also be necessary to make decisions that conserve water. The decisions made by land use planners have an undeniable and significant effect on future water demand, but water supply is projected and planned

3.2 The Look Ahead

Like many other Colorado counties, Douglas County is forecasted to experience significant growth over the next 25 years. As shown in Chapter 5, the county's total population is projected to grow by nearly 150,000 by 2050, a 37 percent increase over the 2025 population. The number of households in the county is expected to increase by nearly 70,000 by 2050, also a 37 percent increase over the current number.

Substantial job growth is also predicted with approximately 56,000 new jobs anticipated by 2050. With the average square footage of commercial space required for a single, new job being 200 square feet (sf), this could result in construction of approximately 11.2 million sf of new commercial space in the next 25 years.

Taken together, this growth will induce a proportional increase in the demand for water. By 2050, demand is projected to increase from approximately 77,000 acre-feet per year (AFY) to 100,000 AFY.

In addition to projected growth, climate and weather are important factors to consider in planning for sustainable water supplies. While the prevailing weather patterns and climate affecting Douglas County over the next 25 years is uncertain, there is a growing body of quantitative data suggesting that changing patterns will increase water demand throughout the county and potentially reduce supply availability.

Figure 2. Forecasted increases in annual average temperatures could increase the County's demand for water

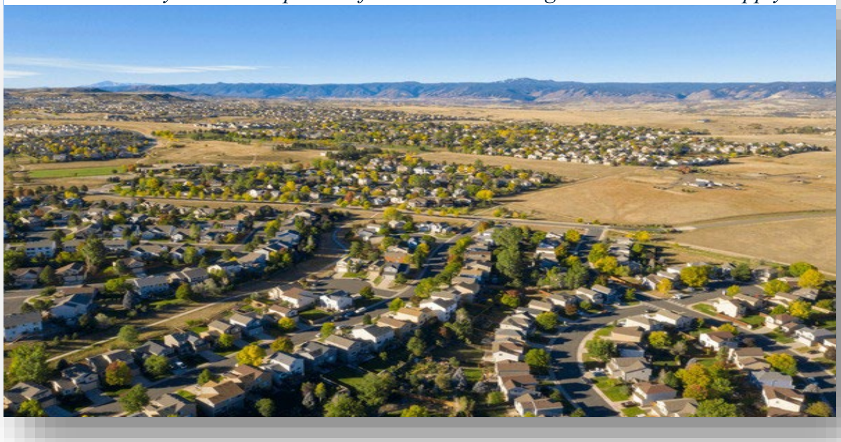
As indicated by a 2024 report prepared for the Colorado Water Conservation Board (CWCB):

- Colorado has warmed substantially in the last 30 years and even more over the last 50 years. Future estimates project temperatures rising an additional 2.5 °F to 5 °F by 2050. This means the warmest summers from our past may become the average summers in our future. With increasing temperatures come shifts in snowmelt runoff, water quality effects, and stressed ecosystems.
  Source: https://cwcb.colorado.gov/focus-areas/hazards/climate

- Future warming could lead to declines in summer soil moisture statewide. Spring soil moisture will likely increase due to shifting snowmelt timing. Moreover, evaporative demand, or the "thirst" of the atmosphere, is projected to increase by 8 to 17 percent by 2050 due to warming.
  Source: https://cwcb.colorado.gov/focus-areas/hazards/climate
- Despite the uncertainty about water availability, new modeling shows that snow, soil moisture and stream flows will likely decline, and heat waves, fires and droughts will become more frequent.

  Source: https://watereducationcolorado.org/fresh-water-news/new-colorado-climate-report-says-state-will-continue-to-heat-up-but-whether-it-will-dry-out-is-unclear/

Figure 3. The amount, location and form of new development in Douglas County over the next 25 years are important factors in sustaining a reliable water supply



3.3 A Sustainable Approach

For Douglas County, a sustainable approach is one that is built on sound water supply and demand projections. By integrating water conservation and water reuse into its way of doing business and how it accommodates forecasted growth, water providers throughout the county can sustainably manage water supplies over the next 25 years and beyond 2050.

Conservation benefits can be quantified by reducing demand per capita through a series of regulations, policies, and programs. Conversely, if water is used in the same ways and at the same levels that it has been in the last 25 to 50 years, it elevates the risk that sufficient supplies may not be economically available to fully meet demands in 2050 and beyond.

While the supply and demand analysis completed for this study show that sufficient water supplies will be available to serve Douglas County over the next 25 years, the analysis also shows that the margin between supply and demand will tighten. Whereas demand is expected to increase from approximately 77,000 AFY to 100,000 AFY, an increase of 30 percent, supplies are expected to increase from 143,000 AFY to 160,000 AFY, only 12 percent. As such, a prudent approach for the County is to consider enacting a series of regulations, policies, and programs to bolster the longevity of available water supplies.

3.4 The Current Framework

As an initial step to develop recommendations, the project team reviewed the County's policies and plans related to water usage, conservation, reuse and sustainability. The review confirmed that the County has already established a positive foundation for long-term water conservation and demand/supply management. However, challenges remain, as do a wide range of opportunities for addressing them.

> Water supply is a top priority for Douglas County residents. The County, while not a water provider, aims to assist water providers with prolonging the life of its finite Denver Basin water resources, as

2040 Comprehensive Master Plan

As a long-range planning document, the County's Comprehensive Plan sets the vision and high-level framework for guiding water use. The Plan includes a stand-alone section related to water supply including several goals, objectives, and policies supporting the sustainable use and management of water. These include:

Goal 7-1: Prolong the life of water resources.

Objective 7-1A: Minimize water consumption.

Policy 1A.1: Encourage landscapes that minimize water consumption.

Policy 7-1A.2: Support development that uses water resources wisely.

Objective 7-1B: Maximize the efficient use of water.

Policy 7-1B.1: Encourage the reuse of water supplies.

Policy 7-1B.2: Promote the use of techniques that capture rainwater as allowed by law.

Policy 7-1B.3: Promote graywater technologies.

Policy 7-1B.4: Support water-saving technologies.

Objective 7-1C: Support long-term water supply planning.

Policy 7-1C.1: Encourage developments to obtain service from existing water providers.

Policy 7-1C.2: Promote conjunctive-use water systems.

Policy 7-1C.3: Work with water providers to explore opportunities to bring renewable water supplies to Douglas County.

Policy 7-1C.5: Develop and maintain partnerships with countywide and regional water providers.

Policy 7-1C.6: Encourage proactive, collaborative efforts in developing a long-term water supply.

Douglas County Zoning Resolution

The County's Zoning Resolution governs land use for residential and non-residential purposes. Section 18A of the resolution contains the Water Supply Overlay District ("the District") and the Water Supply Zones Map.

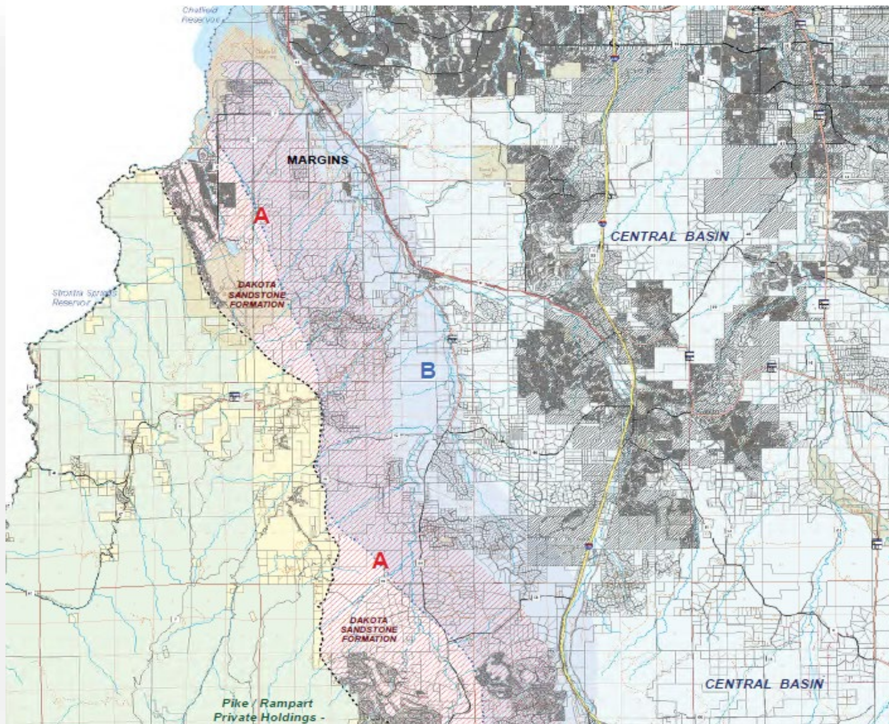


Figure 4. Water Supply Zones Map in the County's Zoning Resolution

The District encompasses the entire county and applies to specified applicants (such as those for a rezoning, planned development, or use by special review). The District aims to ensure that development in all areas of Douglas County provides for a water supply that is sufficient in terms of quantity, quality, and dependability. The District divides the County into water-supply zones and it includes methods and provisions for accomplishing the following:

- Restricting dependence on nonrenewable water sources
- Encumbering groundwater through the use of restrictive covenants
- Verifying water rights and adjudicating these rights
- Identifying minimum water demand standards
- Identifying minimum water supply standards
- Identifying the land use process affected by these standards
- Providing an appeal process to prove water supply sufficiency

The District also requires applicants to document all applications proposing a water supply from an existing district, either directly or through execution of an intergovernmental agreement with a new special district.

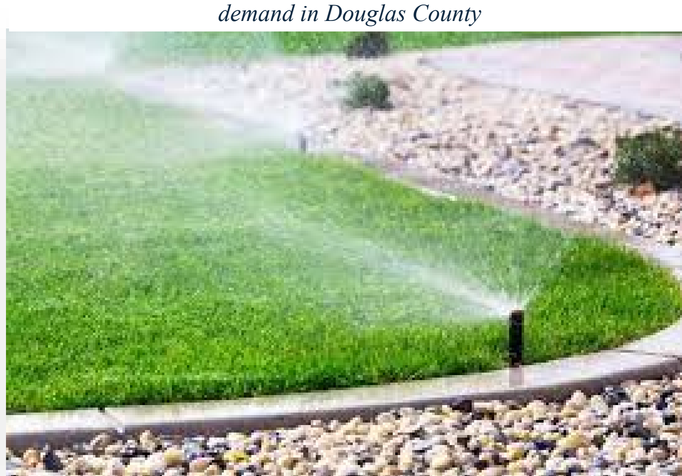
The provisions of Sections 27 (Site Improvement Plan) and 2708 (Landscape Plan) in the zoning resolution also affect water usage, supply, and management. They emphasize sustainable use by requiring that a sustainable landscape plan be included as part of site improvement applications to conserve water, reduce runoff, and enhance water quality.

In addition, applicants proposing a site improvement plan for an unplatted parcel must demonstrate adequate water supply in terms of quantity, quality, and reliability, consistent with the Water Supply Overlay District requirements. However, parcels zoned A-1 (Agricultural) or LRR (Large Rural Residential) with water demand not exceeding three AFY supplied by a permitted groundwater well, are exempt from these overlay provisions.

Landscape plan requirements further restrict high-water-use plants (as defined by the Colorado Nursery and Greenhouse Association), limiting them to 1.5 percent of the gross site area (or five percent for multifamily projects to accommodate recreational spaces), and prohibit their use in parking lot islands. Through these provisions, Sections 27 and 2708 serve as a key tools for promoting responsible water resource management and ensuring that development aligns with sustainable practices.

Development Review & Approvals

Figure 5. Landscape irrigation is a significant source of water demand in Douglas County



As a prerequisite to submitting a preliminary plan for a subdivision, applicants in Douglas County are required to contact the Planning Office for a pre-submittal meeting. Once complete, the applicant may submit a preliminary plan--intended to be an in-depth analysis of the proposed subdivision, **including the ability to obtain water.** Overlay districts require applicants to demonstrate the adequacy of a proposed subdivision's water supply in the preliminary plan.

Under Douglas County's Subdivision Regulations and Water Supply Overlay District requirements, the Board of County Commissioners (BOCC) must confirm the adequacy of a subdivision's water supply in the preliminary plan. Before approving a final plat application, the Board must ensure that the water rights to serve the subdivision have been conveyed to the district providing water and are available for the intended uses. The water credits to serve the subdivision must have also been purchased from the district (as necessary), and/or the water supply is the subject of a fully executed contract or intergovernmental agreement (IGA) with another water provider in which all terms have been fully satisfied, as confirmed by a signed will-serve letter from the water provider.

State Legislation

In addition to the County's policies and regulations, the Colorado Legislature has passed several bills within the last three years that will further support sustainable use of water supplies for years to come.

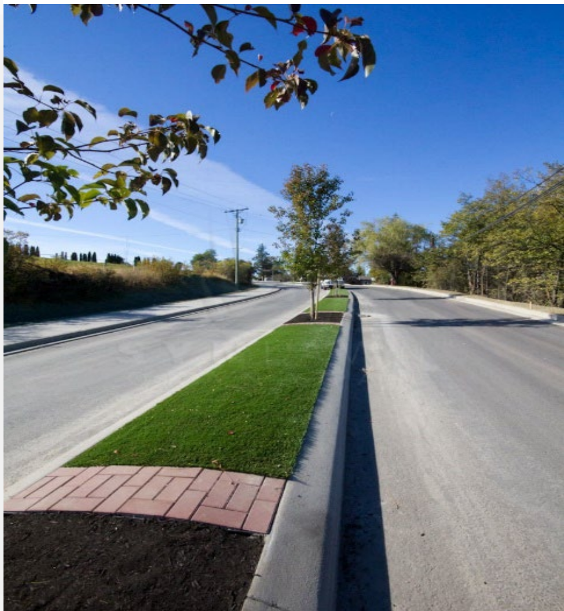
Senate Bill 23-178 removes barriers to water-wise landscaping in common interest communities, specifically those with single-family detached homes. It requires homeowners associations (HOAs) to allow homeowners to use drought-tolerant and nonvegetative landscapes, prohibits preventing vegetable gardens in front yards, and restricts HOA rules that overly limit the use of hardscape or prohibit nonvegetative turf grass in backyards.

Figure 6. Removal of water-intensive turf and replacement with xeriscaping can reduce water demand

Senate Bill 24-005 requires communities to prohibit the installation of nonfunctional turf, nonfunctional artificial turf, and invasive plant species for new development or redevelopment of:

- Commercial, institutional and industrial properties;
- Common interest community property (e.g., homeowner association/HOA) common areas, and
- Street rights-of-way, parking lots, medians, and transportation corridors.

Figure 7. Recent state legislation seeks to minimize the application of non-functional turf, as shown here

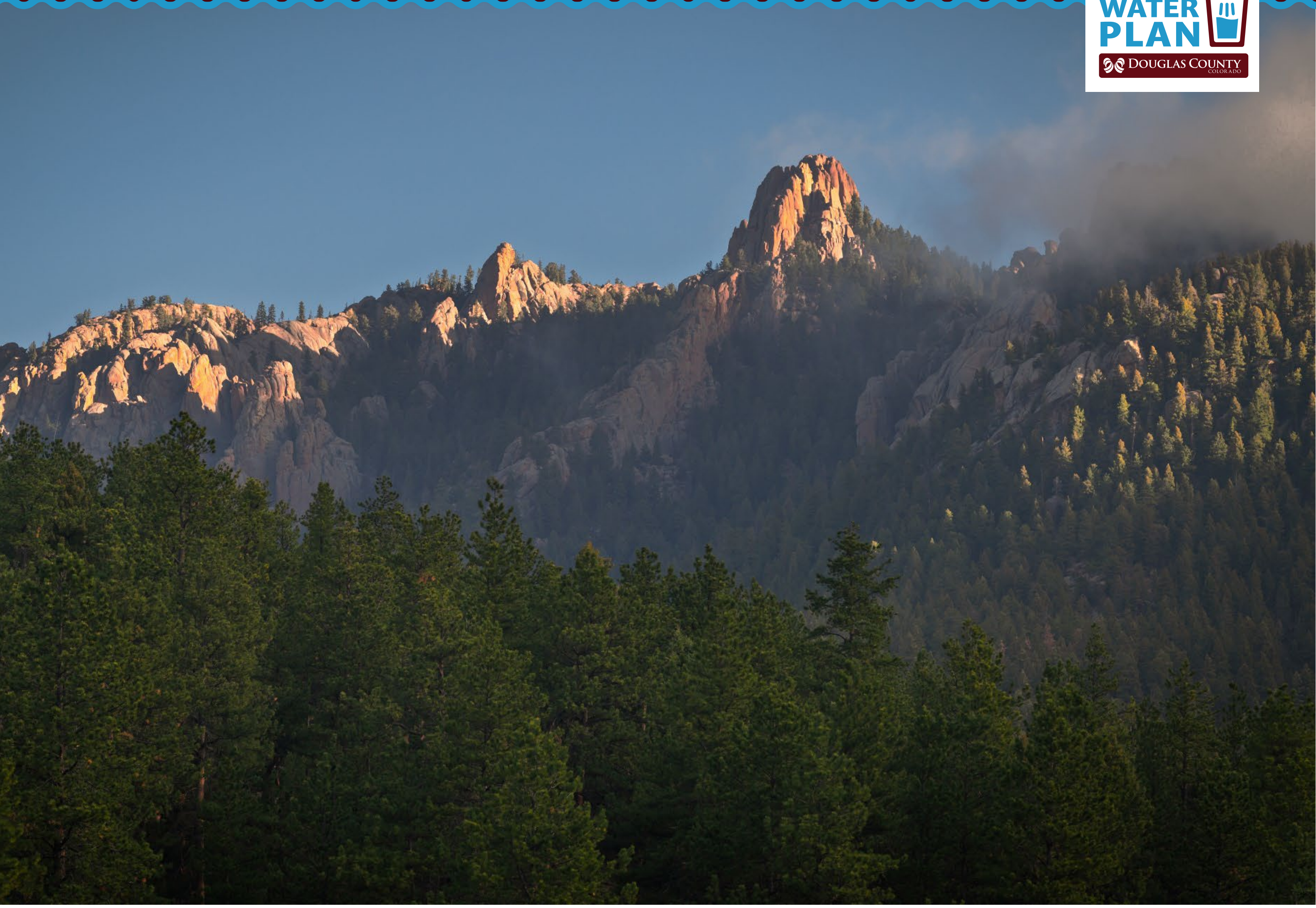


The primary intent of the bill is for communities to replace the practice of installing nonfunctional, high water use turf with "water-wise landscaping" that reduces outdoor water consumption without impacting landscape functionality or quality of life.

Senate Bill 25-1113 expands the current prohibition on SB 24-005. It requires that on or after January 1, 2026, local entities (e.g. counties) may not install, plant, or place, or allow a person to install, plant, or place, nonfunctional turf, artificial turf, or invasive plant species on the common elements within Common Interest Communities (or "HOAs") with more than twelve (12) dwelling units. A local entity may still install, plant, or place, or allow a person to install, plant, or place, this type of landscaping for HOAs with twelve (12) or fewer dwelling units.

3.5 Recommendations

As documented, there is a strong foundation of county-specific and statewide regulations and policies to guide the sustainable use of water in Douglas County over the next 25 years. Recommendations to build on that foundation and further strengthen the County's efforts to promote the long-term reliability of water supplies for projected growth are discussed in Chapter 10.



CHAPTER 4
WATER PROVIDERS

CHAPTER 4 - WATER PROVIDERS

4.1 General

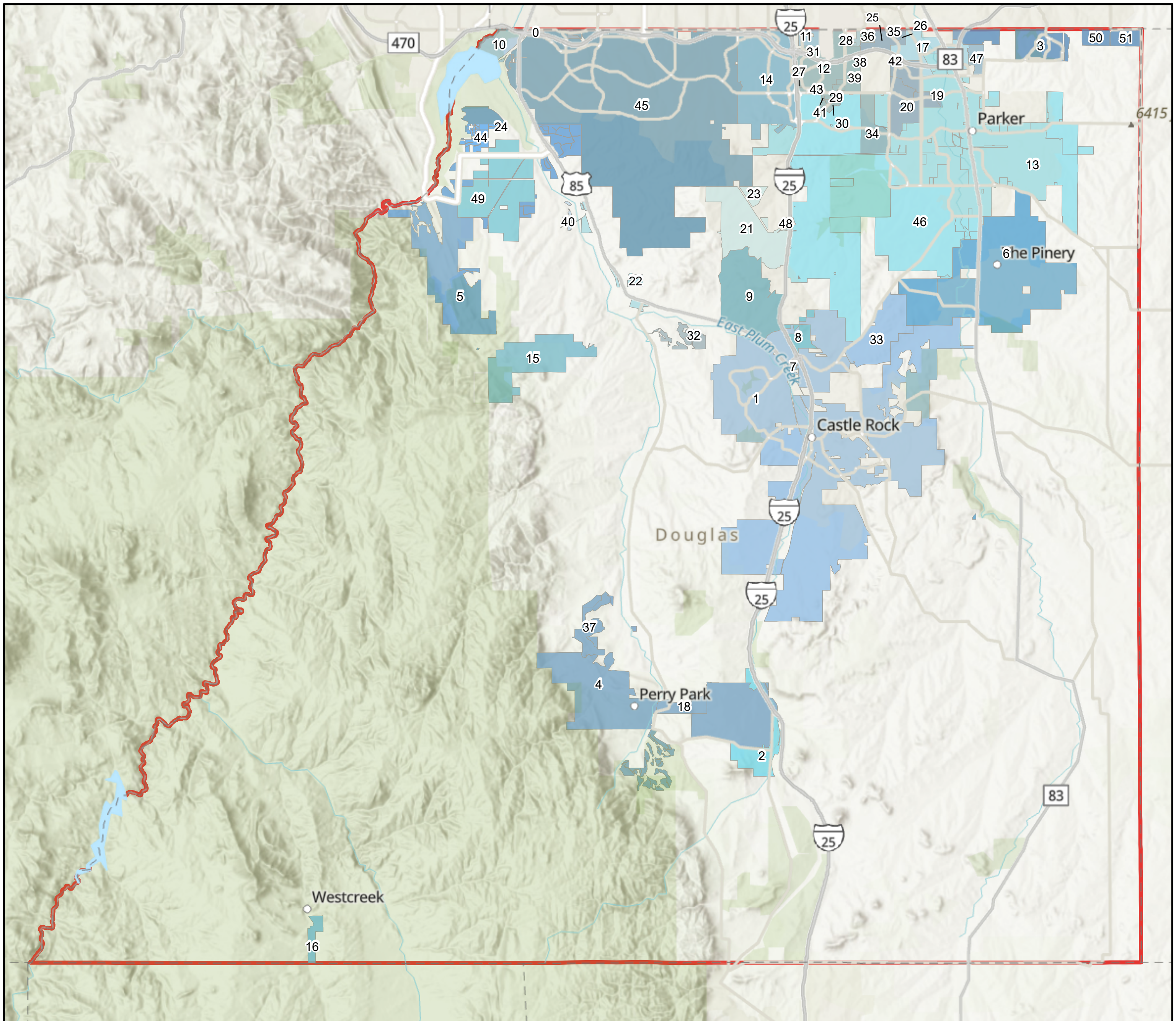
This chapter identifies the water providers across Douglas County responsible for securing adequate water supplies to serve their customers. A list of Douglas County's water providers is shown in Table 4-1. Please see the map that follows for the Douglas County Water Provider boundary.

There is significant variation in the size and complexity of water providers in the county. From responses to the water provider survey, we have grouped the water providers into three categories based on current annual water demand: Major (>10,000 AFY), Medium (<10,000 AFY and >1,000 AFY), and Minor (<1,000 AFY). Of the 31 providers, 24 responded to the survey. Five minor providers did not respond. (Two are not shown; one connects to a major provider and was included in that larger provider's response, and another does not serve developable land in Douglas County.)

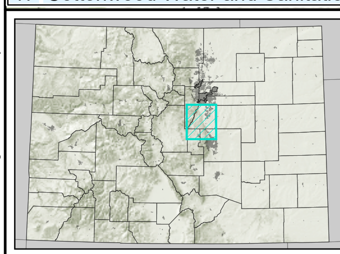
TABLE 4-1: Douglas County Water Providers

Arapahoe County WWA	Perry Park WSD
Aurora Water	Pinery – Denver SE Suburban
Beverly Hills Mutual Water Company	Roxborough WSD
Castle Pines MD	Sedalia WSD
Castle Pines North MD	Sierra Vista Douglas MWC
Castleton Center WSD	Silver Heights WSD
Chatfield South WD	Solitude Metropolitan District
City of Littleton	Southgate WD
Cottonwood WSD	Stonegate Village Metro
Highlands Ranch WSD	Thunderbird WSD
Inverness WSD	Town of Castle Rock
Louviers WSD	Town of Larkspur
Median MD	View Ridge MWC
Northern Douglas County WSD	Westcreek Lakes WD
Parker WSD	

Note: WD is Water District; WSD is Water and Sanitation District; WWA is Water and Wastewater Authority; MD is Metropolitan District; MWC is Mutual Water Company



ID	Water Provider	ID	Water Provider	ID	Water Provider
0	City of Littleton	18	Perry Park Water and Sanitation District	36	Arapahoe County Water and Wastewater Authority
1	Town of Castle Rock	19	Stonegate Village Metro	37	Perry Park Water and Sanitation District
2	Town of Larkspur	20	Stonegate Village Metro	38	Meridian Metropolitan District
3	Aurora Water	21	Castle Pines North Metro District	39	Meridian Metropolitan District
4	Perry Park Water and Sanitation District	22	Sedalia Water and Sanitation District	40	Louviers Water and Sanitation District
5	Roxborough Water and Sanitation District	23	Castle Pines North Metro District	41	Meridian Metropolitan District
6	Pinery - Denver SE Suburban	24	Chatfield South Water District	42	Stonegate Village Metro
7	Castleton Water and Sanitation	25	Stonegate Village Metro	43	Meridian Metropolitan District
8	Silver Heights Water and Sanitation	26	Stonegate Village Metro	44	View Ridge Mutual Water Company
9	Castle Pines Metropolitan District	27	Meridian Metropolitan District	45	Highlands Ranch Water & Sanitation District
10	Southwest Metro WSD	28	Arapahoe County Water and Wastewater Authority	46	Parker Water and Sanitation District
11	Inverness Water and Sanitation District	29	Meridian Metropolitan District	47	Sierra Vista Douglas Mutual Water Company
12	Meridian Metropolitan District	30	Meridian Metropolitan District	48	Beverly Hills Mutual Water Company
13	Parker Water and Sanitation District	31	Meridian Metropolitan District	49	Dominion Water & Sanitation District
14	Southgate Water District	32	Solitude Metro District	50	Aurora Water
15	Thunderbird Water and Sanitation District	33	Town of Castle Rock	51	Aurora Water
16	Westcreek Lakes Water District	34	Meridian Metropolitan District		
17	Cottonwood Water and Sanitation District	35	Stonegate Village Metro		



Douglas County

Water Providers

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DOUGLAS COUNTY WATER PROVIDER BOUNDARIES

SPHEROS ENVIRONMENTAL

It should be noted that several of the water provider responses included discrepancies in the responses. The project team is working to follow up with providers to reconcile the discrepancies.

4.2 Major Water Providers

The major water providers, with demands over 10,000 AFY, account for 67 percent of municipal water demands in the county and include:

- Highlands Ranch WSD
- Parker WSD
- Town of Castle Rock

4.2.1 Highlands Ranch WSD

Highlands Ranch WSD (formerly known as Centennial WSD) is a water and wastewater service provider located in the northwest part of the county that serves Highlands Ranch, Solstice (Mirabelle), and northern Douglas County. Highlands Ranch WSD serves a population of approximately 110,000 through about 35,000 homes. They indicated in their survey that the area within their service boundary is 98 percent built out.

Highlands Ranch WSD obtains 85 percent of their water supply from surface water and reuse. Surface water is the primary water supply source, drawn from 29 different sources primarily through the South Platte River system. The remaining 15 percent of the water supply comes from Denver Basin wells, which are used as a secondary and supplemental supply to surface water.

Table 4-1
Highlands Ranch WSD Current Water Demands

Use Type Categories	No. of Active Connections	No. of SFEs	Avg. Annual Usage (AFY)	Notes
Residential Single Family	31,488	31,488	12,500	SFE usage is 0.40 AFY
Residential Multi-Family	757	8,644	3,400	
Utility/Municipal	0	0	0	
Irrigation Only	949	4,864	2,000	
Commercial/Industrial	152	1,498	600	
Evaporation Replacement			1,500	For loss from storage reservoirs
Total	33,346	46,494	20,000	

Table 4-2
Highlands Ranch Water Current Water Supplies

Supply Type	Volume (AFY)	Notes
Wholesale Water	0	
Surface Water	15,700	
Alluvial Well Water	0	Alluvial water is included in surface water volume
Denver Basin Groundwater	2,800	
Designated Basin Groundwater	0	
Total (without reuse)	18,500	
Reuse	4,000	
Total (with reuse)	22,500	

Table 4-3
Highlands Ranch Water Projected Demands and Supplies

Period	Demand (AFY)	Supply (AFY)
2024	20,000	22,500
2030	20,000	22,500
2040	20,000	22,500
2050	20,000	22,500

Highlands Ranch reported in their survey that they are actively working to increase surface water supplies and reduce water demand by several AFY, but no specific projects have been identified at present.

4.2.2 Parker Water and Sanitation District

Located in central northeast Douglas County, Parker WSD is one of the larger water providers in the county, and serves the majority of residents in the Town of Parker.

Table 4-4
Parker WSD Current Water Demands

Use Type Categories	No. of Active Connections	No. of SFEs	Avg. Annual Usage (AFY)	Notes
Residential Single Family	20,062	20,062	5,853	
Residential Multi-Family	441	2,710	862	
Utility/Municipal	0	0	0	
Irrigation Only	601	6,664	520	
Commercial/Industrial	399	1,634	2,120	
Wholesale Water (Provided to others)	6	12,112	3,853	
Wholesale Water (Received from others)	1	80	25	
Total	21,503	43,262	13,233	

Table 4-5
Parker WSD Current Water Supplies

Supply Type	Volume (AFY)	Notes
Wholesale Water	959	1,600 AFY subscription from WISE
Surface Water	588	Excludes alluvial well water
Alluvial Well Water	952	Excludes reuse
Denver Basin Groundwater	9,475	
Designated Basin Groundwater	0	
Total (without reuse)	11,974	
Reuse	2,300	
Total (with reuse)	14,274	

Table 4-6
Parker WSD Projected Demands and Supplies

Period	Demand (AFY)	Supply (AFY)
2024	14,145	23,487
2030	16,967	27,306
2040	20,302	27,848
2050	22,527	28,210

Parker WSD uses Denver Basin groundwater as base supply and uses that source year-round. Occasionally, the option of WISE (Water Infrastructure and Supply Efficiency project) water is available. That water is used whenever offered to offset pumping of the Parker WSD wells.

Alluvial wells are mainly used to capture reusable supplies. Both Denver Basin and WISE are reusable, and what is captured is sent to Rueter-Hess Reservoir to use again. There are limited times when Parker WSD's junior water rights are in priority on Cherry Creek. When they are, the water captured goes into Rueter-Hess Reservoir.

4.1.3 Castle Rock Water

Castle Rock Water provides water and wastewater services to the Town of Castle Rock and serves approximately 90,000 residents in and around Castle Rock. That population is expected to increase to 155,000 residents by 2050.

Table 4-7
Castle Rock Water Current Water Demands

Use Type Categories	No. of Active Connections	No. of SFEs	Avg. Annual Usage (AFY)	Notes
Residential Single Family	25,502	24,920	8,383	Based on 0.3364 AFY/SFE
Residential Multi-Family	538	1,637	551	Based on 0.3364 AFY/SFE
Utility/Municipal	0	0	0	
Commercial/Industrial	727	2,179	733	Based on 0.3364 AFY/SFE
Irrigation Only	648	2,068	696	Based on 0.3364 AFY/SFE
Wholesale Water (Providing)	0	0	0	
Wholesale Water (Receiving)	0	0	0	
Total	27,415	30,804	10,362	

Table 4-8
Castle Rock Water Current Water Supplies

Supply Type	Volume (AFY)	Notes
Wholesale Water	3,842	From WISE
Surface Water	5,284	From Plum Creek
Alluvial Well Water	896	From 14 alluvial wells
Denver Basin Groundwater	3,328	From 63 wells
Designated Basin Groundwater	0	
Total (without reuse)	13,350	
Reuse		
Total (with reuse)	13,350	

The water provider indicated that 5,170 AFY of the supply listed above is not reusable.

Table 4-9
Castle Rock Water Projected Demands and Supplies

Period	Demand (AFY)	Supply (AFY)
2024	10,354	13,446
2030	14,121	14,408
2040	16,010	17,847
2050	18,995	20,652

The base supply for Castle Rock consists of surface water, alluvial water and Denver Basin groundwater. There are six connections to other water entities within the system. These connections are for providing and receiving water. Three of the connections can flow either direction, two of the connections only provide water and one of the connections only receives water. Castle Rock is targeting increasing their supplies through participation in the Box Elder project, Chatfield pump-back, and Platte Valley Water Partnership.

4.3 Medium Water Providers

The medium water providers (<10,000 AFY and >1,000 AFY) for Douglas County include:

- Southgate WD
- Pinery WWD
- Meridian MD
- Stonegate Village MD
- Castle Pines North MD
- Roxborough WSD
- Cottonwood WSD

4.3.1 Southgate Water District

Southgate WD is located in the north central region of the county. It serves approximately 80,000 people, however only about 40% of the district is within Douglas County. The data in the following tables only includes the service area in Douglas County.

Table 4-10
Southgate WD Current Water Demands

Use Type Categories	No. of Active Connections	No. of SFEs	Avg. Annual Usage (AFY)	Notes
Residential Single Family	4,144		2,045	
Residential Multi-Family	75		50	
Utility/Municipal	4		26	
Irrigation Only	101		576	
Commercial/Industrial	438		1,657	
Wholesale Water (Provided to others)	0		0	
Wholesale Water (Receiving to others)	0		0	
Total	4,762	8,826	4,354	

Table 4-11
Southgate WD Current Water Supplies

Supply Type	Volume (AFY)	Notes
Wholesale Water	0	
Surface Water	4,354	All from Denver Water
Alluvial Well Water	0	
Denver Basin Groundwater	0	
Designated Basin Groundwater	0	
Total (without reuse)	4,354	
Reuse	0	
Total (with reuse)	4,354	

Table 4-12
Southgate WD Projected Demands and Supplies

Period	Demand (AFY)	Supply (AFY)
2024	4,354	4,354
2030	4,354	4,354
2040	4,354	4,354
2050	4,354	4,354

All water distributed within the Southgate WD is supplied by Denver under a Water Service Agreement dated December 20, 1994, for all customers of all types; the distribution is year-round.

4.3.2 Pinery WWD

The Pinery WWD (also known as Denver Southeast Suburban WSD) provides water and wastewater service to an unincorporated urbanized area in northeastern Douglas County. They serve approximately 5,200 connections.

Over 80 percent of the water demand is met using Denver Basin wells, with the remaining demand met through alluvial well water and wholesale water provided through the WISE system.

Table 4-13
Pinery WWD Current Water Demands

Use Type Categories	No. of Active Connections	No. of SFEs	Avg. Annual Usage (AFY)	Notes
Residential Single-Family	5,063	5,064	2,520	SFE usage is 0.51 AFY
Residential Multi-Family	0	0	0	
Utility/Municipal	6	13	3	
Commercial/Industrial	35	137	85	
Irrigation Only	74	2,403	842	
Total	5,178	7,617	3,450	

Table 4-14
Pinery WWD Current Water Supplies

Supply Type	Volume (AFY)	Notes
Wholesale Water	900	
Surface Water	0	
Alluvial Well Water	2,150	
Denver Basin Groundwater	13,817	
Designated Basin Groundwater	0	
Total (without reuse)	16,867	
Reuse	0	
Total (with reuse)	16,867	

Table 4-15
Pinery WWD Projected Demands and Supplies

Period	Demand (AFY)	Supply (AFY)
2024	3,450	15,964
2030	3,702	15,964
2040	4,097	15,964
2050	4,493	15,964

The primary base supply is alluvial water drawn from the district's eight active alluvial wells, and the water is reported to be of satisfactory quality. Water levels in the alluvial wells dip in the hot, dry summer months but rebound fully in the winter months. Denver Basin water provides some base supply, and some additional water is used during irrigation season to meet the higher demands. Some Denver Basin wells are reported to have elevated iron and manganese levels. The 20 active Denver Basin wells, and some have stayed at steady water levels over the years, while other wells have shown decreases of approximately 3 to 7 feet per year on average. Wholesale water is used to supplement supplies during higher use periods.

4.3.3 Meridian Metropolitan District

Located in the north central region of the county, Meridian MD is a mid-sized provider. They source their water from the Denver Basin and surface water. Meridian MD joined the WISE program in 2019. Meridian MD now uses approximately 2,675 AFY to meet demand. Fully built out, their system supply will total 5,447 AFY. Note that this information is based on a 2020 document that Meridian provided in lieu of a completed survey.

Table 4-16
Meridian MD Current Water Demands

Use Type Categories	No. of Active Connections	No. of SFEs	Avg. Annual Usage (AFY)	Notes
Residential Single Family		2,187	1,268	SFE usage is 0.58 AFY
Residential Multi-Family		3,029	993	
Utility/Municipal			8	
Commercial/Industrial		560	390	
Irrigation Only			16	
Other				
Total		5,776	2,675	

Table 4-17
Meridian MD Current Water Supply

Supply Type	Volume (AFY)	Notes
Wholesale Water	0	
Surface Water	800	
Alluvial Well Water	0	
Denver Basin Groundwater	4,647	
Designated Basin Groundwater	0	
Total (without reuse)	5,447	
Reuse	0	
Total (with reuse)	5,447	

Table 4-18
Meridian MD Projected Demands and Supplies

Period	Demand (AFY)	Supply (AFY)
2024	2,675	5,447
2030	3,253	5,447
2040	3,831	5,447
2050	4,409	5,447

4.3.4 Stonegate Village MD

Located in the northeast region of the county, Stonegate Village MD is a mid-size water provider.

Table 4-19
Stonegate Village MD Current Water Demands

Use Type Categories	No. of Active Connections	No. of SFEs	Avg. Annual Usage (AFY)	Notes
Residential Single Family	3,562	3,562	1,000	
Residential Multi-Family	104	423	140	
Utility/Municipal	0	0	0	
Irrigation Only	59	343	250	
Commercial/Industrial	79	389	225	
Total	3,804	4,717	1,615	

Table 4-20
Stonegate Village MD Current Water Supply

Supply Type	Volume (AFY)	Notes
Wholesale Water	456	
Surface Water	0	
Alluvial Well Water	0	
Denver Basin Groundwater	1,313	
Designated Basin Groundwater	0	
Total (without reuse)	1,769	
Reuse	0	
Total (with reuse)	1,769	

Table 4-21
Stonegate Village MD Projected Demands and Supplies

Period	Demand (AFY)	Supply* (AFY)
2025	2,100	2,300
2030	2,500	2,800
2040	2,600	3,200
2050	2,700	3,300

The Stonegate Village MD's water portfolio includes 2,491.5 ac-ft of decreed Denver Basin groundwater rights. Approximately 2,000 ac-ft per year has been developed to date. The district also receives water from WISE, in an average amount of 1,000 AFY with some variable volume subject to annual availability. The district has three decreed, but not-yet constructed alluvial wells along Cherry Creek. The district is actively working on demand reduction programs aiming to decrease the outdoor irrigation use within their boundaries.

4.3.5 Castle Pines North MD

Castle Pines North MD is just north of the Castle Pines MD. They service approximately 12,000 residents within approximately 2,660 acres.

Table 4-22
Castle Pines North MD Current Water Demands

Use Type Categories	No. of Active Connections	No. of SFEs	Avg. Annual Usage (AFY)	Notes
Residential Single Family	3,785	3,789	1,478	SFE demand of 0.39 AFY/SFE
Residential Multi-Family	89	266	104	SFE demand of 0.39 AFY/SFE
Utility/Municipal	0	0	0	
Commercial/Industrial	68	341	133	SFE demand of 0.39 AFY/SFE
Irrigation Only	100	436	148	Total demands to golf course
Total	4,042	4,832	1,862	

Table 4-23
Castle Pines North MD Current Water Supply

Supply Type	Volume (AFY)	Notes
Wholesale Water	333	From Highlands Ranch Water
Surface Water	0	
Alluvial Well Water	0	
Denver Basin Groundwater	3,176	
Designated Basin Groundwater	0	
Total (without reuse)	3,509	
Reuse	0	
Total (with reuse)	3,509	

Table 4-24
Castle Pines North MD Projected Demands and Supplies

Period	Demand (AFY)	Supply (AFY)
2024	2,100	3,509
2030	2,100	3,509
2040	2,100	3,509
2050	2,100	3,509

About 10 percent of the Castle Pines North MD water is supplied from the South Platte River via Highlands Ranch WSD and the other 90 percent is supplied from Denver Basin wells. The main water quality report is the presence of manganese and iron; Castle Pines North uses their own water treatment facility. Both water sources (surface water and Denver Basin water) are 100% reusable. Wastewater is treated by the Plum Creek Water Reclamation Authority, and the treated wastewater return flows are used as the primary source of irrigation for the Ridge golf course.

4.3.6 Roxborough WSD

Roxborough WSD is located in the northwest portion of Douglas County. They provide water and wastewater services to approximately 10,000 people.

Table 4-25
Roxborough WSD Current Water Demands

Use Type Categories	No. of Active Connections	No. of SFEs	Avg. Annual Usage (AFY)	Notes
Residential Single Family	3,794	3,794	978	SFE usage is 0.29 AFY
Residential Multi-Family	99	99	29	
Utility/Municipal	48	48	14	
Commercial/Industrial	155	155	43	
Irrigation Only	44	44	15	
Wholesale Water to Others	2		266	Irrigation to Arrowhead and Metro District
Total	4,142	4,140	1,345	

Table 4-26
Roxborough WSD Current Water Supply

Supply Type	Volume (AFY)	Notes
Wholesale Water	0	
Surface Water	2,235	
Alluvial Well Water	0	
Denver Basin Groundwater	0	
Designated Basin Groundwater	0	
Total (without reuse)	2,235	
Reuse	0	
Total (with reuse)	2,235	

Table 4-27
Roxborough WSD Projected Demands and Supplies

Period	Demand (AFY)	Supply (AFY)
2024	1,428	2,235
2030	1,491	2,235
2040	1,563	2,235
2050	1,636	2,235

Roxborough WSD has an agreement with the City of Aurora that grants a maximum of 2,235 AFY at a flow rate not to exceed 6 MGD. The water provided through the agreement is primarily snowmelt and is first run surface water from Strontia Springs Reservoir and Aurora Rampart Reservoir. This water is used to meet all demands, potable and irrigation, throughout the district.

4.3.7 Cottonwood WSD

Cottonwood WSD is located in the northeast region of the county north of the Town of Parker. They provide water and wastewater services to approximately 11,000 people.

Table 4-28
Cottonwood WSD Current Water Demands

Use Type Categories	No. of Active Connections	No. of SFEs	Avg. Annual Usage (AFY)	Notes
Residential Single Family	2,167	2,167	454	SFE usage is 0.24 AFY
Residential Multi-Family	127	2,046	225	SFE usage is 0.12 AFY
Utility/Municipal	0	0	5	
Commercial/Industrial	68	1,100	266	SFE estimated using 0.24 AFY/SFE
Irrigation Only	0	0	280	
Total	2,362	5,313	1,230	

Table 4-29
Cottonwood WSD Current Water Supply

Supply Type	Volume (AFY)	Notes
Wholesale Water	894	
Surface Water	0	
Alluvial Well Water	0	
Denver Basin Groundwater	172	
Designated Basin Groundwater	0	
Total (without reuse)	1,066	
Reuse	647	
Total (with reuse)	1,713	

Table 4-30
Cottonwood WSD Projected Demands and Supplies

Period	Demand (AFY)	Supply (AFY)
2024	1,230	2,344
2030	1,744	2,263
2040	1,812	2,162
2050	1,812	2,062

Cottonwood WSD base water is supplied from wholesale water. Alluvial water is used for irrigation-only base water. During higher demand time periods, Denver Basin water is used to meet the additional demand. Five out of 20 Denver Basin wells have been developed within the district's boundaries; all five wells have been developed in the Arapahoe Aquifer.

4.4 Minor Water Providers

The minor water providers for Douglas County, with demands less than 1,000 AFY, include:

- Arapahoe County WWA
- Aurora Water
- Beverly Hills Mutual Water Co.
- Castle Pines MD
- Castleton Center WSD
- Chatfield South WD
- City of Littleton
- Dominion WSD
- Inverness WSD
- Louviers WSD
- Northern Douglas County WSD
- Perry Park WSD

- Sedalia WSD
- Sierra Vista Douglas Water
- Silver Heights WSD
- Solitude MD
- Southwest Metro WSD
- Thunderbird WSD
- Town of Larkspur
- View Ridge Mutual Water
- Westcreek Lakes WD

	Demand	Supply
Current (2024)	5,326	13,565
2030	6,989	14,807
2040	8,908	15,456
2050	9,988	15,733

*All Minor Water Providers Combined

4.4.1 Arapahoe County WWA

The Arapahoe County WWA provides water to a small portion of Douglas County in the central north area. They serve water to the Douglas County Industrial Park and Highfield Business Park located North of the E-470 Toll Road and report having just 71 connections within the county boundary.

The supply consists of wholesale water, alluvial water, and Denver Basin groundwater. Wholesale water provides for base supply and irrigation demands. Alluvial water provides for irrigation demands and peaking demands. Denver Basin groundwater provides for some small base supply and peaking demands.

Arapahoe County WWA has one active alluvial well within Douglas County. It's supply trends with the hydrologic conditions in Cherry Creek.

Table 4-31
Arapahoe County WWA Current Water Demands

Use Type Categories	No. of Active Connections	No. of SFEs	Avg. Annual Usage (AFY)	Notes
Residential Single Family				
Residential Multi-Family				
Utility/Municipal				
Irrigation Only				
Commercial/Industrial	71	240	127	
Total	71	240	127	

Table 4-32
Arapahoe County WWA Current Water Supplies

Supply Type	Volume (AFY)	Notes
Wholesale Water	2,640	
Surface Water	0	
Alluvial Well Water	400	
Denver Basin Groundwater	1,600	
Designated Basin Groundwater	0	
Total (without reuse)	4,640	
Reuse	0	
Total (with reuse)	4,640	

Table 4-33
Arapahoe County WWA Projected Demands and Supplies

Period	Demand (AFY)	Supply* (AFY)
2024	127	127
2030	151	151
2040	151	151
2050	151	151

*Supply shown is sufficient for demands in a small portion of the service area.

Source:
https://www.google.com/maps/d/u/0/viewer?mid=1FFr9fuXZux0YSnwTVWvE9wzmZzZLTYg&ll=39.56405782520376%2C-104.816980438446 05&z=14

4.4.2 Aurora Water

The City of Aurora provides water to residents within their service boundaries, a small portion of which is within the Douglas County boundary; the exact number of connections was not provided. Their service region in Douglas County is in the northeastern portion of the county.

Base water is primarily sourced from surface water from the Colorado River Basin, Arkansas River Basin and South Platte River Basin. Aurora Water's groundwater consists of Cherry Creek alluvial and non-tributary groundwater wells, which typically operate during the summer to assist with water quality and peak demands. Demands and supplies shown are a prorated share of their totals based on Aurora's land area that lies within Douglas County.

Table 4-34
Aurora Water Current Demands

Use Type Categories	No. of Active Connections	No. of SFEs	Avg. Annual Usage (AFY)	Notes
Residential Single Family			272	
Residential Multi-Family			272	
Utility/Municipal				
Irrigation Only			84	
Commercial/Industrial			195	
Wholesale Water (Provided)			142	
Total	0	5,263	965	

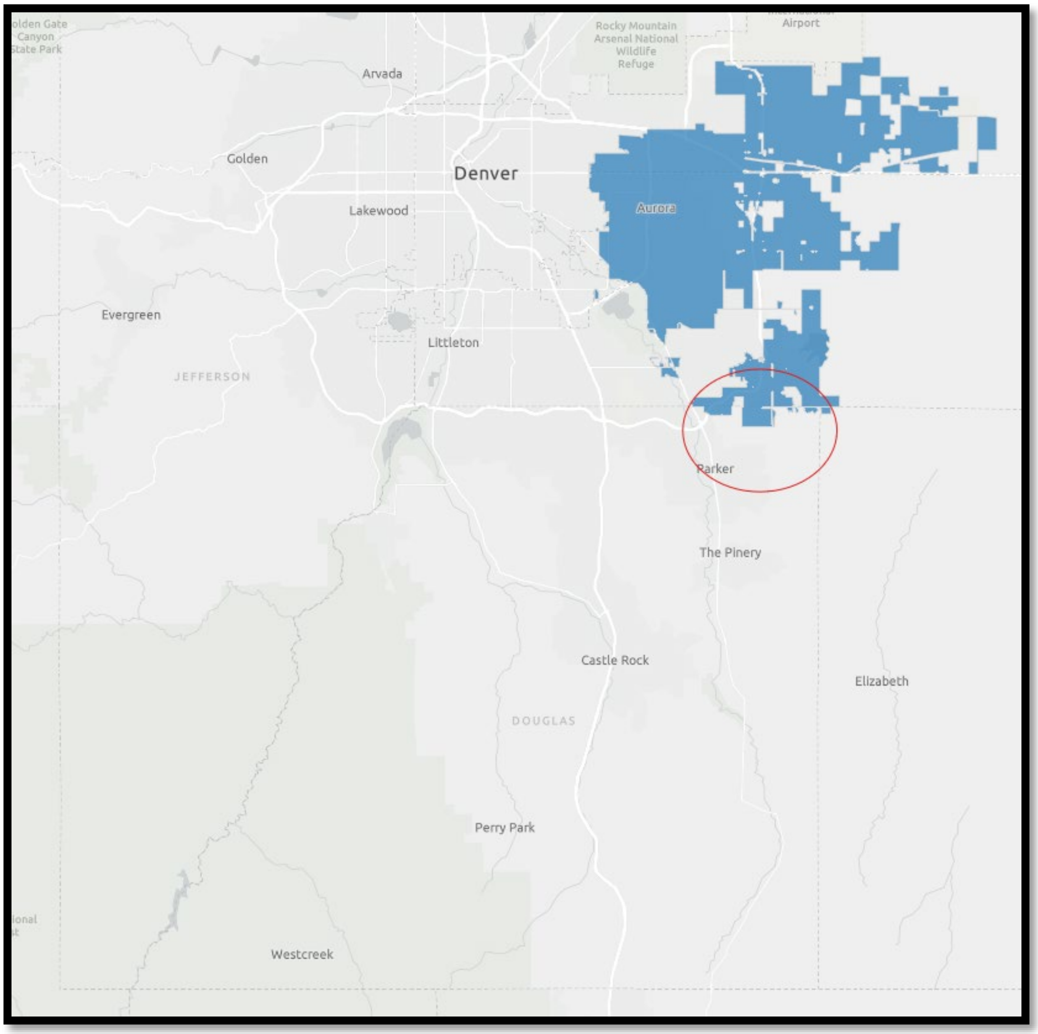
Table 4-35
Aurora Water Current Supplies

Supply Type	Volume (AFY)	Notes
Wholesale Water		
Surface Water	1,000	95% of supply
Alluvial Well Water		
Denver Basin Groundwater		
Designated Basin Groundwater	0	
Total (without reuse)	1,000	
Reuse	0	
Total (with reuse)	1,053	

Table 4-36
Aurora Water Projected Demands and Supplies

Period	Demand (AFY)	Supply* (AFY)
2024	1,053	1,053
2030	1,099	1,099
2040	1,177	1,177
2050	1,255	1,255

*Supply shown is sufficient for demands in a small portion of the service area.



Source:https://data-auroraco.opendata.arcgis.com/datasets/AuroraCo::water-service-area-boundary/explore?location=39.489521%2C-104.770886%2C9.26

4.4.3 Beverly Hills MWC

Beverly Hills MWC provides water to the Beverly Hills community just west of I-25 approximately 6 miles south of the I-25 and CO-470 Interchange. Beverly Hills serves a small number of residents; approximately 325 people live within the community according to the Colorado Department of Public Health and Environment (CDPHE) 2025 Monitoring Schedule.

Beverly Hills MWC is a rural water provider in rural water district 4 of Douglas County.

Source: https://rwadc.specialdistrict.org/files/3c12ef818/Rural-Water-Providers-17X22-50dpi.pdf?get_file=true

4.4.4 Castle Pines MD

Castle Pines MD provides water to residents within the Castle Pines area. The district is approximately 3,050 Acres. This district is just west of I-25 between Exit 187 and Exist 185, roughly. There are approximately 1900 SFEs in the district. Denver Basin groundwater is the sole water supply.

Table 4-37
Castle Pines MD Current Demands

Use Type Categories	No. of Active Connections	No. of SFEs	Avg. Annual Usage (AFY)	Notes
Residential Single Family		1,897	949	
Residential Multi-Family		0	0	
Utility/Municipal		0	0	
Irrigation Only		1	60	
Commercial/Industrial		0	0	
Total	0	1,898	1,009	

Table 4-38
Castle Pines MD Current Supplies

Supply Type	Volume (AFY)	Notes
Wholesale Water	0	
Surface Water	0	
Alluvial Well Water	0	
Denver Basin Groundwater	1,245	
Designated Basin Groundwater	0	
Total (without reuse)	1,245	
Reuse	0	
Total (with reuse)	1,245	

Table 4-39
Castle Pines MD Projected Demands and Supplies

Period	Demand (AFY)	Supply (AFY)
2024	1,065	1,508
2030	1,119	1,585
2040	1,119	1,585
2050	1,119	1,585

4.4.5 Castleton Center WSD

The Castleton Center WSD is a small provider in Douglas County Rural Water District 5. CCWSD is located between Sante Fe Drive and I-25 in Castle Rock. The district has 21 active connections. The water supply is from tank storage and water rights.

Table 4-40
Castleton Center WSD Current Demands

Use Type Categories	No. of Active Connections	No. of SFEs	Avg. Annual Usage (AFY)	Notes
Residential Single Family	0	0	0	
Residential Multi-Family	0	0	0	
Utility/Municipal	0	0	0	
Irrigation Only	0	0	0	
Commercial/Industrial	21	21	13	
Total	21	21	13	

Table 4-41
Castleton Center WSD Current Supplies

Supply Type	Volume (AFY)	Notes
Wholesale Water	0	
Surface Water	0	
Alluvial Well Water	0	
Denver Basin Groundwater	13	
Designated Basin Groundwater	0	
Total (without reuse)	13	
Reuse	0	
Total (with reuse)	13	

Table 4-42
Castleton Center WSD Projected Demands and Supplies

Period	Demand (AFY)	Supply (AFY)
2024	13	13
2030	24	24
2040	28	28
2050	32	32

4.4.6 Chatfield South WD

Chatfield South WD is in the northwest corner of Douglas County. They are a rural water provider in Rural Water District 4 of Douglas County. They have 139 active connections. All water is supplied by Denver Water. The water is used for potable and irrigation.

Table 4-43
Chatfield South WD Current Demands

Use Type Categories	No. of Active Connections	No. of SFEs	Avg. Annual Usage (AFY)	Notes
Residential Single Family	139	139	30	
Residential Multi-Family	0	0	0	
Utility/Municipal	0	0	0	
Irrigation Only	0	0	0	
Commercial/Industrial	0	0	0	
Total	139	139	30	

Table 4-44
Chatfield South WD Current Supplies

Supply Type	Volume (AFY)	Notes
Wholesale Water	69	
Surface Water	0	
Alluvial Well Water	0	
Denver Basin Groundwater	0	
Designated Basin Groundwater	0	
Total (without reuse)	69	
Reuse	0	
Total (with reuse)	69	

Table 4-45
Chatfield South WD Projected Demands and Supplies

Period	Demand (AFY)	Supply (AFY)
2024	30	35
2030	31	35
2040	31	35
2050	31	35

4.4.7 City of Littleton

Very little of the City of Littleton lies within the Douglas County boundary. A small portion of water is provided to the residents between County Line Road and the Highlands Ranch WSD boundary.

4.4.8 Dominion WSD

Located in the northwest region of the county. Dominion has 2,448 active connections consisting of residential (single and multi-family), municipal, commercial/industrial and irrigation-only. Dominion WSD sources water from wholesale, surface water and firming supplies.

Table 4-46
Dominion WSD Current Demands

Use Type Categories	No. of Active Connections	No. of SFEs	Avg. Annual Usage (AFY)	Notes
Residential Single Family	2,151	1,367	328	
Residential Multi-Family	260	138	33	
Utility/Municipal	3	23	6	
Irrigation Only	28	573	137	
Commercial/Industrial	6	125	30	
Wholesale Water (provided)	0	0	198	
Total	2,449	2,226	732	

Table 4-47
Dominion WSD Current Supplies

Supply Type	Volume (AFY)	Notes
Wholesale Water	1,680	
Surface Water	374	
Alluvial Well Water	0	
Denver Basin Groundwater	507	
Designated Basin Groundwater	0	
Total (without reuse)	2,561	
Reuse	0	
Total (with reuse)	2,561	

Table 4-48
Dominion WSD Projected Demands and Supplies

Period	Demand (AFY)	Supply (AFY)
2024	732	2,561
2030	1,652	3,253
2040	2,953	3,776
2050	3,837	4,091

4.4.9 Inverness WSD

Located in the northeast region of the county, Inverness WSD is a small provider with 382 connections. The base water supply is from wholesale and reuse with supplements from Denver Basin wells during peak demand.

Table 4-49
Inverness WSD Current Demands

Use Type Categories	No. of Active Connections	No. of SFEs	Avg. Annual Usage (AFY)	Notes
Residential Single Family	0	0	0	
Residential Multi-Family	73	0	188	
Utility/Municipal	0	0	2	
Irrigation Only	153	0	907	
Commercial/Industrial	154	0	288	
Wholesale Water (receiving)	2	0	801	
Total	382	0	2,186	

Table 4-50
Inverness WSD Current Supplies

Supply Type	Volume (AFY)	Notes
Wholesale Water	1,097	
Surface Water	0	
Alluvial Well Water	155	
Denver Basin Groundwater	250	
Designated Basin Groundwater	0	
Total (without reuse)	1,502	
Reuse	546	
Total (with reuse)	2,048	

Table 4-51
Inverness WSD Projected Demands and Supplies

Period	Demand (AFY)	Supply (AFY)
2024	1,447	3,463
2030	2,003	3,558
2040	2,435	3,602
2050	2,435	3,482

4.4.10 Louviers WSD

Louviers WSD is small provider with 113 active connections in the rural central west portion of the county. The district meets demands solely through treatment of Denver Basin groundwater.

Table 4-52
Louviers WSD Current Demands

Use Type Categories	No. of Active Connections	No. of SFEs	Avg. Annual Usage (AFY)	Notes
Residential Single Family	110	110	34	
Residential Multi-Family	0	0	0	
Utility/Municipal	0	0	0	
Irrigation Only	2	2	1	
Commercial/Industrial	1	1	0	
Wholesale Water (receiving)	0	0	0	
Total	113	113	35	

Table 4-53
Louviers WSD Current Supplies

Supply Type	Volume (AFY)	Notes
Wholesale Water	0	
Surface Water	0	
Alluvial Well Water	0	
Denver Basin Groundwater	35	
Designated Basin Groundwater	0	
Total (without reuse)	35	
Reuse	0	
Total (with reuse)	35	

Table 4-54
Louviers WSD Projected Demands and Supplies

Period	Demand (AFY)	Supply (AFY)
2024	35	150
2030	35	150
2040	35	150
2050	35	150

4.4.11 Northern Douglas County WSD

Northern Douglas County WSD is a very small connector to Highlands Ranch WSD. Northern Douglas County WSD's demands and supplies are included in the Highlands Ranch WSD totals.

4.4.12 Perry Park WSD

Located in the southern portion of Douglas County, Perry Park WSD has 1, 569 active connections within their system. The district meets demands through treatment from alluvial wells. In 2010, the district switched from the Glen Grove WTP to the Sageport WTP due to the CDPHE determining that the facility treating the water needed to meet the groundwater under direct influence of surface water treatment requirements, and that significantly impacted the treatment capacity for the plant. Now, Denver Basin groundwater from the Sageport WTP is conveyed to West Perry Park to meet demands. The primary source of potable water is Denver Basin groundwater treated at the Sageport WTP.

Table 4-55
Perry Park WSD Current Demands

Use Type Categories	No. of Active Connections	No. of SFEs	Avg. Annual Usage (AFY)	Notes
Residential Single Family	1,559	1,559	515	
Residential Multi-Family	0	0	0	
Utility/Municipal	0	0	0	
Irrigation Only	0	0	0	
Commercial/Industrial	10	10	11	
Wholesale Water (receiving)	0	0	0	
Total	1,569	1,569	525	

Table 4-56
Perry Park WSD Current Supplies

Supply Type	Volume (AFY)	Notes
Wholesale Water	0	
Surface Water	126	
Alluvial Well Water	0	
Denver Basin Groundwater	399	
Designated Basin Groundwater	0	
Total (without reuse)	525	
Reuse	0	
Total (with reuse)	525	

Table 4-57
Perry Park WSD Projected Demands and Supplies

Period	Demand (AFY)	Supply (AFY)
2024	525	4,359
2030	559	4,656
2040	642	4,656
2050	724	4,656

4.4.13 Sedalia WSD

Located in northern central west of Douglas County, Sedalia WSD is a small provider with just 92 active connections in their system. The district relies on two in-service wells to provide water to their system. The District's Arapahoe Well is approximately 1,080 feet deep and is the larger of the two wells. Water from both wells is chlorinated at the Arapahoe Well House and stored in the district's 142,000-gallon steel tank. The District's Alluvial Well No. 1 draws water from the alluvium tributary to East Plum Creek. That well is approximately 40 feet deep and requires filtration due to high mineral content.

Table 4-58
Sedalia WSD Current Demands

Use Type Categories	No. of Active Connections	No. of SFEs	Avg. Annual Usage (AFY)	Notes
Residential Single Family	67	67	22	
Residential Multi-Family	0	0	0	
Utility/Municipal	0	0	0	
Irrigation Only	0	0	0	
Commercial/Industrial	25	25	10	
Wholesale Water (receiving)	0	0	0	
Total	92	92	32	

Table 4-59
Sedalia WSD Current Supplies

Supply Type	Volume (AFY)	Notes
Wholesale Water	0	
Surface Water	0	
Alluvial Well Water	2	
Denver Basin Groundwater	0	
Designated Basin Groundwater	32	
Total (without reuse)	34	
Reuse	0	
Total (with reuse)	34	

Table 4-60
Sedalia WSD Projected Demands and Supplies

Period	Demand (AFY)	Supply (AFY)
2024	37	34
2030	45	34
2040	60	34
2050	75	34

Sedalia WSD is reviewing long range master planning for water supply. There are five viable options to increase water supplies, but no current plans are in place to bring additional water supplies online at this time.

4.4.14 Sierra Vista Douglas MWC

Located in the northeast region of the county, Sierra Vista Douglas MWC is a small provider with just 48 connections. The district has one community well. The well has maintained its static water level over the years. Summertime level drops but recharges during winter months.

Table 4-61
Sierra Vista Douglas MWC Current Demands

Use Type Categories	No. of Active Connections	No. of SFEs	Avg. Annual Usage (AFY)	Notes
Residential Single Family	48	48	60	
Residential Multi-Family	0	0	0	
Utility/Municipal	0	0	0	
Irrigation Only	0	0	0	
Commercial/Industrial	0	0	0	
Wholesale Water (receiving)	0	0	0	
Total	48	48	60	

Table 4-62
Sierra Vista Douglas MWC Current Supplies

Supply Type	Volume (AFY)	Notes
Wholesale Water	0	
Surface Water	0	
Alluvial Well Water	0	
Denver Basin Groundwater	60	
Designated Basin Groundwater	0	
Total (without reuse)	60	
Reuse	0	
Total (with reuse)	60	

Table 4-63
Sierra Vista Douglas MWC Projected Demands and Supplies

Period	Demand (AFY)	Supply (AFY)
2024	60	60
2030	60	60
2040	60	60
2050	60	60

4.4.15 Silver Heights WSD

Located just northeast of the Town of Castle Rock boundary, Silver Heights WSD is a small provider with just 112 active connections. The water is supplied from two Arapahoe wells. The well levels have significantly dropped but are currently holding. Water is used mainly for potable water as the water bills were high enough that most residents have significantly reduced or eliminated water consumption for irrigation.

Table 4-64
Silver Heights WSD Current Demands

Use Type Categories	No. of Active Connections	No. of SFEs	Avg. Annual Usage (AFY)	Notes
Residential Single Family	111	0	39	
Residential Multi-Family	0	0	0	
Utility/Municipal	0	0	0	
Irrigation Only	1	0	0	
Commercial/Industrial	0	0	0	
Wholesale Water (receiving)	0	0	0	
Total	112	0	39	

Table 4-65
Silver Heights WSD Current Supplies

Supply Type	Volume (AFY)	Notes
Wholesale Water	0	
Surface Water	0	
Alluvial Well Water	0	
Denver Basin Groundwater	39	
Designated Basin Groundwater	0	
Total (without reuse)	39	
Reuse	0	
Total (with reuse)	39	

Table 4-66
Silver Heights WSD Projected Demands and Supplies

Period	Demand (AFY)	Supply (AFY)
2024	39	39
2030	40	39
2040	40	39
2050	40	39

4.4.16 Solitude MD

Solitude MD is a small provider in central Douglas County. They have approximately 224 active connections, estimated from the 2002 service plan.

4.4.17 Southwest Metro WSD

Located in the northwest region of the county, Southwest Metro WSD is a small provider just west of the Highlands Ranch WSD boundary.

4.4.18 Thunderbird WSD

Thunderbird WSD is a smaller provider located in the central west of the county. The district has 180 active connections. The sole supply of water comes from Denver Basin groundwater. There are plans for a new Arapahoe aquifer well in 2026 or 2027.

Table 4-67
Thunderbird WSD Current Demands

Use Type Categories	No. of Active Connections	No. of SFEs	Avg. Annual Usage (AFY)	Notes
Residential Single Family	180	180	43	
Residential Multi-Family	0	0	0	
Utility/Municipal	0	0	0	
Irrigation Only	1	0	0	
Commercial/Industrial	0	0	0	
Wholesale Water (receiving)	0	0	0	
Total	181	180	43	

Table 4-68
Thunderbird WSD Current Supplies

Supply Type	Volume (AFY)	Notes
Wholesale Water	0	
Surface Water	0	
Alluvial Well Water	0	
Denver Basin Groundwater	43	
Designated Basin Groundwater	0	
Total (without reuse)	43	
Reuse	0	
Total (with reuse)	43	

Table 4-69
Thunderbird WSD Projected Demands and Supplies

Period	Demand (AFY)	Supply (AFY)
2024	43	43
2030	43	43
2040	43	43
2050	43	43

4.4.19 Town of Larkspur

The Town of Larkspur is a small provider in the southern portion of Douglas County. There are 106 active connections in the system. The water is supplied from the Denver Basin. There are three wells associated with the Town of Larkspur; one in the Denver aquifer and two in the Arapahoe aquifer.

Table 4-70
Town of Larkspur Current Demands

Use Type Categories	No. of Active Connections	No. of SFEs	Avg. Annual Usage (AFY)	Notes
Residential Single Family	72	72	81	
Residential Multi-Family	1	1	1	
Utility/Municipal	0	0	0	
Irrigation Only	5	5	6	
Commercial/Industrial	28	28	31	
Wholesale Water (receiving)	0	0	0	
Total	106	106	119	

Table 4-71
Town of Larkspur Current Supplies

Supply Type	Volume (AFY)	Notes
Wholesale Water	0	
Surface Water	0	
Alluvial Well Water	0	
Denver Basin Groundwater	119	
Designated Basin Groundwater	0	
Total (without reuse)	119	
Reuse	0	
Total (with reuse)	119	

Table 4-72
Town of Larkspur Projected Demands and Supplies

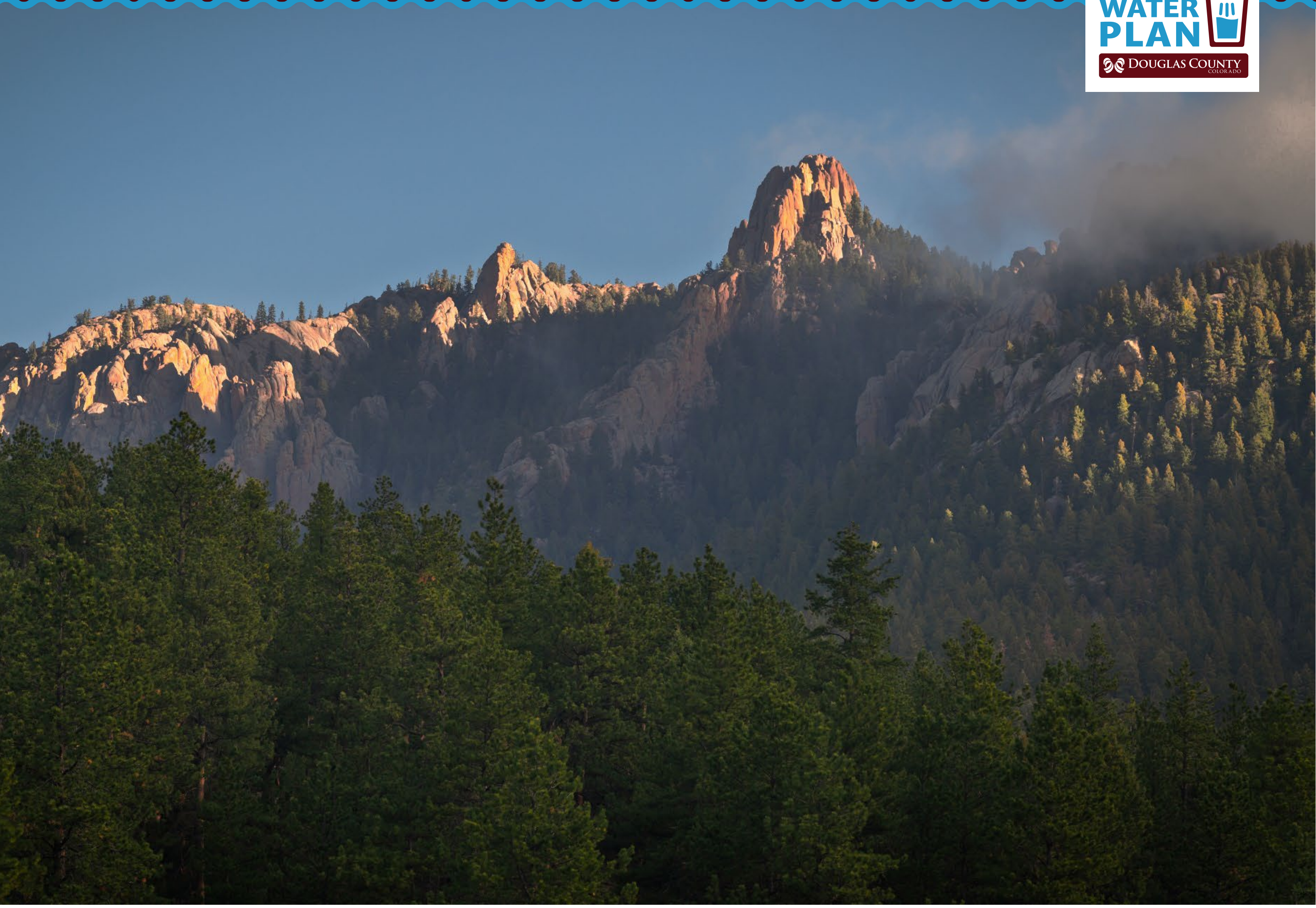
Period	Demand (AFY)	Supply (AFY)
2024	120	120
2030	128	120
2040	134	120
2050	151	120

4.4.20 View Ridge MWC

Located in the northwest region of the county, View Ridge MWC is a small provider with approximately 35 active connections according to the CDPHE 2025 Monitoring Schedule.

4.4.21 Westcreek Lakes WD

Located in the southwestern portion of Douglas County, Westcreek Lakes WD is a small provider with approximately 165 active connections according to the CDPHE 2025 Monitoring Schedule.



CHAPTER 5
PROJECTED WATER DEMANDS

CHAPTER 5 - PROJECTED WATER DEMANDS

In this chapter, the methodology of applying the Douglas County population projections to determine projected water demands is provided. The projections are compared to current water demands and identified by where the growth is expected to occur.

5.1 Current Population

The County's current population and distribution are listed in Table 5-1. Note that over half of the population resides in unincorporated areas.

Table 5-1
Current Population Distribution

Area	2024 Population
Aurora (Part)	4,287
Castle Pines	15,121
Castle Rock	83,497
Larkspur	204
Littleton (Part)	623
Lone Tree	14,682
Parker	66,704
Unincorporated Douglas County	208,912
Total	394,030

5.2 Population Projections

This section expands upon the Chapter 3 population projection summary for Douglas County. The growth projections were calculated using two methods, as shown in Table 5-2:

1. Comprehensive Plan: The 2019 Comprehensive Plan included population estimates and projections as shown in the table. The basis of the projections is not indicated in the Plan.
2. Colorado State Demographers Office (SDO): The SDO released its latest population estimates (for 2024) and projections (through 2060) in October 2025. These numbers are presented as the SDO column in the table. Note that these values are also used in the draft 2025 Douglas County Transportation Plan.

Table 5-2 shows that the more recent population projections show a higher growth rate than used in the Comprehensive Plan.

Table 5-2
Overall County Population Projections

Year	2019 Comprehensive Plan	2025 SDO Projections/ Trans. Plan
2010	285,465	287,124
2020	352,000	360,315
2025	385,000	401,211
2030	418,000	436,921
2040	484,000	501,601
2050		550,552

The two methods of population projecting resulted in different populations for the year 2050 with the SDO projection resulting in a larger population projection. For this Water Master Plan, the higher population projections from the SDO will be used to determine projected demands more conservatively with respect to water supplies.

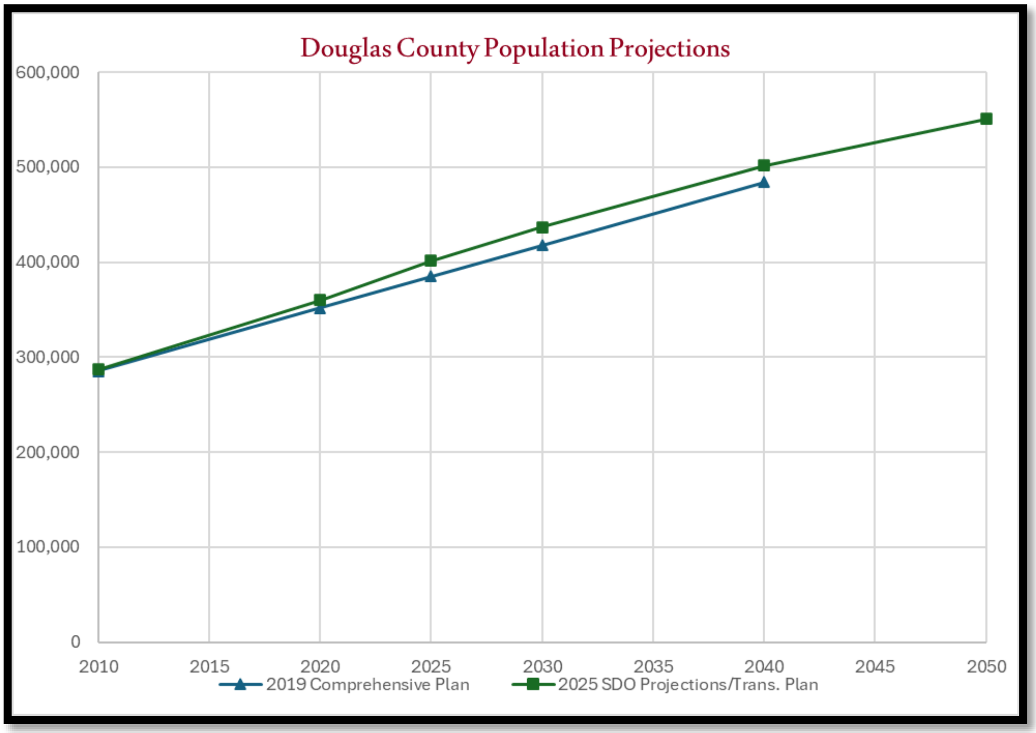


Figure 5-1. Douglas County population projections.

[Show where growth is expected to occur in the county--make a "heat map" using the provider survey responses.]

5.3 Current Demands

Douglas County was evaluated as a whole; the current demands were gathered from survey responses from water providers throughout the county. As noted in Chapter 4, five minor water providers did not respond to the WMP survey. Nonresponsive providers' demands were estimated using the equation shown. In addition, exempt well users were each estimated to use 0.75 AFY. The current demand within Douglas County from all providers and wells users is shown in Table 5-3 and Figure 5-2.

Estimated Demand, Nonresponsive Water Providers

[749 Connections] x [2.15 Assumed People/SFE] x [0.51] = 178 AFY

Table 5-3
Current Demands Summary

Item	Annual Volume (AFY)	Average Daily Volume (MGD)
Survey Responsive	67,250	60.0
Survey Non-Responsive	178	0.2
Exempt Wells	6,440	5.7
Total Water Demand	**73,868**	**65.9**
Unit Demand per Capita	0.19	167 GPCD

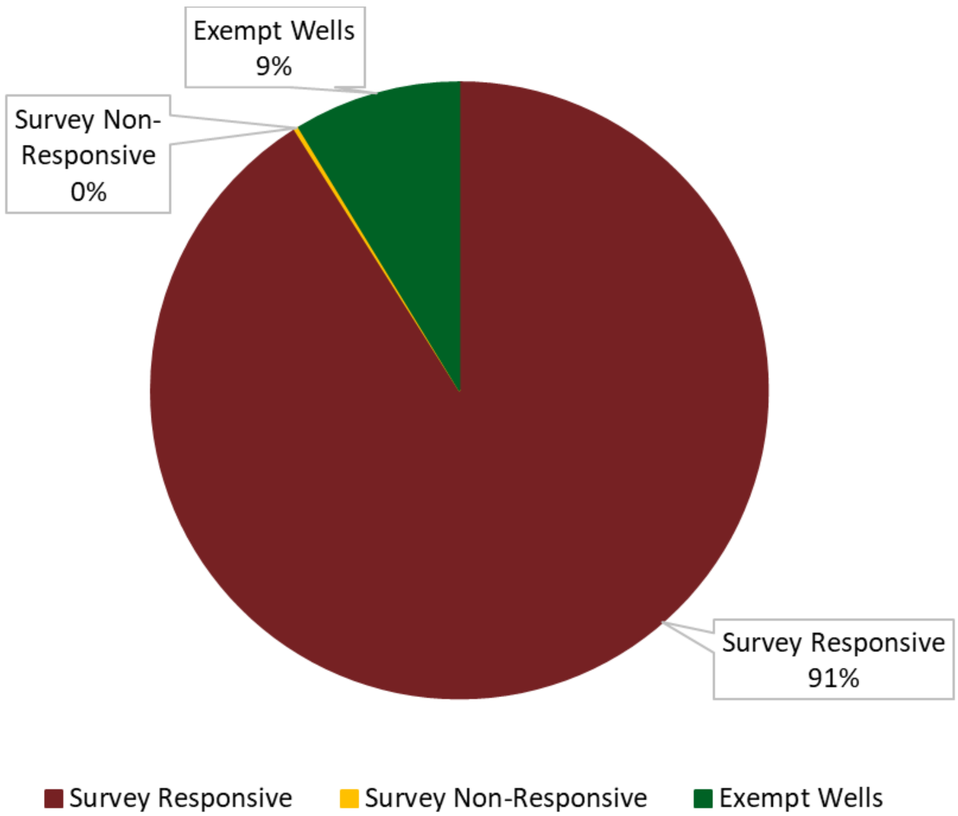


Figure 5-2. Douglas County Water Demands.

Table 5-4
Current Demands Details

Water Provider	Residential Single Family (AFY)	Residential Multi-Family (AFY)	Utility/ Municipal (AFY)	Commercial/ Industrial (AFY)	Irrigation Only (AFY)	Wholesale Water to Others (AFY)	Other (AFY)	Total (AFY)
Major Providers								
Highlands Ranch Water	12,500	3,400		600	2,000		1,500	20,000
Parker WSD	5,853	862		2,120	520	3,853	25	13,233
Castle Rock Water	8,383	551		733	696			10,363
Medium Providers								
Southgate WD	2,045	50	26	1,657	576			4,354
Pinery WWD	2,520		3	85	842			3,450
Meridian MD	1,268	993	8	390	16			2,675
Stonegate Village MD	1,000	140		225	250			1,615
Castle Pines North MD	1,478	104		133	148			1,863
Roxborough WSD	978	29	14	43	15	266		1,345
Cottonwood WSD	454	225	5	266	280			1,230
Small Providers								
Arapahoe County WWA				127				127
Aurora Water	272	272		195	84			823
Beverly Hills MWC								0
Castle Pines MD	949				60			1,009
Castleton Center WSD				13				13
Chatfield South WD	30							30
Littleton								0
Dominion WSD	328	33	6	30	137	198		732
Inverness WSD		188	2	288	907			1,385
Louviers WSD	34				1			35
Northern Douglas County WSD								0
Perry Park WSD	515			11				526
Sedalia WSD	22			10				32
Sierra Vista Douglas MWC	60							60
Silver Heights WSD	39							39
Solitude WSD								0
Southwest Metro WSD								0
Thunderbird WSD	43							43
Town of Larkspur	81	1		31	6			119
View Ridge MWC								0
Westcreek Lakes WD								0
Individual Systems								
Exempt Wells	6,440							6,440
Total	45,292	6,848	64	6,957	6,538		1,525	71,541

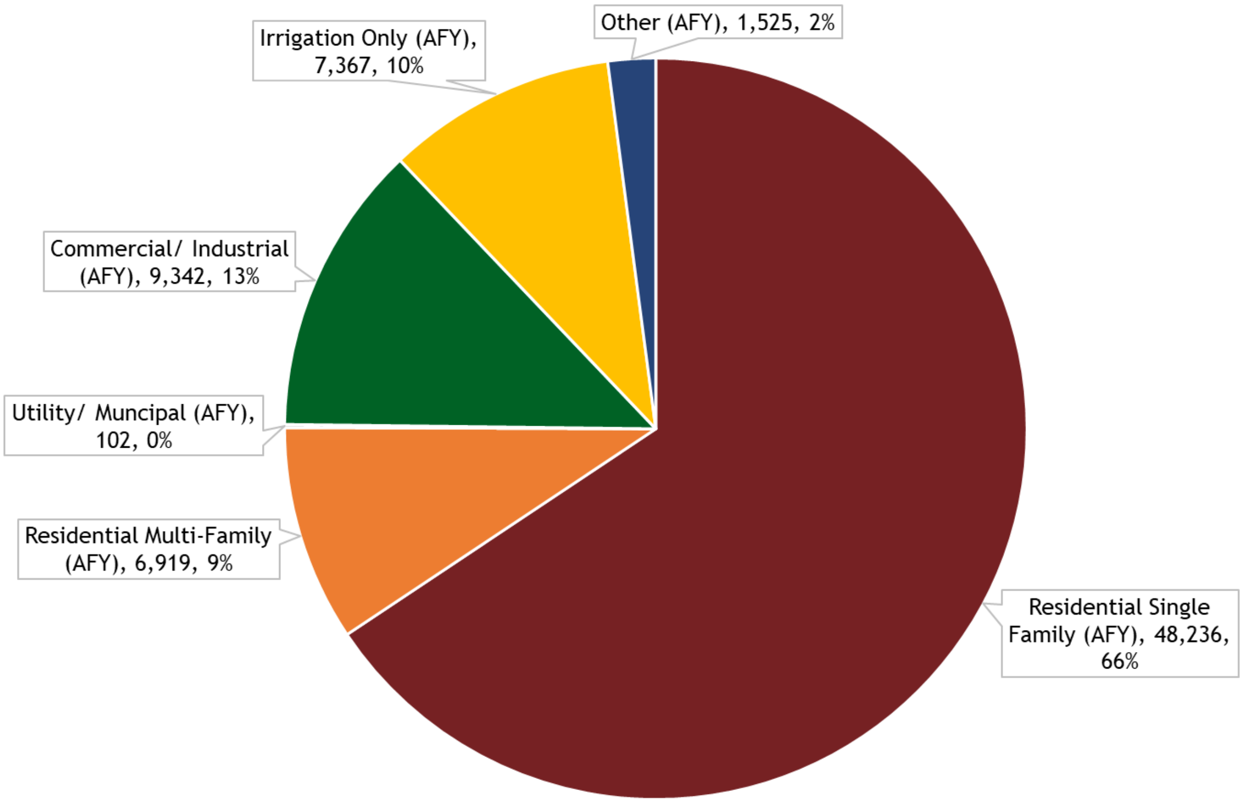


Figure 5-3: Current Douglas County Demands by Customer Type

5.4 Projected Demands

The demand projections are calculated using two methods for comparison: (1) future population as projected by the SDO times the unit demand per capita value listed in Table 5-3 [0.19 AFY/CAP], and (2) the summary of future projections listed by the water providers in the surveys along with estimated demands from nonresponsive water providers and exempt well users, which are increased at the same rate as the provider survey demands. Both methods are shown in Table 5-5.

Table 5-5
Demand Projections Summary

Year	Population	Demand as Calculated per Population (AFY)	Demand as Calculated per Provider Surveys			
			Provider Demand (AFY)	Provider Non-Responsive Demand (AFY)	Exempt Wells Demand (AFY)	Total Demand (AFY)
2025	401,211	**73,868**	67,250	178	6,440	**73,868**
2030	436,921	**81,909**	77,222	197	7,141	**84,560**
2040	501,601	**94,034**	85,578	227	8,198	**94,003**
2050	550,552	**103,211**	93,014	249	8,998	**102,261**

The two methods to project water demands are really very close with differences of only 3.2, 0.03, and 0.9 percent for 2030, 2040 and 2050 respectively. The higher number for each decadal projection is highlighted. Using the higher numbers is a more conservative approach with respect to water supply planning and is recommended for this WMP analysis. Effects of improving water efficiency could offset a portion of those future water demands as discussed in Chapter 9, allowing for a greater margin between water demands and planned supplies.

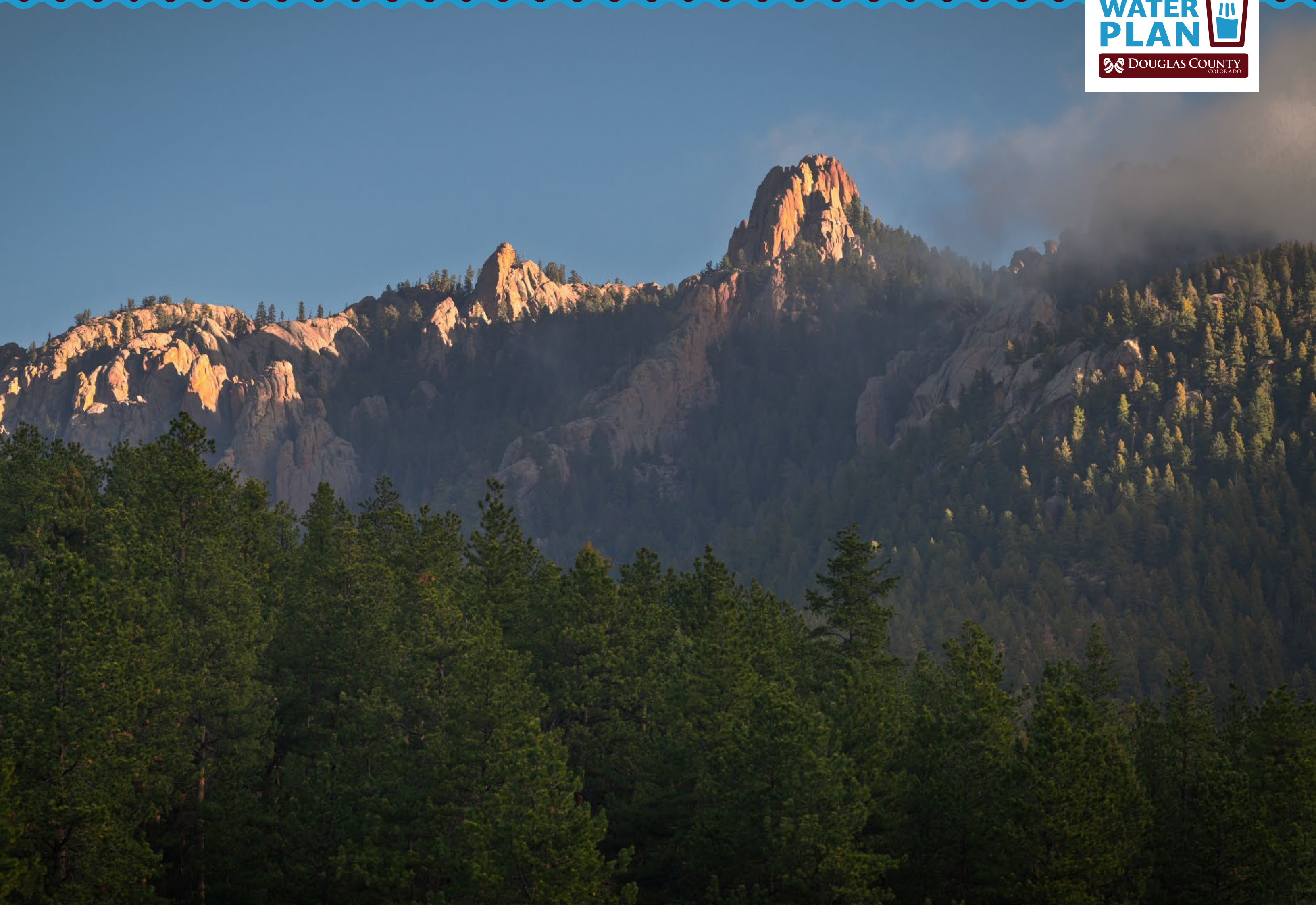
Table 5-6
Projected Demands Details

Water Provider	Current Demand (AFY)	2030 Demand (AFY)	2040 Demand (AFY)	2050 Demand (AFY)	Percent Change 2025-2050
Major Providers					
Highlands Ranch Water	20,000	20,000	20,000	20,000	0.0%
Parker WSD	14,145	16,967	20,302	22,527	59.3%
Castle Rock Water	10,354	14,121	16,010	18,995	83.5%
Medium Providers					
Southgate WD	4,354	4,354	4,354	4,354	0.0%
Pinery WWD	3,450	3,702	4,097	4,493	30.2%
Meridian MD	2,675	3,253	3,831	4,409	64.8%
Stonegate Village MD	2,100	2,500	2,600	2,700	28.6%
Castle Pines North MD	2,100	2,100	2,100	2,100	0.0%
Roxborough WSD	1,428	1,491	1,563	1,636	14.6%
Cottonwood WSD	1,237	1,744	1,812	1,812	46.5%
Small Providers					
Arapahoe County WWA	127	151	151	151	18.9%
Aurora Water	1,053	1,099	1,177	1,255	19.2%
Beverly Hills MWC					
Castle Pines MD	1,065	1,119	1,119	1,119	5.1%
Castleton Center WSD	13	24	28	32	146.2%
Chatfield South WD	30	31	31	31	3.3%
Littleton					

Water Provider	Current Demand (AFY)	2030 Demand (AFY)	2040 Demand (AFY)	2050 Demand (AFY)	Percent Change 2025-2050
Dominion WSD	732	1,652	2,953	3,837	424.2%
Inverness WSD	1,447	2,003	2,435	2,435	68.3%
Louviers WSD	35	35	35	35	0.0%
Northern Douglas County WSD					
Perry Park WSD	525	559	642	724	37.9%
Sedalia WSD	37	45	60	75	102.7%
Sierra Vista Douglas MWC	60	60	60	60	0.0%
Silver Heights WSD	39	40	40	40	2.6%
Solitude WSD					
Southwest Metro WSD					
Thunderbird WSD	43	43	43	43	0.0%
Town of Larkspur	120	128	134	151	25.8%
View Ridge MWC					
Westcreek Lakes WD					
Individual Systems					
Exempt Wells	6,440	7,141	8,198	8,998	39.7%
Total	73,609	84,362	93,775	102,012	38.6%

The county's population increases are expected to be concentrated in the northern sectors of the county due to proximity to Denver and the Denver Tech Center, with notable growth also expected in and around Castle Rock. This will put more demand on the water suppliers in those areas.

[Add mapping showing the current and future decadal populations/water demands by water provider.]



CHAPTER 6
WATER SUPPLIES

CHAPTER 6 –WATER SUPPLIES

Having reviewed the water providers responsible for supplying water across Douglas County, projected water demands through 2050, and analyzed the county's critical groundwater supplies in prior sections, this chapter compares water supplies available and used by the county's water providers.

6.1 Types of Water Supplies

This section reviews the types of water sources that the provider survey presented as options.

6.1.1 Wholesale Water

Wholesale water (also called contract water) is water provided to a water service provider from another entity. In Douglas County, this is typically renewable surface water from providers in the Denver metro area. One example is the WISE project water used by several entities in northern part of the county.

WISE is a regional partnership that allows reusable return flows from Denver and Aurora, drawn from the South Platte River and treated via Aurora Water's Prairie Waters project, to be bought and distributed to participating entities to help offset their reliance on nonrenewable groundwater. WISE water is available to nine Douglas County water providers and makes up a portion of the water supply for both Parker WSD and Stonegate Village MD.

More examples of wholesale water are those providers supplied by Denver Water in full. Southgate WD and Chatfield South WD are both fully supplied by Denver Water. Several water providers are supplied by wholesale in part or in full. Cottonwood WSD's base supply is fully wholesale. Arapahoe County WWA base supply is partially wholesale. Dominion WSD sources water from wholesale, and Inverness WSD's base supply is fully wholesale.

6.1.2 Surface Water

Surface water refers to the supplies that come from streams, rivers, lakes, and reservoirs. This water is generally considered to be renewable and is potentially reusable. Most surface water in Douglas County is part of or tributary to the South Platte River system.

6.1.3 Alluvial Well Water

Alluvial well water refers to water obtained through shallow wells located in the alluvium of surface water features like streams and rivers. It is essentially surface water since it is directly connected to surface water, is renewable, and is potentially reusable. Alluvial wells within Douglas County are used by many providers to different degrees. Parker WSD uses alluvial wells mainly to capture reusable return flows. Pinery WWD uses eight alluvial wells as base supply. These well levels dip during the summer but historically have rebounded fully during the winter and spring months.

Stonegate has three decreed but not yet constructed alluvial wells along Cherry Creek. Perry Park WSD historically met their demands through treatment from the district's alluvial wells; however, in 2010, they could not keep up with the treatment at their facility and switched water supplies.

6.1.4 Denver Basin Groundwater

Denver Basin groundwater refers to the water supply obtained from a set of five groundwater aquifers collectively known as the Denver Basin aquifers. Water from these sources is generally considered to be nonrenewable and may or may not be reusable depending on which aquifer it is sourced from. Twelve water providers indicated that they are supplied at least in part by Denver Basin groundwater.

Two of the 'Big Four' providers are included in those twelve. Parker WSD, Stonegate Village Metro, Castle Pines MD, Perry Park WSD, and Thunderbird WSD indicated this source as their entire base supply. Castle Pines North MD reported 90 percent of their base supply originates from Denver Basin groundwater. Highlands Ranch WSD said 15 percent of their base supply comes from this source. The other six water providers use Denver Basin groundwater either as a minimal supply of base water or for meeting demands during low water periods or demands during peaking.

6.1.5 Designated Basin Groundwater

Designated Basin groundwater refers to water obtained from aquifers that are established by the Colorado Ground Water Commission. There are no designated basins within the Douglas County boundary; the nearest designated basin is Kiowa Bijou, which is located in Elbert County. No providers indicated that they source water from a designated basin.

6.2 Current Water Supplies

Water providers included information about their current supplies in the survey responses. Table 6-1 lists information about the current supplies for the water providers, and Figure 6-1 shows a pie chart of the supply types.

Table 6-1
Summary of Current Water Supplies

Water Provider	Wholesale Water (AFY)	Surface Water (AFY)	Alluvial Well Water (AFY)	Denver Basin Groundwater (AFY)	Designated Basin Groundwater (AFY)	Reuse Water (AFY)	Total Excluding Reuse (AFY)	Total Including Reuse (AFY)
Major Providers								
Highlands Ranch Water		15,700		2,800		4,000	18,500	22,500
Parker WSD	959	588	952	9,475		2,300	11,974	14,274
Castle Rock Water	3,842	5,284	896	3,328			13,350	13,350
Medium Providers								
Southgate WD		4,354					4,354	4,354
Pinery WWD	900		2,150	13,817			16,867	16,867
Meridian MD		800		4,647			5,447	5,447
Stonegate Village MD	456			1,313			1,769	1,769
Castle Pines North MD	333			3,176			3,509	3,509
Roxborough WSD		2,235					2,235	2,235
Cottonwood WSD	894			172			1,066	1,066
Small Providers								
Arapahoe County WWA	127						127	127
Aurora Water		1,000					1,000	1,000
Beverly Hills MWC							0	0
Castle Pines MD				1,245			1,245	1,245
Castleton Center WSD				13			13	13
Chatfield South WD	69						69	69
Littleton							0	0
Dominion WSD	1,680	374		507			2,561	2,561
Inverness WSD	1,097		155	250			1,502	1,502
Louviers WSD				35			35	35
Northern Douglas County WSD							0	0
Perry Park WSD		126		399			525	525
Sedalia WSD			2	32			34	34
Sierra Vista Douglas MWC				60			60	60
Silver Heights WSD				39			39	39
Solitude WSD							0	0
Southwest Metro WSD							0	0
Thunderbird WSD				43			43	43
Town of Larkspur				119			119	119
View Ridge MWC							0	0
Westcreek Lakes WD							0	0
Individual Systems								
Exempt Wells				6,440			6,440	6,440
Total	10,357	30,461	4,155	47,910	0	6,300	92,883	99,183

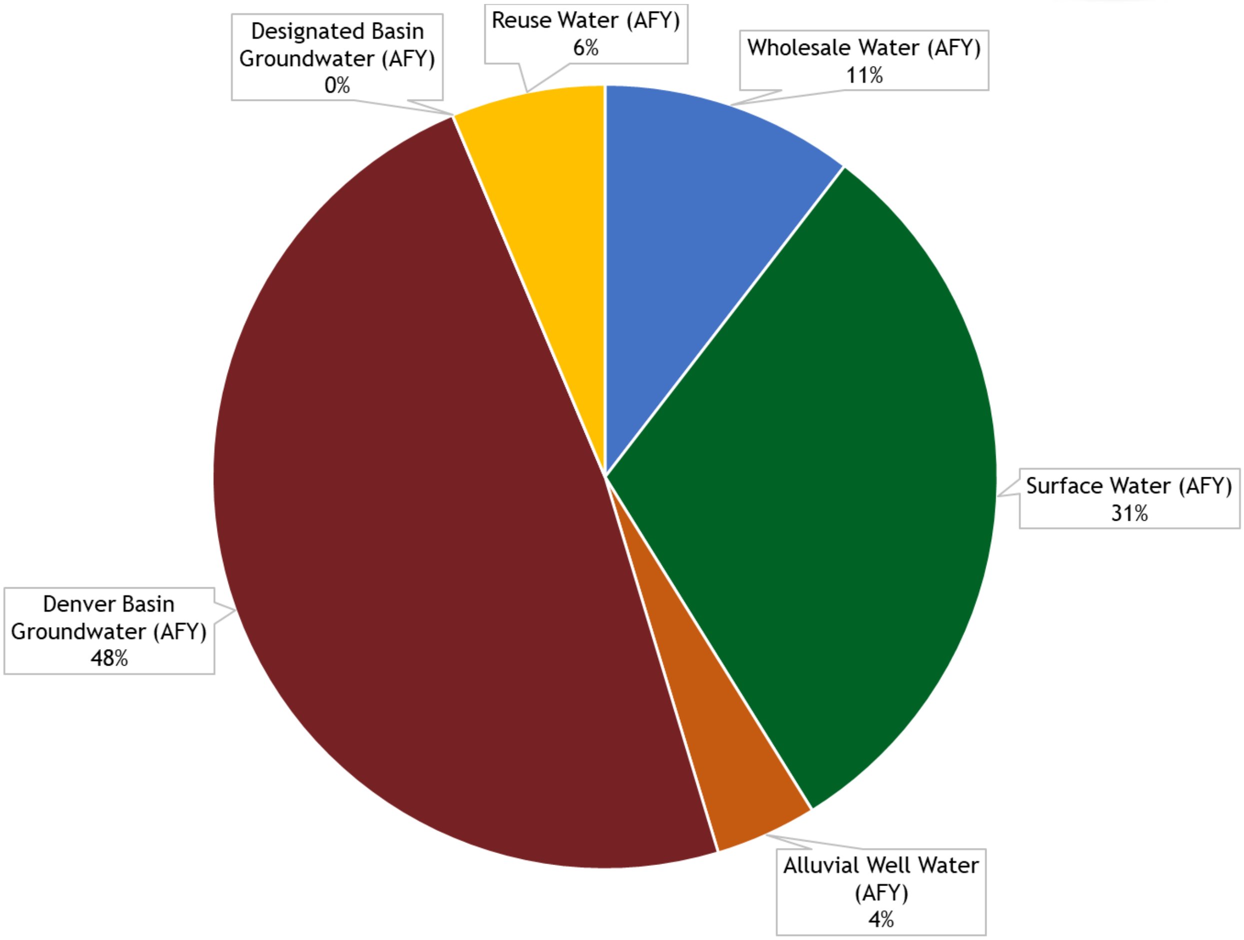


Figure 6-1. Current Water Supply Types.

6.3 Future Water Supplies

Water providers included information about their anticipated future supplies in the survey responses. Table 6-2 lists their planned future supply quantities.

Table 6-2
Summary of Future Water Supplies

Water Provider	Current Supply (AFY)	2030 Supply (AFY)	2040 Supply (AFY)	2050 Supply (AFY)	Percent Change 2025-2050
Major Providers					
Highlands Ranch Water	22,500	22,500	22,500	22,500	0.0%
Parker WSD	23,487	27,306	27,848	28,210	20.1%
Castle Rock Water	13,446	14,408	17,847	20,652	53.6%
Medium Providers					
Southgate WD	4,354	4,354	4,354	4,354	0.0%
Pinery WWD	15,964	15,964	15,964	15,964	0.0%
Meridian MD	5,447	5,447	5,447	5,447	0.0%
Stonegate Village MD	2,300	2,800	3,200	3,300	43.5%
Castle Pines North MD	3,509	3,509	3,509	3,509	0.0%
Roxborough WSD	2,235	2,235	2,235	2,235	0.0%
Cottonwood WSD	2,344	2,263	2,162	2,062	-12.0%
Small Providers					
Araphoe County WWA	127	151	151	151	18.9%
Aurora Water	1,053	1,099	1,177	1,255	19.2%
Beverly Hills MWC					
Castle Pines MD	1,508	1,585	1,585	1,585	5.1%
Castleton Center WSD	13	24	28	32	146.2%
Chatfield South WD	35	35	35	35	0.0%
Littleton					
Dominion WSD	2,561	3,235	3,776	4,091	59.7%
Inverness WSD	3,463	3,558	3,602	3,482	0.5%
Louviers WSD	150	150	150	150	0.0%
Northern Douglas County WSD					
Perry Park WSD	525	559	642	724	37.9%
Sedalia WSD	34	34	34	34	0.0%
Sierra Vista Douglas MWC	60	60	60	60	0.0%
Silver Heights WSD	39	39	39	39	0.0%
Solitude WSD					
Southwest Metro WSD					
Thunderbird WSD	43	43	43	43	0.0%
Town of Larkspur	120	120	120	120	0.0%
View Ridge MWC					
Westcreek Lakes WD					
Individual Systems					
Exempt Wells	6,440	7,141	8,198	8,998	39.7%
Total	111,757	118,619	124,706	129,032	15.5%

[Need mapping showing providers with pie charts showing demand vs. supply in 2050.]

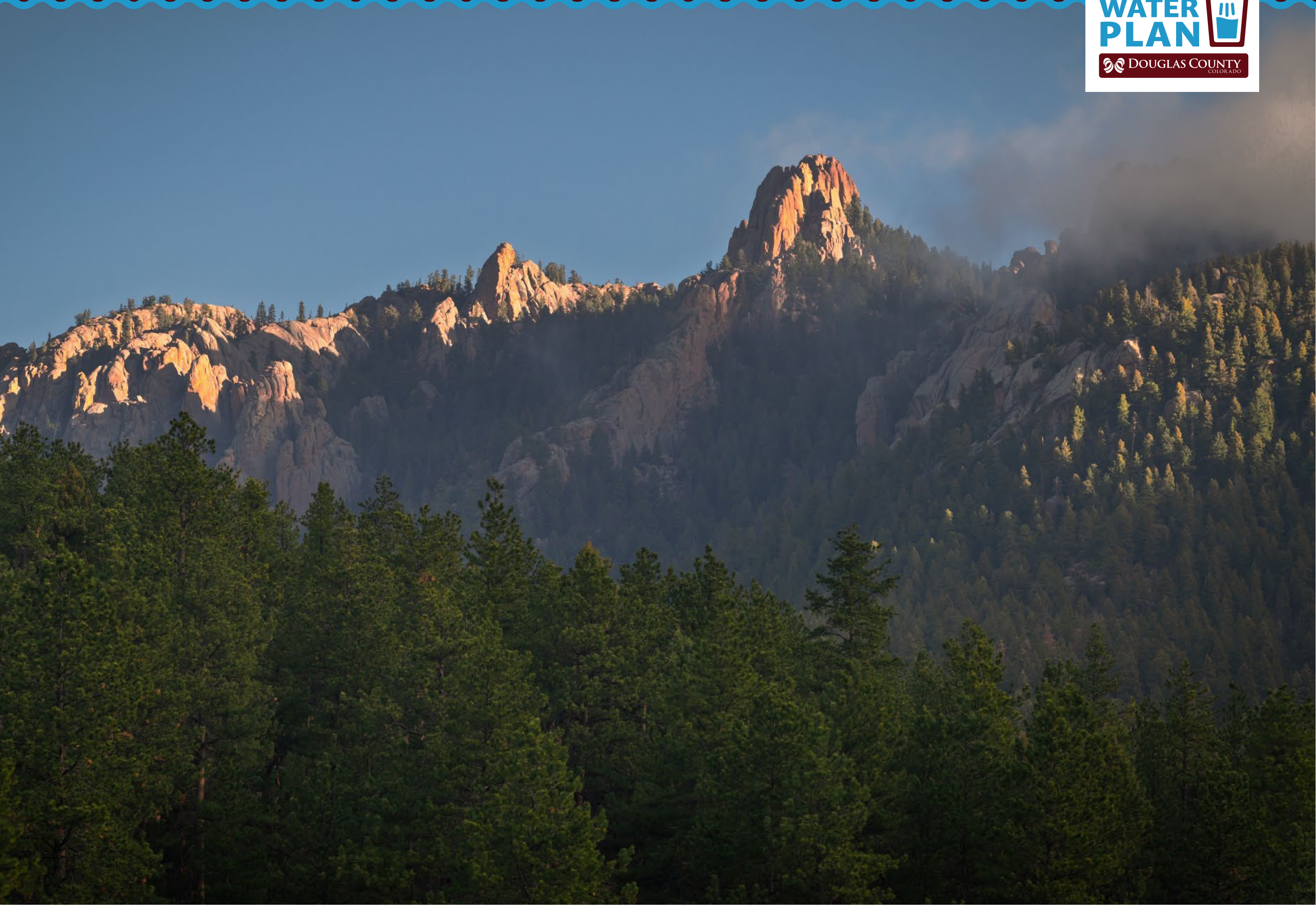
[Need bar chart showing reusable vs. non-reusable.]

6.4 Potential Water Supplies

[Insert descriptions of potential projects from water providers.]

6.5 Water Quality

Water quality was reported by the providers in the survey. A few providers indicated concerns with high iron and manganese, both of which can be reduced through treatment prior to serving customers. All providers are required to meet the State's drinking water requirements.



CHAPTER 7
GROUNDWATER ANALYSIS

CHAPTER 7 - GROUNDWATER ANALYSIS

This chapter includes the methodology and results of the Douglas County groundwater analysis.

7.1 Background

An important aspect in evaluating the county's water supplies is to conduct a groundwater availability assessment, which includes evaluating current and future groundwater supplies and demands across the county, with a focus on the unincorporated areas. The groundwater analysis was prepared to support quantifying county-wide water supplies in the WMP.

To perform this work, the project team collected a significant amount of data from (i) Douglas County GIS, (ii) Colorado Division of Water Resources ("CDWR") (HydroBase); (iii) United States Geological Survey ("USGS"); and (iv) numerous water supplier websites.

The groundwater analysis consisted of:

- Categorizing wells as high capacity (commercial, industrial, municipal), low capacity (domestic and stock wells), and for irrigation uses
- Identifying and categorizing existing water right decrees and determinations
- Mapping the existing wells and decrees in relation to Water Supply Zones, as defined by Douglas County's Zoning Resolution Section 18A
- Mapping land use outside of current water service areas (unincorporated areas of the county)
- Performing geological modeling using Petra software to assess the Denver Basin groundwater resources within the county
- Organizing and reviewing available groundwater level data within the county
- Generally describing groundwater quality in the Denver Basin aquifers within the county

7.2 Web Map Development

An online map deliverable was developed that displays interactive GIS data relevant to the Douglas County WMP ("Interactive Web Map"). The Interactive Web Map summarizes primary data sources and results from the groundwater analysis and can be accessed using the following weblink: https://experience.arcgis.com/experience/226b9e18fafd4aa89dcd7b5d2bc2deba/

Included in the Interactive Map are:

- General Denver Basin groundwater information (i.e. boundaries, decrees, pre-213 cylinders, etc.)
- Groundwater wells by aquifer and by County Zones

- Links to Colorado Division of Water Resources (CDWR) well data
- General land use data from the County
- Petra (geologic) maps and analysis

7.3 Summary of Conclusions

The following is a summary of conclusions resulting from the groundwater analysis. The conclusions will be described in detail in the remainder of this chapter.

- **Water Levels** - Groundwater levels have been monitored by different entities throughout Douglas County for decades and vary greatly in quality and length of record. After careful vetting and graphical analysis, the reviewed water level data showed clear patterns that reflected well type, aquifer conditions, and local groundwater use. The spatial and aquifer well distribution of the reviewed dataset provides critical insight into current groundwater conditions that local stakeholders may encounter when developing groundwater, particularly if more robust analyses are performed.
- **Wells in County** – Approximately 10,500 groundwater wells are permitted in the county. Low-capacity wells make up 93 percent of all wells in the county. High-capacity wells make up about five percent, and the rest are irrigation wells. Tributary wells make up approximately 11 percent of wells in the county. The remaining 89 percent are Denver Basin wells.
- **Tributary Water** – A few sources of tributary water exist in Douglas County including Dakota sandstone, alluvial aquifers, and hard-rock aquifers. These sources can be accessed, however, will require an augmentation plan with exception of low-capacity exempt wells.
- **Denver Basin Groundwater** – The estimated physically available groundwater based on the Petra Based 3D Geologic model of aquifers in the county is about 710,000 AFY available for allocation. Approximately 470,000 AFY is available for allocation without an augmentation plan.
    - **Comparison SB5 Groundwater** – Based on this analysis, approximately 36 percent more Denver Basin groundwater on average is available for allocation compared to the State's SB5 estimates for the entire county.
    - **Unincorporated Areas -** Gross estimated water available for allocation from the Denver Basin aquifers in the county's unincorporated areas is about 484,000 AFY. This makes up about 68 percent of Denver Basin groundwater available for allocation.
- **Decreed Water** – Approximately 10 percent of water in the county is currently decreed, which is about 160,000 AFY.
- **Water Quality In the Denver Basin**– The Denver Basin aquifers have contaminants from natural sources, like geologic sources and include manganese, radon, arsenic, selenium, and uranium. Site specific investigations are

recommended.

- **Regulation 1804A** – The County's Regulation 1804A, wherein the county is divided into zones, is sufficient to promote water sustainability for new development and promote responsible use of Denver Basin groundwater.
- **Regulation 1807A**- The County should consider evaluating Regulation 1807A to promote use of deeper Denver Basin aquifers, central supply systems (rather than individual on-lot wells), and use of renewable water for new development, particularly in Margin B and the Central Valley.

7.4 Sources of Groundwater in the County

Groundwater resources that may be legally and physically available in the county were evaluated. The sources of groundwater are shallow, tributary aquifers and deep, bedrock groundwater from the Denver Basin aquifer system. Tributary aquifers are comprised of unconsolidated sediments near the earth's surface and fractured hard rock that are typically in direct hydrologic connection with surface water bodies (streams, rivers and lakes; Figure 7-1).

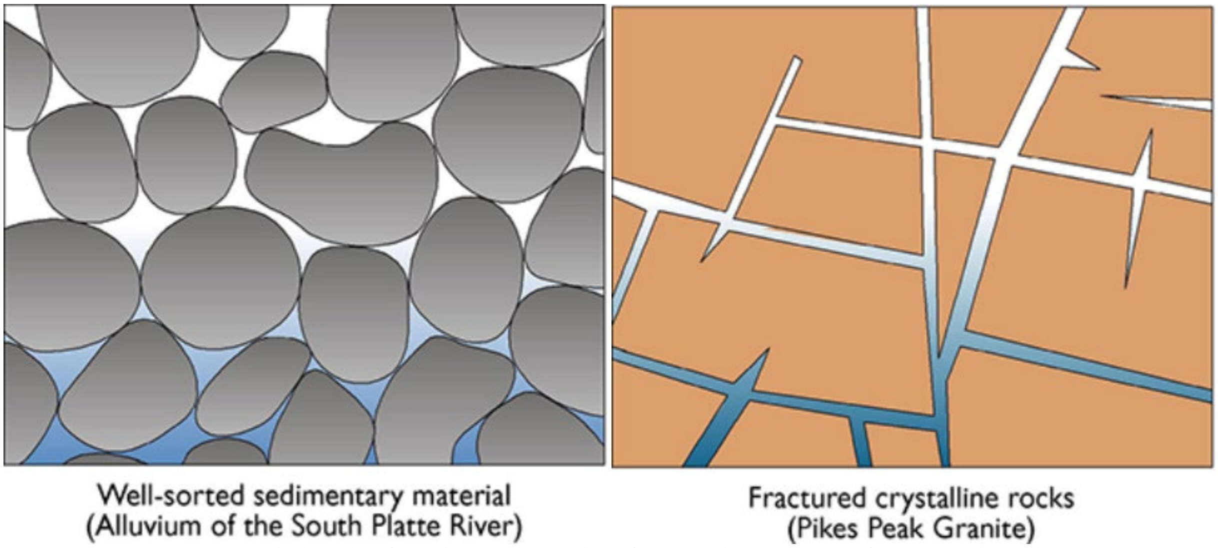


Figure 7-1. Conceptual sketch of geologic units that form tributary aquifers in Colorado. CGS (2003).

The Denver Basin is a large (7,000 square-mile), strongly asymmetric, sedimentary aquifer system comprised of water-bearing sandstone and siltstone aquifers that is bounded to the west by the Front Range foothills, extends as far east as Limon, and stretches north to south from Greeley to beyond Colorado Springs. See Figure 7-2.

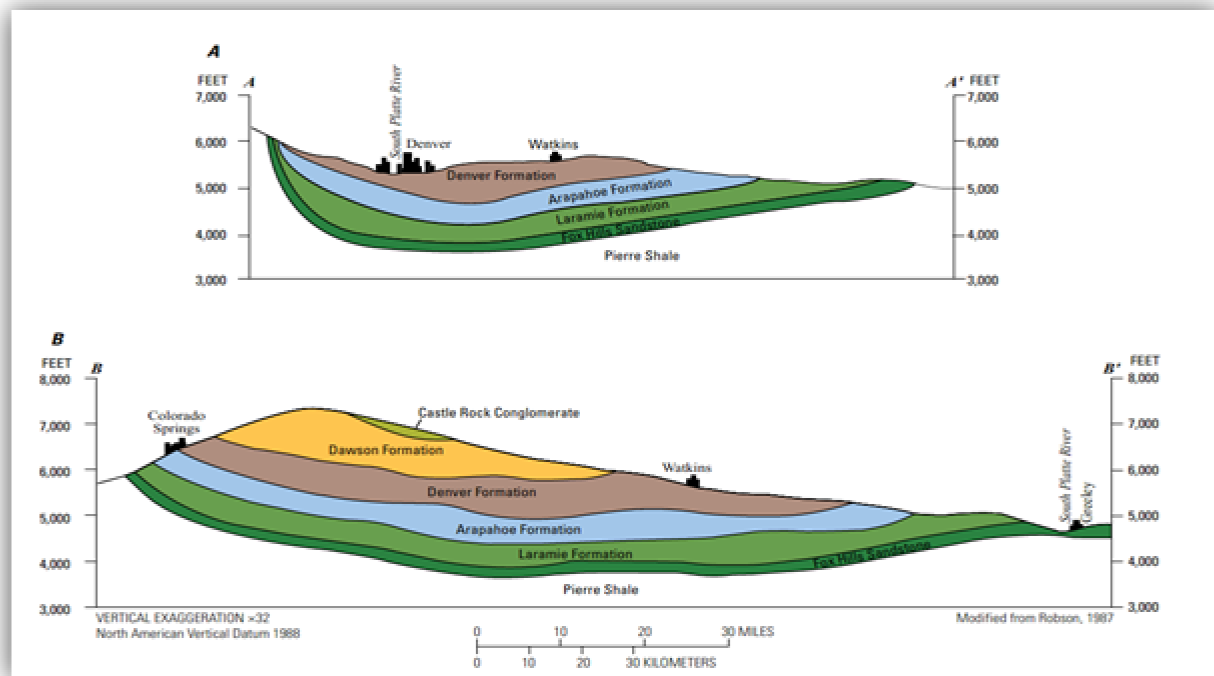


Figure 7-2. Generalized Geologic Cross Section of the Denver Basin Aquifer System (Everett, 2014, modified from Robson, 1987).

The major aquifers are separated by thick intervening layers of claystone and shale (confining units) which prevent the transmission of water between aquifers, thereby separating the recognized aquifers. Confining units allow for water in the underlying aquifer to be stored under pressure, which can result in additional water storage within the aquifer and can create a potentiometric (hydraulic) head that is higher in elevation than the top of the aquifer.

The potentiometric head is represented by water levels recorded in wells that are higher than an overlying confining unit indicating confined (artesian) conditions. Pumping removes water and causes declines in pressure and artesian water levels, which can ultimately result in an aquifer transitioning from confined to unconfined conditions, where water is released from the aquifer through gravity (unconfined conditions) rather than pressure changes (confined conditions).

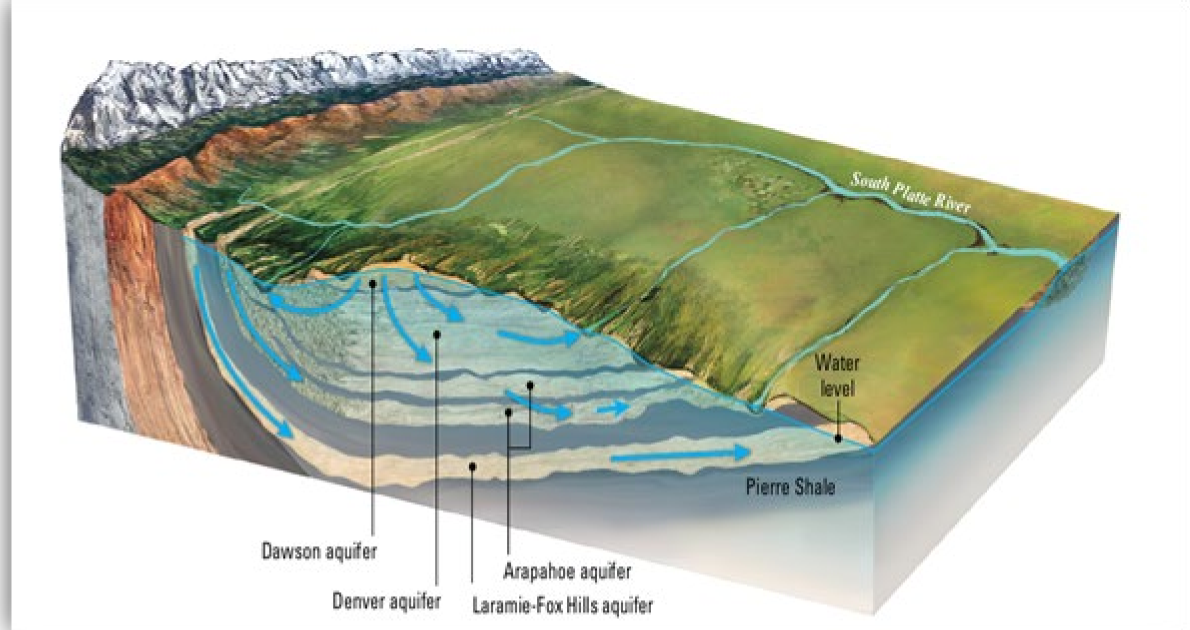


Figure 7-3. Conceptual Diagram of the Denver Basin Aquifer System (from Paschke et. al., USGS, 2011).

The major Denver Basin aquifers that are recognized by the State and underly Douglas County (from shallowest to deepest) are the Dawson, Denver, Arapahoe, and Laramie-Fox Hills aquifers. The different aquifers were created when various types of sediments (e.g. mud, sands, gravels) were deposited through different processes (gravity, water, etc.) and therefore have relatively distinct characteristics. The water held within the aquifers has been recharged and stored in the aquifers over millennia, and the rate at which groundwater being pumped out of the aquifers is greater than the rate it is currently stored, which is why groundwater from the Denver Basin is considered nonrenewable (finite; Figure 7-3).

Natural systems tend to vary spatially, so each aquifer's abilities to store and transmit water, and its water quality can also change depending on where groundwater is used in the basin. For example, in the northeastern third of Douglas County, the Dawson aquifer is divided further by a confining unit into the Upper and Lower Dawson aquifers, while the Dawson aquifer is undifferentiated in other parts of the county (Appendix A, Figure 1).

The Denver Basin aquifers outcrop along the front range and have been subject to faulting, adding unique structural complexity to the layered system. This faulting makes interpreting the layered aquifer system difficult because thickness or properties of the lithological deposits can vary greatly in short distances. Additionally, several aquifers are close to the surface and are in contact with the upper alluvial (shallow) aquifer systems.

Available geophysical logs rarely provide data on the full thickness of these shallow aquifers, increasing the difficulty in totaling the water-bearing net sands in these locations. These complications highlight the importance of using an updated geophysical log dataset to improve estimates of available groundwater in the county. Even with the updated dataset available today, the interpretations in this report still have limitations and should only be used as a reference for planning purposes.

7.4.1 Groundwater Well Summary

Because of how the water is appropriated and regulated, groundwater wells are categorized and quantified into two types within the county – (i) tributary including fractured hard rock, Dakota Sandstone, and alluvial aquifers; and (ii) Denver Basin bedrock aquifers. However, the primary source of groundwater identified for current and future development within the county is from the Denver Basin aquifers. As a result, the project team focused this analysis on Denver Basin groundwater. A primary goal in this analysis was to categorize data presented herein according to the Douglas County Zoning Resolution Section 18A boundaries (see Section 7.6.1) to assess well and water quantification differences through this lens (Appendix A, Figure 2).

It is reported that there are 10,468 groundwater wells in the county (CDWR; Appendix A, Figures 3-8; Appendix B, Table 1). The CDWR database used to quantify wells in Table 1 (see Appendix B) has some limitations and approximately two percent of wells in the database did not have enough information to categorize them well enough to include in the county well totals. These wells are often older permitted wells with very little documentation available within the CDWR well database.

7.4.1.a Tributary Groundwater

Tributary groundwater within the County is groundwater outside the boundaries of the Denver Basin and includes fractured rock (Pike-Rampart), the Dakota formation (Margin A) and shallow alluvial deposits in Margin B and the Central Basin. The project team is considering the Dakota in Margin A as tributary in this analysis because of the complexity of the resource, unreliability of the source, and direct connection of this groundwater to the tributary system.

Alluvial groundwater, fractured rock, and the Dakota formation are tributary, and therefore augmentation is necessary to prevent injury to senior water rights with one exception. If groundwater from these sources meets the requirements of C.R.S. 37-92-602 (exempt well statute) they do not need to be included in an augmentation plan.

Dakota and Fractured Hard Rock

Upon review of the CDWR public records, there are approximately 742 Dakota or hard-rock wells in the county. These wells are in the western portion of the county, in the Pike-Rampart and Margin A zones. About 98 percent of these wells are low capacity, exempt, domestic or stock wells. The remaining two percent do not meet the requirements of C.R.S. 37-92-602 and therefore, require augmentation and are included in an augmentation plan. A summary of these Dakota and fractured hard rock wells are provided in Table 1, Appendix B and are shown in Figure 3, Appendix A.

Alluvial Groundwater

Alluvial groundwater is present primarily in the Central Basin of the County. This groundwater is in the alluvial channel of rivers and streams comprised of well-sorted sedimentary materials. From review of the CDWR public records, there are approximately 273 shallow alluvial wells in the county. About 74 percent of these wells are low capacity, exempt domestic, or stock wells. The remaining 26 percent do not meet the requirements of C.R.S. 37-92-602 and therefore require augmentation. A number of the non-exempt alluvial wells have been curtailed because they are not included in an augmentation plan. This is due to the lack of augmentation water necessary to account for current and past pumping depletions that affect priority water rights on local rivers and streams. A summary of these alluvial wells is provided in Table 1, Appendix B and shown in Figure 3, Appendix A.

7.4.1.b Denver Basin Groundwater

Denver Basin groundwater is primarily present in Water Supply Zone B and the Central Basin of the County. The CDWR records show that there are approximately 9,453 Denver Basin wells in the county. Similar to the fractured hard rock, Dakota and alluvial wells, the bulk (94 percent) of the Denver Basin wells are low capacity, domestic, or stock wells. High Capacity Commercial/Industrial type wells make up four percent of the well totals and the remaining two percent are Irrigation wells. The bulk (78 percent) of Denver Basin wells are in the Central zone. A summary of these wells is provided in Table 1, Appendix B and shown in Figures 3-8, Appendix A.

Denver Basin groundwater within each aquifer is administratively divided into three categories under the Rules: non-tributary (NT), not-nontributary actual (NNT actual), and not-nontributary 4% (NNT-4%). Each category is outlined in Appendix B, Tables 2 and 3.

NT groundwater is groundwater wherein the withdrawal will not, within one hundred years of continuous withdrawal, deplete the flow of a natural stream at an annual rate greater than 1/10th of one percent of the annual rate of withdrawal. NT in the Denver Basin shall account for the de minimis amount of water discharging from the Dawson, Denver, Arapahoe, and Laramie-Fox Hills aquifers into surface streams due to artesian pressure (two percent).

NNT groundwater is Denver Basin groundwater for which withdrawal will impact a natural stream greater than 1/10th of one percent of the annual rate of withdrawal within one hundred years. However, in the Denver Basin there is NNT Actual and NNT-4% classes depending upon where the well is in reference to a natural stream including the alluvium. As to NNT wells completed in the Denver Basin aquifers more than one mile from any point of contact between any natural stream including its alluvium, replacement of four percent of the amount of water withdrawn must be returned to the affected stream system or systems on an annual basis. For ells completed in such aquifers at points closer than one mile to any such contact, the amount of replacement is the actual water depletion determined assuming that the hydrostatic pressure in each such aquifer has been lowered at least to the top of that aquifer throughout. A summary of the estimated groundwater in each of these categories is reviewed in Sections 7.5 and 7.6.

7.5 Summary of Groundwater Computation Methodology

Because the groundwater available in the Denver Basin aquifers varies significantly by aquifer and spatially within aquifers due to geologic properties, it is critical to use location-specific information on the aquifer characteristics gleaned from well construction reports, lithologic (rock) descriptions, and geophysical data. Down-hole geophysical data, such as electrical resistivity logs, provide important information related to the amount of groundwater available for withdrawal, and these datasets are used by the CDWR and landowners to determine the volume of legally and physically available Denver Basin groundwater underlying land parcels. Geophysical data provides information on aquifer depth intervals, proxies of aquifer properties, and thicknesses of saturated sands for the different Denver Basin aquifers.

CDWR allocates Denver Basin groundwater and regulates the withdrawal of groundwater from Denver Basin aquifers through the enactment of Senate Bill 213 (1973) and Senate Bill 5 (SB5), which was proposed and enacted into law in 1985. Senate Bill 213 (See section 6.1.1-2) allocated non-tributary (including the Denver Basin) groundwater based upon land ownership and that landowners could pump up to one percent of the volume of water underlying their property per year. This simple method primarily limited water production on a yearly basis and created a new type of well permit for nontributary resources.

SB5 built on the SB 213 legislation by focusing on the Denver Basin and that its withdrawals be evaluated for their potential hydraulic connection to surface water, which was accomplished through modeling by the State Engineer's Office. SB5 also created the NNT Denver Basin groundwater definition and determined site-specific aquifer thickness estimates and an agreed upon storage parameter for each aquifer. Finally, SB5 directed the CDWR to adopt the Denver Basin Rules (2 CCR 402-6) to carry out the provisions of SB5.

Consistent with the legislative direction, State groundwater hydrogeologists interpreted available geophysical log data to determine the elevation and depth intervals of the aquifers, and the total thicknesses of water-bearing sand layers (net sands) within each recognized aquifer. This information was then used to create basin-wide maps of the Denver Basin aquifers. These maps provide an initial estimate of key aquifer properties, aquifer depths and thicknesses, and estimated volumes of groundwater that may be legally available to a landowner. However, these estimates can be, and are, routinely updated using site-specific data during determination (The Denver Basin Rules 6.B and 9).

- In general, Denver Basin groundwater is appropriated volumetrically by taking the parcel area multiplied by the net thickness of the saturated aquifer. This volume is then multiplied by a specific yield (Sy) determined by the state geologists consistent with the Denver Basin Rules.
  - Annually appropriated volumes (AFY) are calculated by taking the total volume of

groundwater computed underlying the parcel dividing the volume by 100 to obtain the annual withdrawal in AFY.

- Appropriations are given for each aquifer; therefore, to exercise Denver Basin groundwater rights portfolios fully, all aquifers for which groundwater has been determined or appropriated are required to be developed and used.

The project team reassessed the water resources available for each aquifer available in Douglas County by using a more comprehensive and recent geophysical log data set than SB5. Since the development of SB5, geophysical logs have been required during the drilling of non-exempt wells with specific permit conditions; therefore, the catalog of publicly available geophysical logs has increased significantly in quantity and quality since the development of the maps associated with SB5.

This updated geophysical dataset was compiled in the geological modeling software PETRA. A county-wide, geophysically consistent reinterpretation of aquifer thicknesses and characteristics was created, and physically available water was estimated based on these interpretations. The analysis used a similar approach to SB5, as outlined in the Denver Basin Rules (2 CCR 402-6), but incorporated a more comprehensive dataset that includes recent and high-quality geophysical data. The SB5 evaluations (legally available water rights) were compared to the PETRA-based evaluations of physically available groundwater volumes (see Section 6 and Appendix C).

The county-wide reinterpretation of the geophysical data resulted in spatial datasets that contain key information related to groundwater availability. These datasets included geologic maps, aquifer thickness maps, and net-sand ("sand" defined as resistivity greater than 12 ohm-m) maps for each Denver Basin aquifer. This data can be seen on the Interactive Web Map (Web Map Link).

The WMP's available Denver Basin groundwater estimates differ from the SB5 estimates because a more comprehensive dataset was used that includes recent and high-quality geophysical data to quantify aquifer geometry, thickness, and net sand. As shown in Figure 7-4 and Table 3 (Appendix B), the PETRA-based estimate of physically available groundwater is on average approximately 36% more than the SB5 estimates for the Lower Dawson, Denver, and Arapahoe aquifers. The Upper Dawson and Laramie-Fox Hills aquifers are consistent with the Rule computations.

Note that each aquifer with the Denver Basin has a different percentage. This evaluation demonstrates that the net sand amounts, used by CDWR under the Denver Basin Rules, may be underestimating the amount of Denver Basin groundwater that may be available within the county.

"Physically available groundwater" in this WMP refers to the PETRA-based 3D geological model to distinguish the updated evaluation vs legally available groundwater. This term only refers to the calculation of water available based on these estimates; this estimate does not claim or guarantee the amounts calculated are fully available to a well owner.

There is no way of fully understanding what a well will produce or yield over time until it is constructed and tested. Many other factors can limit production of a well over time including the loss of water column head linked to the production volumes throughout the entire aquifer. Moreover, Denver Basin groundwater is not homogeneous and is a complicated water resource. As a result, groundwater withdrawals from each Denver Basin aquifer in certain areas may be greater or less than what was estimated depending on aquifer parameters, drilling techniques, well completion and the use of alternative or future technology. Physically available groundwater estimates are meant to be an updated comparison to the SB5 calculations completed by state geologists in 1985 for planning purposes.

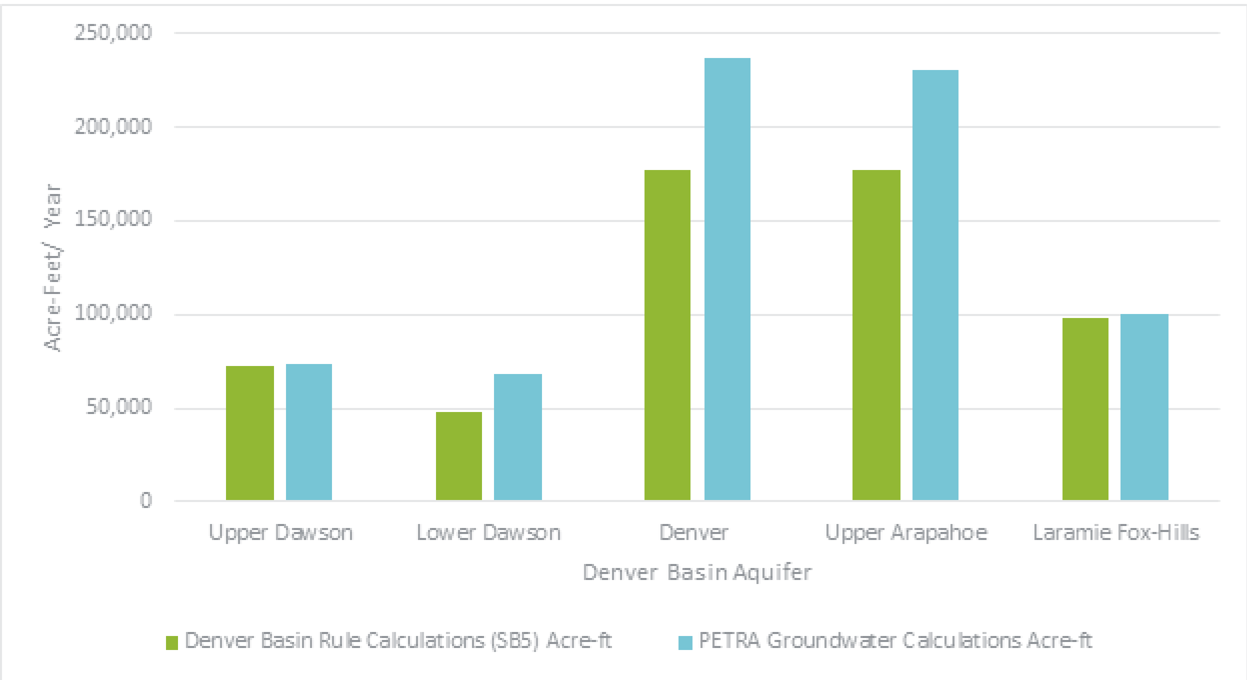


Figure 7-4. Comparison of Groundwater Availability (Petra vs. SB5). Data from Appendix B, Table 3.

7.6 Groundwater Supply Evaluation

7.6.1 Groundwater Supply Evaluation Considerations - Legal

7.6.1.a Legal Considerations - Groundwater Water (GW) Supply Zones

In addition to state-administered water rights, groundwater development in Douglas County is also affected by county zoning resolutions that aim to promote sustainable growth (see Regulation 18A). To ensure that development in all areas of the county provide for a water supply that is sufficient in terms of quantity, quality, and dependability, Douglas County passed the Zoning Resolution Section 18A “Water Supply Overlay District”, dated April 11, 2017. The Water Supply Overlay District is applied as a supplemental regulation to those determined by the respective zoning district and to all well permit applications submitted pursuant to the stated regulations. The Water Supply Overlay District encompasses all of the county and is divided into zones, identified as "Pike-Rampart," "Margin A," "Margin B," and "Central Basin." See Appendix D.

A study of the water supply conditions in the Denver Basin aquifers in Douglas County was completed in 1997 by John C. Halepaska and Associates, Inc. and became the original basis for Section 18A Water Supply Overlay District to the Douglas County Zoning Resolution. The result of the study was that three principal water supply areas ("zones") were identified in the Denver Basin aquifers within Douglas County that had distinctly different hydrogeologic conditions.

- **Margin A** - the western outcrop of the Denver Basin and the Dakota Formation in the Hogback area is characterized by aquifer intervals that thin and turn upwards to the west
  - Margin A area is considered to be unreliable related to long-term water production, and new land use applications with projected water demands are not allowed to rely on Denver Basin aquifers.
- **Margin B** - the area to the east of Margin A
  - Margin B area is considered to be a transition zone between the thinner aquifer intervals to the west and the deepest parts of the Denver Basin.
  - Currently, up to 50 percent of the legally appropriable volume can be developed and relied upon as part of new land use applications. This limit applies to all Denver Basin aquifers.
- **Central Basin** - the remainder of the Denver Basin aquifer system in the County
  - Currently, in the Central Basin, planned development in this area can depend on development of the Denver Basin aquifers, not exceeding 100 percent of the total annual appropriable water supply contained within the Denver Basin aquifers underlying the subject land associated with the water rights or decree.

The County uses these defined boundaries to manage groundwater supply criteria required for new land use applications under Zoning Resolution Section 18A (specifically Section 1804A). Standards for groundwater development vary depending on the zone of interest and the anticipated land use. These zoning regulations (specifically Section 1804A) were evaluated as part of this groundwater analysis to determine if such regulations should be reassessed. The focus of the reassessment would be Margin B and the Central Basin.

Both Margin B and the Central Basin allow for the development of Denver Basin groundwater underlying lands in each zone, in addition to allowing renewable water and water beneath lands located in Margin B and the Central Basin zoned as an Open Space Conservation District, or subject to a perpetual open space conservation district as water supplies for development.
Based upon the project team's analysis of Denver Basin groundwater underlying these two zones, allocations in the Upper Dawson and Laramie Fox-Hills aquifers are consistent with Colorado state law. Allocations in the Lower Dawson, Denver and Arapahoe could be greater than Colorado state law allows (see Sections 7.6.2 and 7.6.3). Since our analysis did not indicate that there may be less Denver Basin groundwater to be allocated versus

Colorado state law, there is no need to change the zoning and water needs analysis under Section 1804A.

While the water supply for development zones in Regulation 1804A and the associated water supply restrictions promote responsible use of Denver Basin groundwater, the County should consider revising Regulation 1807A to have new districts submit, as part of the water service plan, analysis regarding use of deeper Denver Basin aquifers for a centralized system (rather than individual on-lot wells in shallower aquifers), restricting use of the shallow aquifers (Upper Dawson, Lower Dawson, and undifferentiated Dawson), and developing renewable supplies to reduce reliance on Denver Basin aquifers.

7.6.1.b Legal Considerations – Pre-213 Ground Water Rights

In addition to groundwater appropriation via SB5, existing "Pre-213" water rights have to be considered in order to accurately evaluate groundwater resources within the county. Pre-213 Water Rights refer to Denver Basin water rights permitted prior to the enactment of Senate Bill 213 on May 5, 1973. Pre-213 Water Rights are based upon permits and beneficial use within the Denver Basin and not overlying land ownership. The withdrawal of groundwater from Pre-213 wells was limited primarily by an assessment of proximity to other groundwater appropriations in the same aquifer. Therefore, an applicant could appropriate large quantities of groundwater from a Denver Basin aquifer regardless of the amount of land that party owned.

Upon the passage of Senate Bill 213 in 1973, and subsequent legislation (SB5) which allocated Denver Basin groundwater based upon overlying land ownership, protection of these Pre-213 water rights was required. To protect these groundwater rights from Denver Basin water rights subsequently approved based upon overlying land, CDWR converted these older water rights to an equivalent land area by computing a cylinder of appropriation (cylinder of land) that factors in the available volume of water beneficially used, the specific yield of the respective aquifer, and the saturated thickness of the respective aquifer ("Pre-213 cylinder").

Any portions of Pre-213 cylinders (cylinder of land) that overlap any new land area that is the subject of a new Denver Basin water right are subtracted from the land area used to determine the new Denver Basin water right for a given aquifer. The Pre-213 cylinders of appropriation for each aquifer are shown across the County in Figures 9-13, Appendix A.

7.6.1.c Legal Considerations – Current Water Right Determinations

Some landowners within the county have already had Denver Basin allocations determined or decreed by the CDWR or the Water Court. See Table 5 in Appendix B and Figures 9-13 in Appendix A. This typically happens when a landowner seeks to quantify the amount of Denver Basin groundwater underlying their property through either the filing of a well permit with CDWR (C.R.S. 37-90-137(4)) or an application with the Water Court. In all these cases, the CDWR makes a determination of the amount of groundwater available for each aquifer at that time of application. These determinations for each aquifer can be seen in Figures 3-9 (Appendix A).

7.6.1.d Legal Considerations – Current Exempt and Small Capacity Well Allocations

Based on the review of CDWR records, most of the exempt and small capacity wells in the Denver Basin within the county are issued for less than one AFY of withdrawal. A conservative estimate of the total amount of Denver Basin groundwater withdrawn annually is equal to 0.75 AFY multiplied by the number of exempt and small capacity wells in each aquifer. These wells are designated as low-capacity wells.

7.6.1.e Legal Considerations – 2024 Groundwater Supreme Court Decision

While evaluating the allocation of Denver Basin groundwater, the 2024 Colorado Supreme Court[12] decision wherein the Court further interpreted the statutory and regulation of Denver Basin groundwater withdrawals was also evaluated. The Colorado Supreme Court ruled that in addition to the annual withdrawal limitation as calculated by the Rules (one percent of the volume), the maximum volume of Denver Basin groundwater allowed to be withdrawn from each aquifer cannot exceed the total allocation computed by CDWR for the specific parcel of land. While this is a volumetric limitation, the annual withdrawal can be less than the one percent, thereby increasing the time for which the Denver Basin groundwater underlying a specific parcel may be withdrawn.

7.6.2 Groundwater Supply Evaluation Considerations – Physical

7.6.2.a Physical Considerations – Water Levels in the Denver Basin Aquifers

Groundwater levels observed at wells are generally used as a proxy for evaluating water storage conditions and changes in aquifer storage. Although water level data cannot translate directly to an estimate of a change in the water volume stored, declining water levels generally indicate a loss of water storage in the aquifer, usually caused by pumping that outpaces either aquifer recharge or local aquifer recovery.

Groundwater levels can provide an indication of the sustainability of groundwater production practices, as well as the aquifer conditions: confined (artesian) conditions, where water levels are above the top of the aquifer and water is released from storage through pressure, and unconfined conditions, where water is released from gravity once water levels fall below the top of the aquifer. Measuring water levels on a routine basis can help identify when aquifer conditions change from confined to unconfined and monitor critical changes to local storage conditions.

Successful evaluation of patterns or trends in water level data requires that the data are of relatively good quality and are representative of the aquifer of interest. Groundwater levels have been monitored by different entities throughout Douglas County for decades and vary in quality and length of record. The goal of this analysis was to provide Douglas County with:

1. An overview of current water levels and recent water level patterns for the various Denver Basin aquifers in the county
2. A vetted and comprehensive dataset of water levels, aquifer interval information, well location information, and well construction information, from which more rigorous water level analyses could be performed
3. Recommendations for future analyses or studies to further refine groundwater declines in the aquifers.

To accomplish these goals, the project team reviewed, organized, evaluated, and corrected publicly available water level datasets from Denver Basin aquifer wells across Douglas County. Then, using well construction details and publicly available information related to aquifer depths, hydrographs were created showing the reported water levels, aquifer depth intervals, and well-screen intervals, and water level patterns evaluated spatially and by aquifer. The water levels records that were selected had relatively long (more than a decade) of recent water level data and were screened in a single Denver Basin aquifer (no cross-completions) to better evaluate water level conditions in each aquifer.

The resulting dataset includes 96 wells, and the general number and distribution of wells in each major aquifer with reviewed water level data mirrors the number of constructed wells in each aquifer (i.e. the aquifers with fewer constructed wells also tended to have fewer wells with water level data). Although there is generally good spatial coverage of the shallower aquifers (Upper Dawson, Lower Dawson, and the Denver aquifers), across the Denver Basin in Douglas County, the final dataset is missing deeper aquifer wells (Arapahoe and Laramie-Fox Hills) in the southeastern part of the County.

The evaluation used groundwater level data that is likely representative of different aquifer conditions that stakeholders in Douglas County might encounter. The data included in the analysis came from two primary sources, the United States Geological Survey (USGS) and the CDWR, each of which had advantages and limitations, and the selected dataset contained data from a mix of shallower domestic wells and deeper, municipal wells.

Additionally, the spatial distribution and number of wells with water level data in each aquifer reflects the distribution of constructed wells and indicates that the water level data will provide relevant information for future groundwater development. For example, domestic wells included in the analysis are generally completed in the shallowest aquifer, do not fully screen the entire aquifer, contain more non-pumping water level measurements, and are located in areas where domestic wells are similarly constructed. Municipal wells are generally completed in deeper aquifers, are screened across the entire aquifer interval, and have water level patterns that would indicate intermittent pumping during measurements.

Although the water level records reviewed for this evaluation varied in terms of well construction, measurement approach, and overall quality of data, water levels measured at wells in the same area and screened in the same aquifer showed similarities, which indicates that additional and more robust analyses could be performed, using this dataset as a foundation. General observations for each aquifer are summarized below:

Upper Dawson Aquifer

Upper Dawson wells are concentrated in the northeastern part of Douglas County (Central Basin Water Supply Zone), and in general, are private, small-capacity wells used for domestic (household) purposes, and the wells with water level data reflect this distribution. There are few high-capacity wells constructed in the Upper Dawson in Douglas County, and due to costs and the small amount of water needed to meet domestic demands, private wells are generally only screened in the shallowest part of the aquifer. Although these wells are not screened across, and do not reflect the conditions of the entire aquifer, they are representative of aquifer conditions that private (domestic) well owners in the county might encounter.

In the past 15 years, water levels observed in the Upper Dawson wells have remained relatively stable and display seasonal patterns, which are likely caused by precipitation, evapotranspiration, and seasonal increases in pumping due to irrigation. Although almost all of the Upper Dawson wells had water levels above the top of the aquifer, it is likely that these water levels reflect unconfined conditions and a hydraulic connection to the overlying alluvial aquifer.

Lower Dawson Aquifer

All of the Lower Dawson wells are located in the Central Basin Water Supply Zone, and most wells displayed water levels that would indicate unconfined or likely unconfined conditions. In the northeastern part of the county, the Lower Dawson is overlain by the Upper Dawson, while to the west the Lower Dawson crops out and is the shallowest bedrock aquifer. The eight Lower Dawson wells that had water levels that would indicate confined conditions were primarily in the northern and eastern parts of the county, where overlain by the Upper Dawson. Two wells with clearly unconfined conditions were located in the northern part of the county near the edge of the Upper Dawson aquifer. In general, the water levels observed in the Lower Dawson aquifer were generally stable or declining slightly and also displayed seasonal patterns.

Denver Aquifer

The variability in the Denver aquifer wells' permitted uses and locations translated into distinct patterns potentially controlled by area and use but in general, water levels indicated unconfined or likely unconfined conditions and exhibited declining patterns and seasonality. The Denver wells included in this review were a mix of municipal and domestic wells.

The majority of the municipal wells exhibited water levels that would indicate unconfined or likely unconfined conditions in the aquifer; however, the water level patterns also appear to be heavily impacted by pumping activities, so it is difficult to determine if the water levels reflect background conditions in the aquifer or pumping conditions (which can be affected by well efficiency, aquifer confinement, and operational practices). In general, the domestic wells located in the Central Basin display confined conditions, while the four domestic wells located in Margins A and B indicate unconfined or likely unconfined conditions.

Arapahoe Aquifer

The majority of the Arapahoe aquifer wells (25 out of 27) are municipal wells that are fully screened and display potential pumping signals that made it difficult to decipher seasonal or decline patterns. Of the 27 Arapahoe wells, one is in Margin A, two are in Margin B, and 24 are in the Central Basin Water Supply Zone. In general, wells that appear to have confined conditions are located in the Central Basin Water Supply Zone, while wells where recent water levels indicate clear unconfined conditions (where both recent minimum and maximum water levels were below the top of the aquifer and well screen) are located towards the western edge of the basin (Margins A and B and the northern edge of the Central Basin). Multiple wells displayed steep initial declines relative to more recent data, which may be related to changes in pressure conditions in the aquifer; however, it is difficult to discern if water levels represent background conditions or water levels during pumping and recovery.

Laramie-Fox Hills Aquifer

The relatively low number of Laramie-Fox Hills wells evaluated in this analysis (eight total) reflects the fact that Laramie-Fox Hills wells are less developed in Douglas County than the shallower Denver Basin aquifers. Six of the eight wells are non-domestic wells in the Central Basin Water Supply Zone, and the two wells that are domestic are in the western part of the county where the Laramie-Fox Hills is the shallowest bedrock aquifer well (Margin A). All of the recent water levels are above the top of the aquifer and well screen. For wells in the Central Basin, this would indicate clearly confined conditions, while the two domestic wells in Margin A are possibly unconfined and water levels have been relatively stable. In contrast, the six non-domestic wells' water levels show varying degrees of decline, although potential pumping signals make it difficult to evaluate potential seasonality or compare background water level elevations in nearby wells.

If a more quantitative approach to understanding changes in aquifer storage is needed, additional data review and a more robust statistical approach could be used to estimate trends and serve as the basis for a more in-depth hydrological study or model of the Denver

Basin aquifers in Douglas County. To perform a more robust statistical or hydrological analysis, the comprehensive well dataset (of 96 wells) would need to be pared down to a dataset that provide adequate spatial coverage for each aquifer without creating results-bias due to spatial correlation. (If there is a cluster of wells screened in the same aquifer, confirm that they are showing similar patterns and then pick the well with the best quality data to represent the location.)

Moreover, data from other wells that are not currently available (i.e. from additional water provider wells or strategically placed dedicated monitoring wells) could be added to fill in areas with data gaps. The resulting water level dataset should also contain a mix of domestic and municipal wells, since the two datasets represent different aquifer conditions that local stakeholders might face.

However, for any modeling, the municipal wells will be more advantageous, since they tend to fully screen the respective aquifer. For the highest quality municipal wells, water providers may be able to provide production data. Production data would allow for identification of pumping and non-pumping signals, which could be used for tracking aquifer recovery, evaluating background water level conditions within the aquifer, estimating aquifer properties, and assessing the sustainability of groundwater production.

7.6.2.b Physical Considerations – Water Quality

Water quality is an important consideration of groundwater development and use, since it can affect development costs (related to treatment) as well as human health. Water quality data not associated with water providers is limited in Douglas County. As a result, an in-depth review of county-specific water quality data could not be completed as part of this study; rather, conclusions from high-quality datasets published by the USGS (Bauch et al., 2014) were reviewed. In general, water in the Denver Basin aquifers is of good quality, with only about 10 percent of sampled wells having a contaminant detected at a concentration of potential human-health concern. However, contamination from both natural (geologic) and man-made sources have been observed in wells in the Denver Basin.

Most contaminants of concern, particularly in the Denver Basin aquifers, are from geologic sources and include manganese, radon, arsenic, selenium, and uranium; while nitrate contamination is man-made (Bauch et al., 2014). CDWR also recognizes water quality concerns related to coal seams present in the Denver and Laramie-Fox Hills aquifers, which include higher sulfur content (corrosive to pipes, fittings and fixtures as hydrogen sulfide), dissolved hydrogen sulfide gas (H_2S, "rotten eggs"), and methane gas (CH_4 , explosive; inhalation risk) (CDWR, 2021).

Alluvial groundwater can be particularly susceptible to manmade contamination, related to runoff and irrigation (Bauch et al., 2014), and contaminants of concern for alluvial aquifers (either health-related or aesthetic-related) for alluvial aquifers include total dissolved solids, uranium, nutrients and pesticides, and volatile organic compounds (VOCs). Recently, polyfluoroalkyl substances (PFAS) have also been detected in alluvial aquifers (Newman et al., 2024; Colorado Department of Public Health and Environment, 2025). Prior to groundwater development in a particular area, it is recommended that local water quality data be reviewed and considered when determining potential treatment needs.

7.6.2.c Physical Considerations – Aquifer Specific Production Considerations

Although the groundwater production in Denver Basin aquifers can vary significantly by aquifer and spatially within each aquifer, general observations for each aquifer can be made from basin-wide datasets and should be considered during groundwater development planning. Each of the Denver Basin aquifers represents a different depositional environment (river systems, beach environments, etc.). Their sediment types, aquifer characteristics, and production rates also change greatly depending on the aquifer of interest and the location within the basin.

Of the Denver Basin aquifers present in Douglas County, the Dawson aquifer has the smallest footprint and, in the northeastern third of the county, is physically and administratively divided into the Upper Dawson and Lower Dawson Aquifers. In the remaining parts of Douglas County where the Dawson is present, it's undifferentiated. When permitting and designing a Dawson well this should be considered in terms of cost to access the available water.

Some portions of each aquifer are designated NNT water and will require an augmentation plan to divert water that does not meet the requirements of C.R.S. 37-92-602 (see Table 2 and 3 in Appendix B and Figures 3-9 in Appendix A). These portions of aquifers also have areas where water levels are observed to be lower than the top of the aquifer, indicating unconfined conditions. The Upper Dawson, due to its position near the surface, is designated primarily (99 percent) as NNT water.

The shallowness of the Denver aquifer makes it easier and cheaper to access than the Arapahoe or Laramie-Fox Hills aquifers. However, it can also be production limited, due to the isolated nature of its sand packages. In Douglas County, the Denver production rates can vary significantly because the sandstone units often tend to not be as connected vertically compared to the other aquifers in the county, however many have had success drilling these wells.

The Arapahoe aquifer is below the Denver aquifer and more costly to access. The Arapahoe aquifer has a similar amount of water available as the Denver aquifer and has large continuous sand packages that yield generally higher production rates than the Denver or Laramie Fox-Hills aquifers.

The Laramie-Fox Hills aquifer is the deepest and therefore most expensive aquifer to access, has a lower amount of water physically available than the Arapahoe and Denver aquifers, and has the largest aerial footprint in Douglas County. The Laramie Fox-Hills is the least used aquifer in the County, because of cost to access and less reliable production rates than the Arapahoe and Denver aquifers.

Production from the Laramie-Fox Hills aquifer can vary due to heterogeneous sandstones that can vary in thickness and aquifer characteristics. However, since the Laramie-Fox Hills aquifer has not been significantly developed, more evidence is needed to determine if the aquifer can produce at moderate rates to support additional development.

Regardless of which Denver Basin aquifer is of interest, it is highly recommended that a site-specific investigation is made to identify the best possible location for production but also identify any potential concerns about water quality from local wells or geology. A site-specific review of publicly available data surrounding a desired well location can reveal many potential hurdles that will need to be overcome in the Denver Basin well siting and drilling process.

7.6.3 Estimated Denver Basin Groundwater Across the County

In addition to the estimated amount of Denver Basin groundwater available for the county as a whole, the amount of Denver Basin groundwater that would be available outside the water provider service areas was estimated. This analysis was conducted to accomplish a couple of goals. The first was to provide the County with data regarding the amount of Denver Basin groundwater within each aquifer that may be legally available for new development subject to County review.

The second was to ensure that this analysis did not infringe on water providers' Denver Basin groundwater rights that have been adjudicated by the State Engineer or Water Court, have been acquired through deemed consent, or have been dedicated to a water provider by a developer for service area inclusion. Water providers have the best data on the amount of Denver Basin groundwater available for their constituents, how this groundwater is managed and whether other sources (i.e. renewable sources) are or will be used within their respective boundaries.

To estimate the Denver Basin groundwater available for unincorporated portions of the county, GIS and the Interactive Map was used to subtract out each of the water provider service areas overlying each Denver Basin aquifer. The portions of the unincorporated areas with pre-213 water rights were evaluated, and the NNT actual and NNT-4%, and exempt small capacity or residential wells were removed from the gross amount of Denver Basin groundwater computed.

Upon review of the data, it was determined that the vast majority of the pre-213 water rights were within water provider service areas. It was also determined, as expected, that the vast majority of exempt small capacity or residential wells were outside of the service areas. As a result, gross water availability from each aquifer outside the water service area boundaries was computed. The NNT actual, NNT-4% applicable to the unincorporated area and exempt small capacity or residential wells were subtracted out as shown in Table 2 (Appendix B).

As shown in Table 3 (Appendix B) and Figure 7-5, the following groundwater volumes are available for appropriation from the Denver Basin in unincorporated areas of the county:

- Upper Dawson 465 AFY (less than 1 %)
- Lower Dawson 27,539 AFY (72%)
- Denver 119,122 AFY (72%)
- Arapahoe 138,110 AFY (89%)
- Laramie Fox-Hills 89,195 AFY (89%)

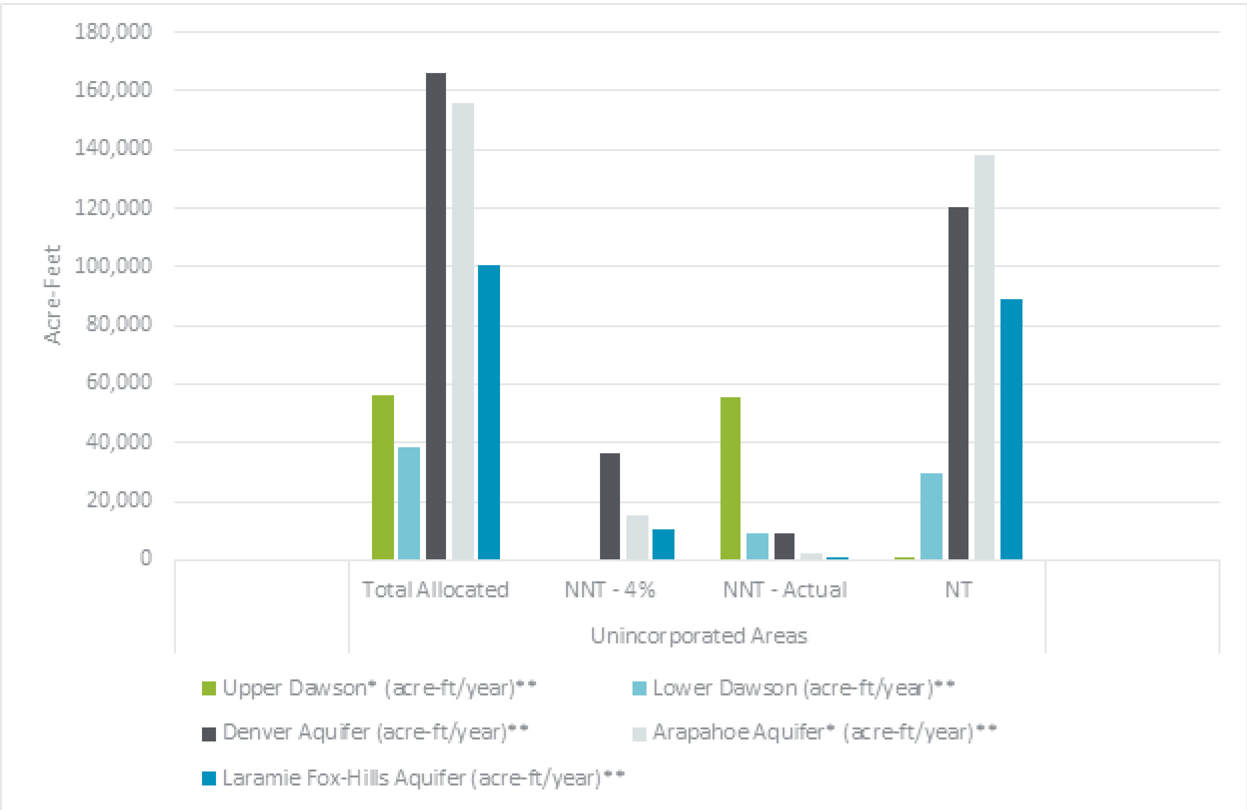
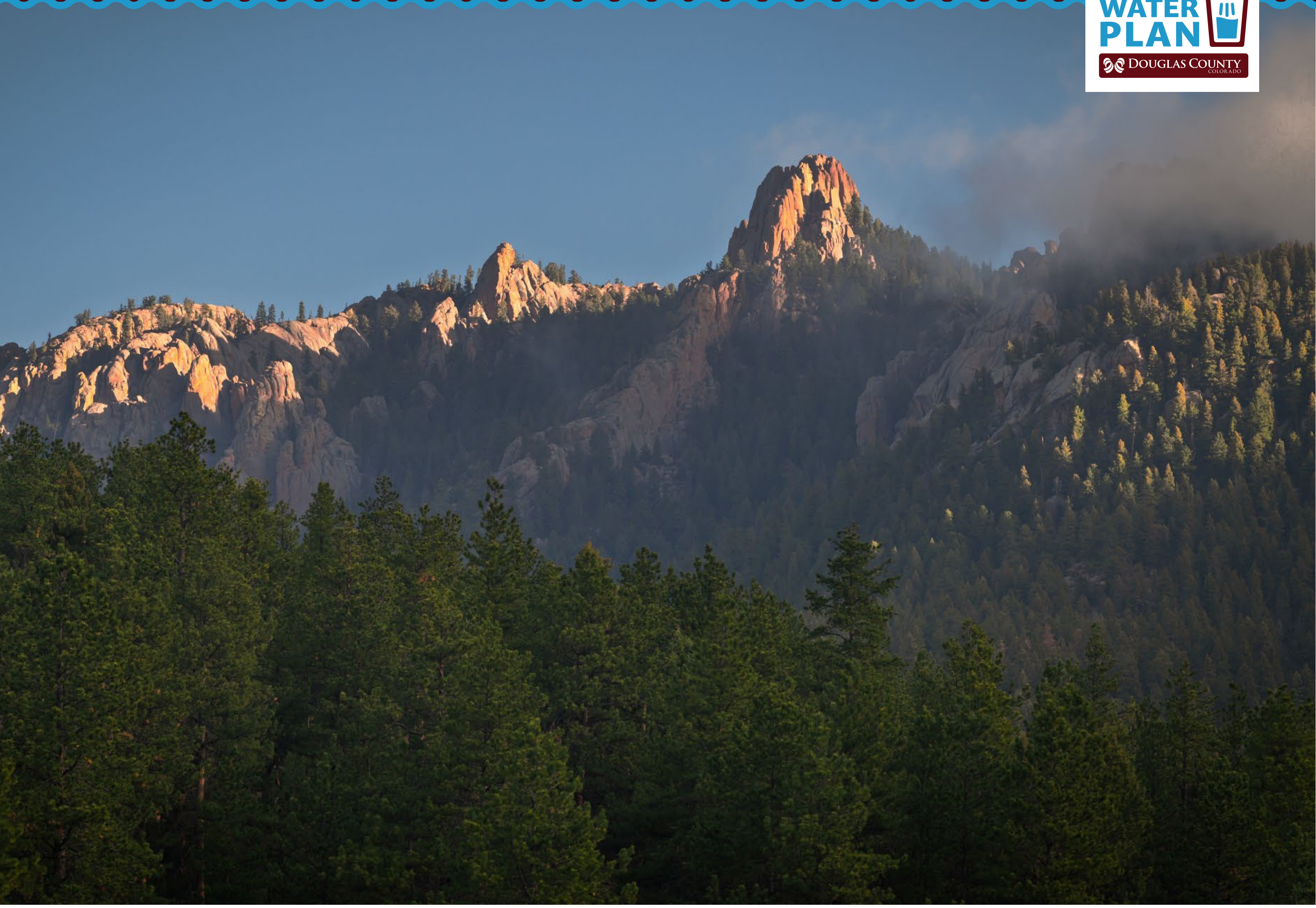


Figure 7-5. Gross Denver Basin Groundwater Availability in the Unincorporated Areas of the County. Data from Table 3 in Appendix B.



CHAPTER 8
SUPPLIES VS. DEMANDS ANALYSIS

CHAPTER 8 - SUPPLIES VERSUS DEMANDS ANALYSIS

This chapter compare includes a comparison of projected water supplies vs. demands in Douglas County as drawn from previous chapters, along with a brief discussion.

8.1 Water Supplies vs. Demands

Figure 8-1 summarizes the supplies versus the demands for Douglas County. The projected water demands increase by 35 percent from 2025 to 2050 as compared to a projected increase in supplies of only 15 percent. Water supplies exceed demand by a factor of 1.43 in 2025, but the gap narrows to a factor of only 1.21 by 2050.

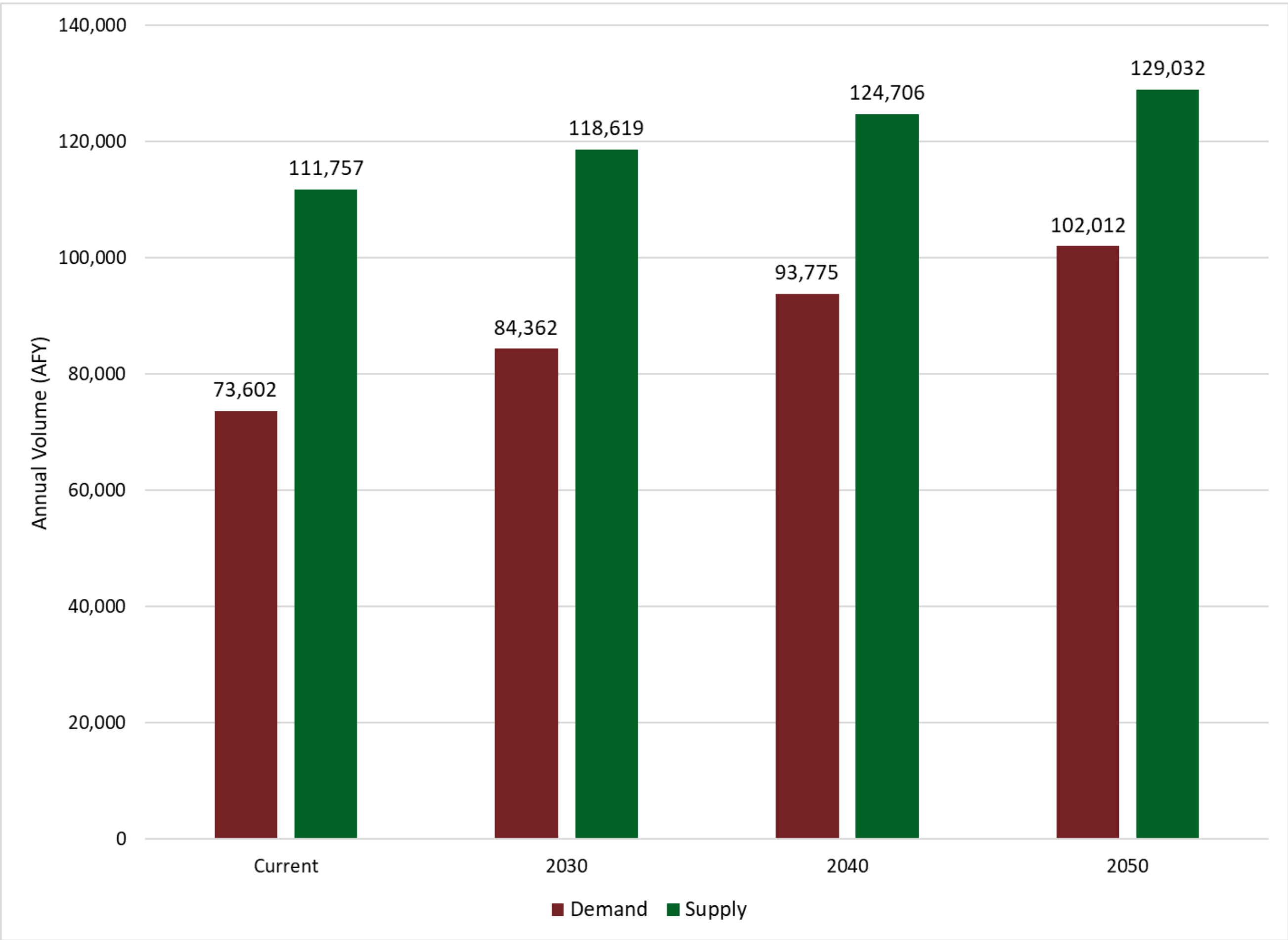
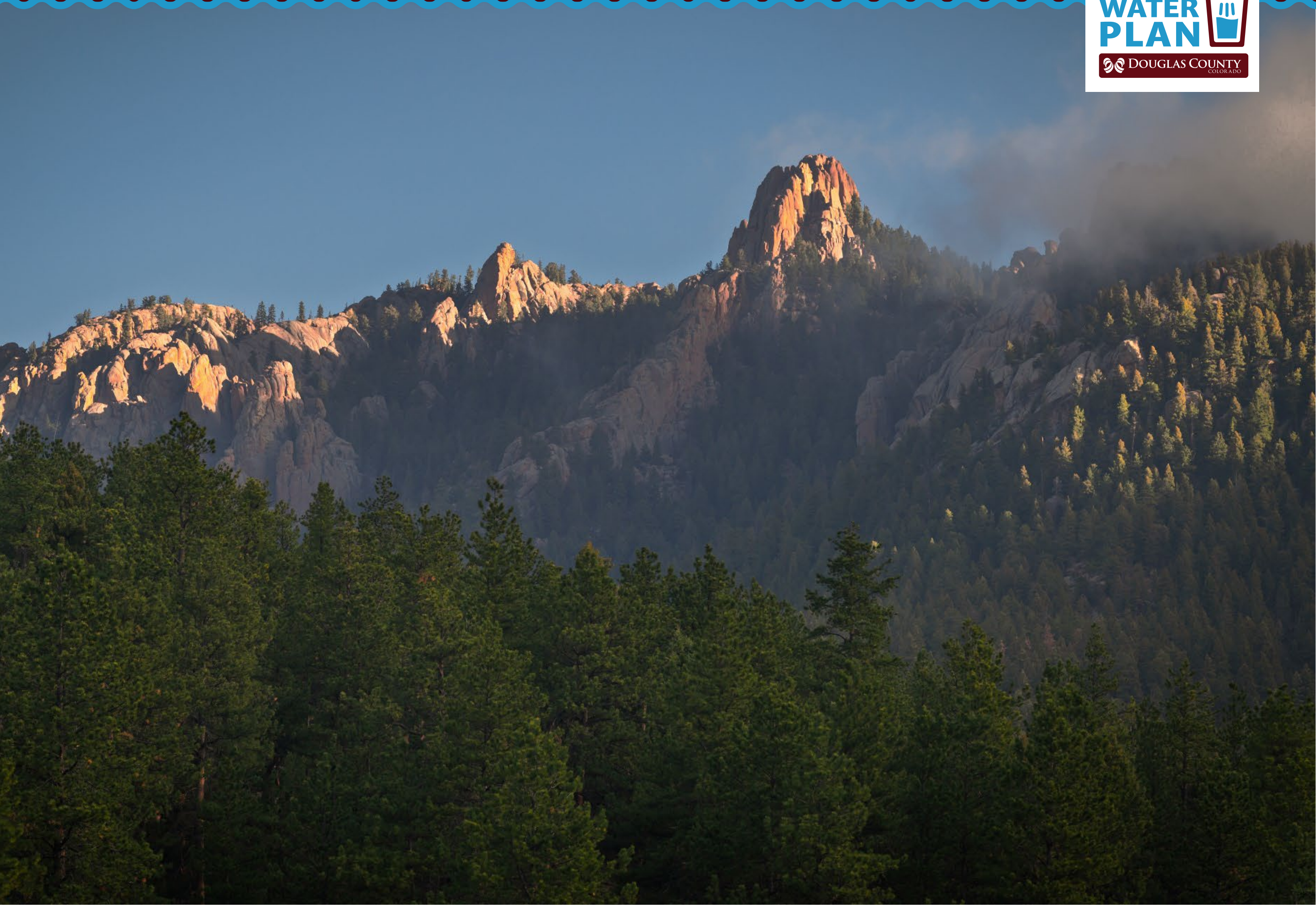


Figure 8-1. Projected supply and demand.

8.2 Analysis

As previously indicated, overall current and planned water supplies for the county exceed current and projected demands. However, there are several factors to consider:

- Most water providers have at least a 1.00 factor of safety on planned supplies vs. projected demands, but some have a factor less than 1.00 and are evaluating how to close that gap. Each provider must frequently review supply versus demand considering changing conditions and develop plans to secure sufficient supplies.
- The supply values presented are based on water rights or allowed usage volumes and not necessarily representative of the actual water economically available from the source ("paper" water vs. physical water). If the physical water proves to be less than the paper water, then less water will be available, and the safety factor will be reduced.
- Changes in supply volumes could also reduce the available supply in the future. Drought can reduce the volume of surface water or alluvial well water available. Fortunately, the Denver Basin aquifers as a primary source for many water providers is not nearly as susceptible to drought effects as surface supplies.
- Conservation is a useful tool to maintain a healthy safety factor. Some providers have established conservation plans while others are just beginning to consider conservation measures. All providers could benefit from effective conservation measures in future water planning.



CHAPTER 9
WATER MANAGEMENT STRATEGIES

CHAPTER 9 – WATER MANAGEMENT STRATEGIES

Given the increasing demand for water resources throughout the region, increasing costs are expected to drive more efficiency in the management of those resources. Water providers are giving much more attention to optimizing water use in their respective service areas and joining with others to develop regional efforts. This section describes those water management strategies: water conservation; water reuse; and "conjunctive use"—all pointing toward a more sustainable future.

9.1 WATER CONSERVATION

Water conservation is well developed in many areas of Douglas County and is expected to expand and develop much further over the projected period of this WMP. This analysis describes the water conservation plans and practices of Douglas County water providers, points to further potential to grow those conservation practices, and determines the reduced growth in projected demands that could result through 2050.

Although the County and its municipalities have interests in water sustainability from a land-use perspective, it is the water providers (and some municipalities that provide that service) that are responsible for water conservation planning, emergency planning, and drought planning standards. Smaller providers, however, may have little or no experience in developing conservation plans. Objectives of this WMP are to: estimate the effects of water conservation planning on future water demands in the county; and recommend elements of conservation planning to include in the County's land development regulations.

9.1.1 DEMAND ANALYSIS

A handful of water providers in Douglas County have prepared water conservation and efficiency plans or have otherwise addressed water conservation in their planning documents. Projected growth reductions due to conservation of water demands of the three large water providers from 2025 through 2050 are estimated from those documents in Table 9-1.

Most of the planning documents reviewed were somewhat dated, and the focus on water conservation has continued to intensify in recent years. For example, the State recently expanded a program to fund rebates for turf replacement. For purposes of this WMP, it is reasonable to assume that an increasing conservation ethic will drive larger demand reductions than those shown in Table 9-1, particularly as water costs increase rapidly over time.

Table 9-1
Demand Reductions from Water Conservation by 2050

Water Provider	% Demand Reduction
Highlands Ranch WSD	4%
Parker WSD	17%
Town of Castle Rock	15%
Average	**12%**

For purposes of this WMP, varying reductions are estimated for existing and new development depending on whether low-water landscape standards are codified, recommended or simply not addressed. Additionally, indoor fixture efficiency and promoting a water-conscious customer base can further improve conservation. It is assumed that existing fixtures will be replaced by 2050 with more efficient fixtures, and that there will be continuing efforts toward customer education.

9.1.2 Water Conservation Impact

The impact of water conservation was determined by applying the average demand reduction percentage to the projected 2050 water demands. Demand reductions for conservation are shown in Figure 9-1.

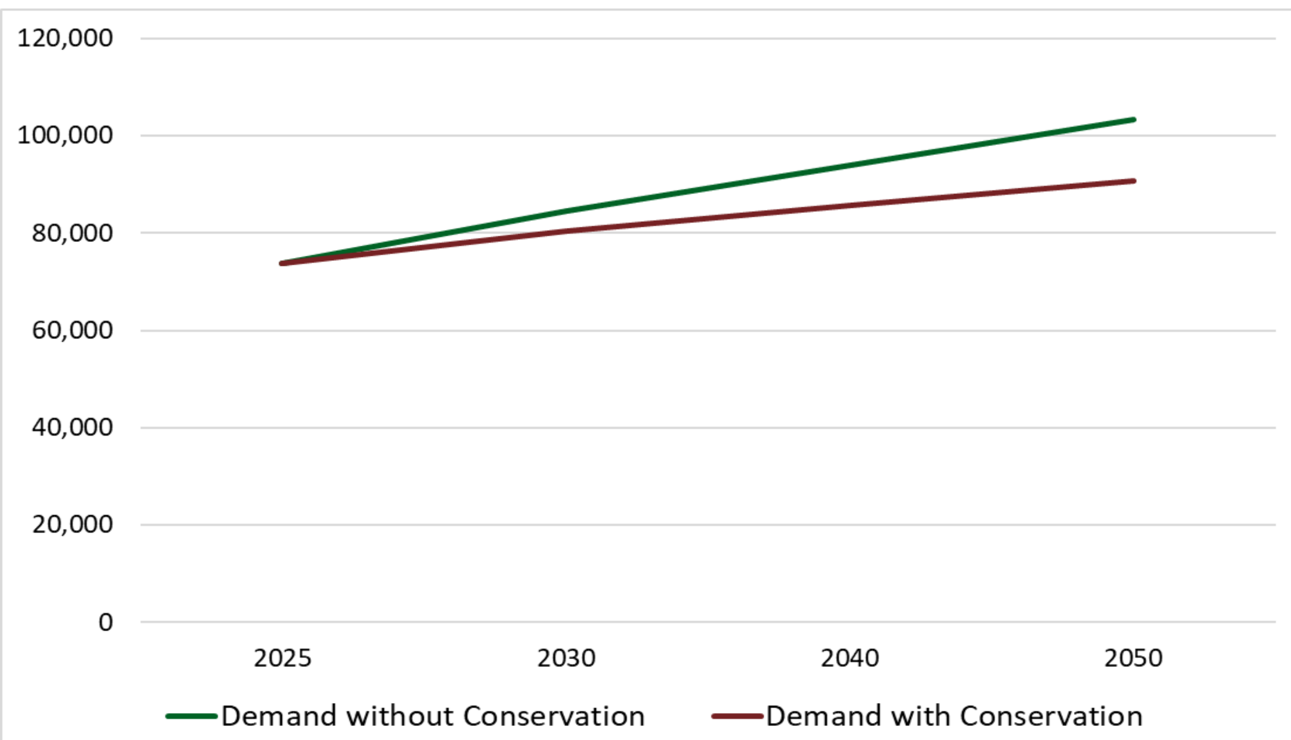


Figure 9-1. Conservation Reductions for 2050 Demand

As shown, conservation measures could save up to 12,400 AFY in overall county demand by 2050 (approximately 12 percent savings).

9.1.3 Water Conservation Best Practices

There are many more conservation measures in addition to water-conscious landscaping and improved indoor fixture efficiencies. The State of Water Conservation in Colorado (WaterWise, March 11, 2022) identifies the three most impactful water conservation measures, and they have been implemented by several water providers throughout Douglas County:

- Inclining Block Rate Structure: The inclining block rate structure is one in which different rates are assigned for increasing volumes of water used, broken into blocks, where the rates increase as water volume consumed increases. The more water a customer uses, the higher the water rate, resulting in a higher bill. This rate schedule promotes water conservation by deterring customers from excessive water use to prevent high water bills.
- Leak Detection/Repair: Leaks in water distribution system piping can lead to significant water loss, and there are now good leak detection technologies available.
- Water System Efficiency Upgrades: Many water system upgrades, such as replacing old, corroded pipe systems, will reduce water waste.

Other significant water efficiency measures used in Douglas County include water-conscious landscaping standards, water reuse, and educational outreach to customers.

9.2 Water-Wise Landscaping

A large part of water conservation is the practice of water-wise landscaping. Irrigation can account for up to 50 percent of single-family residential annual demand. Reducing irrigation needs can provide significant water savings. The guiding premise is that ongoing changes to the types of landscaping commonly used throughout the county can play an important role in reducing long-term demand and improving sustainability of long-term water supplies.

Douglas County's climate is generally arid and average temperatures have increased in the last 30 years. However, many homes, multi-family buildings, and businesses are predominantly landscaped with non-native species from wetter climates. These plants and trees generally require more water to stay healthy than those native to the Mountain West. Kentucky Blue Grass is one example commonly used for residential lawns.

9.2.1 Defining Water-Wise Landscaping

Water-wise landscaping can generally be defined as the use of native plants and hardscape materials that are drought-resistant, and generally require less water and maintenance. It can involve removing non-native plant species that are less tolerant of an arid climate and replacing them with types accustomed to the temperatures, precipitation levels, and aridity associated with a high desert climate, as in Douglas County.

The actual landscaping (plant selection and placement) and volume and frequency of irrigation will depend on the context of a given property but overall, less water is required to maintain healthy vegetation. Throughout the Denver metro area, including Douglas County, a growing number of applications showcase water-wise landscaping, such as turf removal/replacement programs and restrictions on how much turf can be planted on a given property.

9.2.2 Regulatory Framework

Some jurisdictions within Douglas County have water-wise landscaping requirements adopted into municipal code. Other jurisdictions have recommended practices, but not requirements, and some lack any guidance or requirements. Most large jurisdictions have codified provisions that require water-wise landscaping for new development.

For those jurisdictions with **codified requirements**, it is assumed that 10 percent of existing residential and commercial office properties will transition to water-wise landscaping by 2050 based on expected increases in the price of water, incentive and educational campaigns led by municipalities and water providers, and personal preference. For new homes and commercial offices constructed after 2025 subject to code requirements, it is assumed that 100 percent of those properties will have landscaping consistent with water-wise provisions.

For those jurisdictions having **recommendations but not requirements**, it is assumed that 10 percent of existing residential and commercial office properties will transition to water-wise landscaping by 2050 for the same reasons cited above. For new homes and commercial offices constructed after 2025, it is assumed that 20 percent of those properties will include landscaping consistent with water-wise provisions.

For jurisdictions **without standards or recommendations**, it is assumed that 10 percent of existing residential and commercial office properties will transition to water-wise landscaping by 2050 for the reasons cited above. It is expected that only 15 percent of newly built residential and commercial office properties will opt for water-wise landscaping.

The percentages noted above are estimates developed to approximate potential demand reductions for outdoor irrigation over the next 25 years. These percentages may ultimately prove higher or lower based on several variables but provide a useful basis for estimating.

9.2.3 Irrigation Demands

Current and projected water demands through 2050 are shown in Chapter 5. Based on that analysis, outdoor irrigation-only demand accounts for approximately 9.5 percent of total current annual demand. This number significantly increases when accounting for irrigation of residential and commercial properties.

9.2.4 Demand Reductions and Long-Term Supply

Significant reductions in irrigation demands can be achieved across the county in the next 25 years through application of water-wise landscaping. Continued and expanded application of water-wise landscaping on residential, commercial, and municipal (e.g., city-owned) properties will play an important role in extending the use of water supplies. Additionally, more coordination between the County, cities and towns, and water districts and authorities on education, messaging, and incentives will be central to this effort. It is feasible, if not likely that by 2050, water-wise landscaping will be broadly accepted throughout the county and embraced as a critical water management strategy.

9.3 Water Reuse

Another key water management strategy is that of water reuse, and Douglas County's water providers are collectively among the nation's leaders in water reuse applications. Also known as reclamation or recycling, this refers to a wide range of applications in which wastewater is reclaimed to provide a beneficial use. This could be through nonpotable applications, such as irrigation reuse, or potable applications to provide or supplement drinking water. Water reuse can be developed to diversify and extend water supplies. There are different types of reuse, and most have already been implemented to some extent in Douglas County.

9.3.1 Types of Water Reuse

Water reuse is grouped into four main categories: nonpotable, indirect potable, direct potable, and exchange. These categories are explained below and illustrated in Figure 9-1.

Nonpotable Reuse: Nonpotable reuse involves treating wastewater to nonpotable standards suitable for the end use and conveying the water via a dedicated nonpotable system. That system type typically feeds irrigation or industrial uses. This can be on a small scale through on-site wastewater treatment to irrigate a particular property, or on a larger, municipal scale with a dedicated nonpotable distribution system. Nonpotable reuse is regulated by the

Colorado Department of Public Health and Environment (CDPHE) through Regulation 84, Reclaimed Water Control Regulation, which provides treatment standards based on the application. This is a common type of reuse, and is notably used for golf course irrigation by the Castle Pines and Castle Pines North Metropolitan Districts.

Indirect Potable Reuse: Indirect potable reuse (IPR) makes use of an environmental buffer between the wastewater treatment plant's effluent discharge and the supply source for drinking water treatment. When wastewater is treated and discharged into a body of water, like a lake, river, or aquifer, it mixes with the naturally occurring flow for dilution and natural filtration prior to drinking water treatment. Notably, the Water Infrastructure and Supply Efficiency (WISE) partnership project is a good example of IPR.

'De facto' IPR commonly occurs across the country where drinking water treatment plants are located downstream of wastewater treatment plants. Two forms of IPR are illustrated in Figure 9-1 by the 'de facto water reuse' and 'potable water reuse' processes.

Direct Potable Reuse: Direct potable reuse (DPR), also known as "pipe to pipe" reuse, is where treated wastewater is directed to a drinking water treatment plant for purification with no environmental buffer. The water must undergo advanced treatment to meet more stringent standards to safeguard public health.

This is an uncommon type of reuse, with no current installations in Colorado. However, in 2022, CDPHE added DPR policies to the Primary Drinking Water Regulations, Regulation 11. These policies provide a clear framework on how water providers can incorporate DPR into their systems, and several across the state are now considering DPR in their long-term planning.

Exchange: Reuse by exchange occurs when a water provider diverts surface water or pumps groundwater, and then essentially replaces that water volume by discharge of non-native water (sourced from a confined aquifer like those of the Denver Basin, or surface water imported from a different basin) to satisfy water rights priorities of downstream users. The water can be diverted from an upstream location or pumped from an upgradient well, provided there is no injury to priority water rights between the diversion and return flow discharge points. For example, a water provider supplying Denver Basin water to its customers can divert some surface water at an upstream location and then balance that with return flows of wastewater effluent at the discharge point.

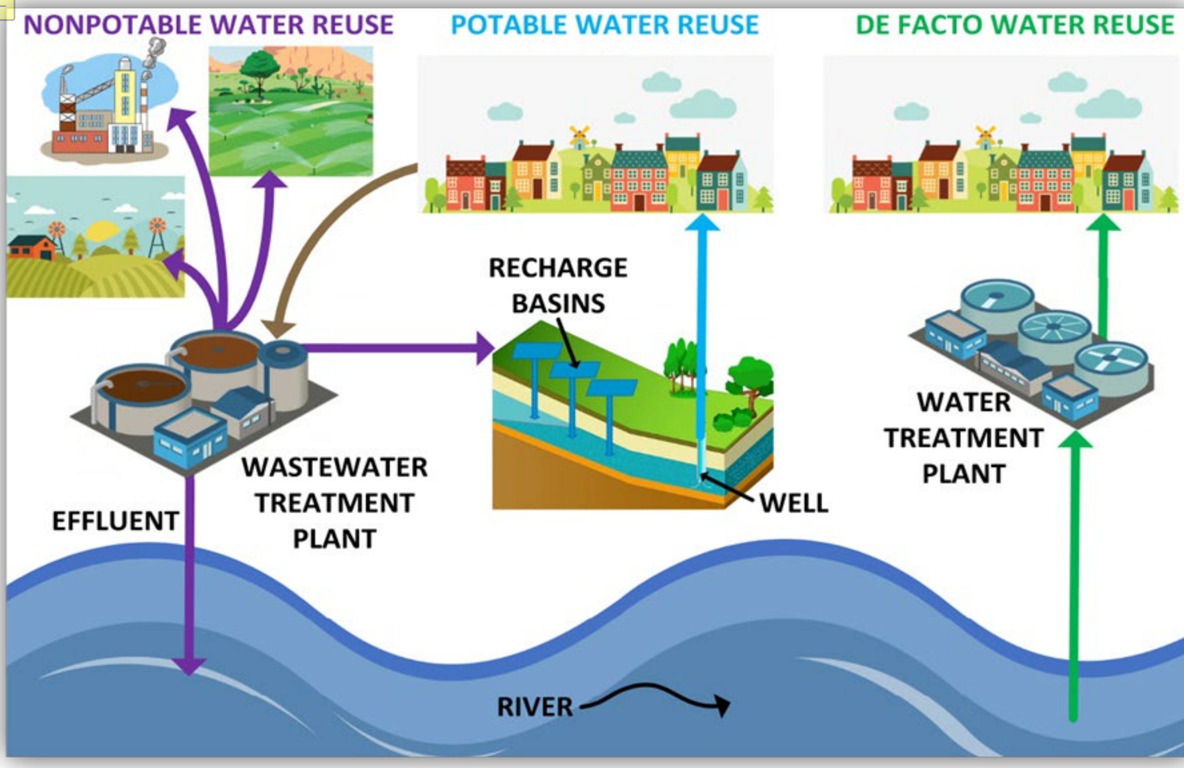


Figure 9-2. Reuse Diagram.

9.3.2 Reuse in Douglas County

Some form of indirect reuse has always taken place in Douglas County. In recent years, an intentional, concerted effort by several water providers has increased water reuse within the county. Several water providers in Douglas County include reuse in their water portfolios. The WISE Partnership is a regional reuse project example that benefits nine Douglas County water providers.

WISE Partnership: The Prairie Waters project was developed by Aurora Water to maximize use of their renewable water supplies through IPR. This involves conveying water from the South Platte River, downstream of metro Denver's effluent discharge (including Aurora's effluent), to south Aurora through a series of pipes and pump stations, to the Binney Water Treatment Facility.

The WISE partnership is a regional partnership between Aurora Water, Denver Water, and the South Metro WISE Authority (Figure 9-2). When Aurora Water has excess water in the Prairie Waters system, the WISE members can buy the excess capacity to supply fully reusable exchange water to their customers. The WISE project can provide an average of 10,000 AFY of reuse water to WISE members.

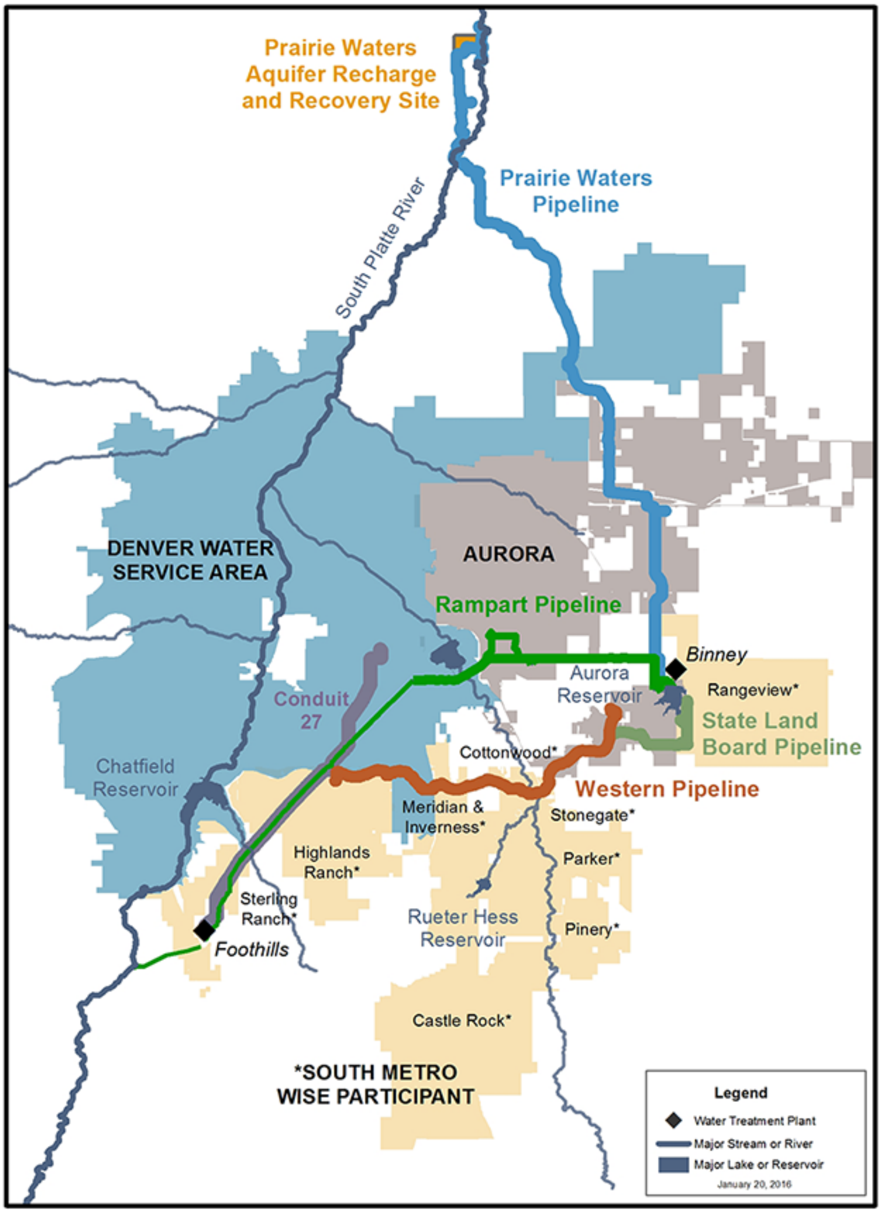


Figure 9-3: WISE Partnership (WISE | Denver Water)

9.3.3 Current and Planned Reuse

Several water providers are planning to expand their reuse systems. Additionally, future projects are expected to include more indirect potable reuse, and even direct potable reuse. Table 9-5 shows current and projected reuse supplies by the three large water providers. The percentage of reuse water was determined by dividing total reuse supplies by total water supplies for each water provider. The values used were taken from water provider surveys described in Chapter 4.

Table 9-5
Estimated Reuse

Water Provider	Reuse as Percent of Water Supplies	Current Reuse Supplies – 2025 (AFY)	Projected Reuse Supplies – 2050 (AFY)
Highlands Ranch WSD	18%	4,000	4,000
Parker WSD	10%	2,300	3,663
Town of Castle Rock	62%	8,276	10,738

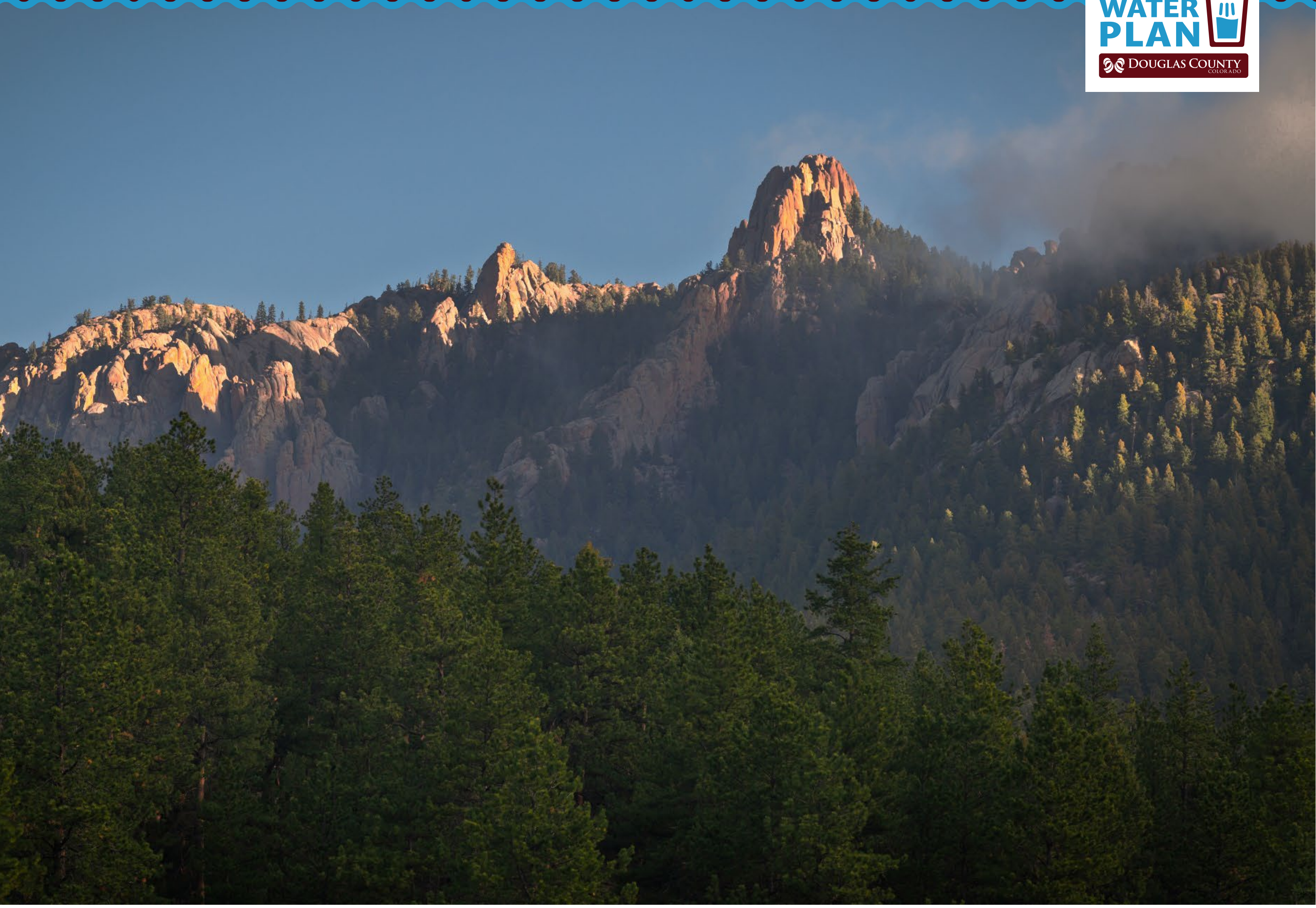
9.4 Conjunctive Use

Conjunctive water use is the coordinated management of surface water and groundwater supplies to maximize their yields. Regionally, it consists of balancing the use or storage of renewable surface water supplies when they are available, and groundwater supplies when they are not (possibly due to seasonal or drought conditions). This has taken the form of diverting, storing and treating available surface water to potable standards and then using it to artificially recharge Denver Basin aquifers for later withdrawal in what is known as aquifer storage and recovery (ASR).

Highlands Ranch WSD has successfully used ASR for decades and other water suppliers are evaluating it further. The SMWSA is also now evaluating it on a regional scale for possible enhancement of the WISE project. ASR makes use of dual-purpose injection/extraction wells to store water underground in times of excess, with removal of the stored water to meet peak seasonal, emergency, or future water demands. Excess water can be available during periods of low demand (winter months) or during severe events such as flooding, when water can be captured and treated for injection into the subsurface. During high demand periods, drought or other water demand challenges, the stored water can be withdrawn to meet demands.

9.5 Conclusions

As the county's population increases, the need for more efficient management of water resources can be expected to expand and intensify. Conservation measures such as expanded use of water-wise landscaping are expected to significantly offset projected demand growth, helping make for a more sustainable future. Water reuse will be expanded as well, helping maximize use of the water developed. More conjunctive water use can also be expected.



CHAPTER 10
IMPLEMENTATION

CHAPTER 10 – IMPLEMENTATION

As documented in Chapter 3, there is a strong foundation of county-specific and statewide regulations and policies to guide the sustainable use of water in Douglas County over the next 25 years. This chapter addresses the County's key role in promoting extending available water supplies to reliably meet projected demands. It includes policies recommended for consideration based on the nexus between land use and water supply planning.

10.1 Policy Recommendations

The following recommendations (identified as "RECC") build on what is already in place and are intended to further strengthen the County's efforts to promote long-term reliability of water supplies with respect to projected water demands. These recommendations primarily stem from a thorough review of regulations and policies that other jurisdictions have enacted. The Douglas County Water Commission (DCWC), BOCC, and county staff are encouraged to consider them in the context of community priorities, the County's capacity to administer and monitor, and the availability of funding to implement them.

County Zoning Resolution

Although Douglas County is not a water provider, it can exercise its regulatory authority over land use decisions and development review to achieve significant water conservation. The zoning resolution is the governing regulation for new development in the county. As such, future amendments to the resolution that aim to more aggressively reduce water demand per capita could serve to extend available long-term water supplies. The following are opportunities to strengthen elements of the zoning resolution to reduce water demands.

Lot Size

Lot sizes have a notable effect on the amount of water used for outside irrigation. Generally speaking, large lots and associated landscaping require more water. Reducing minimum allowances for lot size for several zoning districts in the county could cumulatively allow for more future development on less land and reduce the amount of water used for irrigation.

By accommodating a greater percentage of its future growth on smaller lots, the County could realize a cumulative reduction in water demand per capita.

RECC 1: Lot Size Reductions

Consider reductions in the minimum permitted lot sizes to allow for smaller lots that will require less irrigation. Reductions should be considered for the following zoning districts:

- (LRR) Large Rural Residential District & (RR) Rural Residential District / Lots served by individual wells are minimum two acres, and lots served by central water systems (e.g. a water provider) are minimum one acre.
- (ER) Estate Residential District = lots served by individual septic are a minimum of one acre.
- (SR) Suburban Residential District = the minimum lot size is 9,000 sf and 0.5-acre for accessory dwelling units (ADUs).

Figure 1. Smaller lot development in the future can cumulatively reduce water demand in Douglas County

Any potential reductions will need to consider adequate space requirements for septic leach fields.

Future Development Patterns

Like lot sizes, overall development patterns have a notable effect on water demand and consumption. Namely, less concentrated and more dispersed development patterns generally result in greater water use, whereas increased density reduces demand. In considering how and where future growth will be accommodated, for example, amendments to the zoning resolution could facilitate more multi-family housing as a means of reducing per capita water consumption relative to single-family housing.

RECC 2: Increase Multi-family Zoning

The County should consider increasing the extents of multi-family zoning districts throughout the County to allow for more multi-family housing, and increasing maximum density in these districts from the current limit of 20 dwelling units per acre.

RECC 3: Establish Priority Growth Areas

The County should consider updates to the zoning resolution to establish priority growth areas that would prioritize infill development, both residential and commercial. The zoning for these areas would allow for multifamily buildings, attached housing, and small-lot development. Priority areas should be established in areas where new or renovation development can readily tie into existing water service and not require private wells, which would improve delivery efficiency, and accuracy of use by metering.

RECC 4: Minimize Private Wells

Figure 2. Strategically focusing future residential and commercial growth in priority infill areas can reduce demand through smaller lots and reduce reliance on private, on-lot wells

Through future revisions to the zoning resolution and restricting uses across different districts, the County should minimize the allowance of new developments with individual on-lot wells. In addition, the County should promote connections to centralized water systems (e.g. existing water suppliers) for new development.

Landscaping

Water-wise landscaping can generally be defined as the use of native plants and hardscape

Figure 3 – The application of drought tolerant landscaping can significantly reduce residential water demand.

materials that are drought-resistant and generally require less water and maintenance. It can involve removing non-native plant species that are less tolerant of an arid climate and replacing them with types accustomed to the temperatures, precipitation levels, and aridity associated with Douglas County's high desert climate.

RECC 4: Enhance Landscape Plan Provisions

The County should consider revisions to Section 2708 (Landscape Plan) of the County Zoning Resolution, which was last amended in 2010. The following should be considered:

- Application of the landscape plan requirements to all zoning districts identified in the Zoning Resolution. It currently only applies to multi-family and commercial zoning districts.
- Expand the existing specifications of the 'sustainable landscape plan' required for a Site Improvement Plan to require:
    - A "zoned planting scheme" to reduce water demand by grouping plants with similar water requirements together in the same hydrozone;
- Soil amendments and use of organic mulches that reduce water loss and limit erosion. All plant areas should receive soil amendments of at least three cubic yards per 1,000 sf;

- Limiting large percentages of bluegrass or other traditional turf grasses, including a 15 percent cap for commercial and industrial uses;
- A table summarizing landscaped areas that are water conserving (non-turf) and non-water conserving (turf), to be used by water providers for assessing irrigation tap fees.

Irrigation

RECC 5: Irrigation Ordinance

Consider codification of an irrigation ordinance that regulates the design, installation, and operation of all irrigation systems that connect to potable and/or nonpotable water supplies (as provided by designated water suppliers). The ordinance should include the following:

- Time of Day Irrigation Rules: Limit irrigation to before 10:00AM or after 6:00PM from May 1 to October 15. These restrictions would promote efficient water use, better prepare the community for drought, and are common in neighboring Front Range communities.
- Turf areas irrigated by reclaimed water shall not irrigate before April 1 or after November 30.
- For turf areas irrigated by potable or reclaimed water, irrigation is limited to three days per week.
- Provisions that developers of both commercial and residential developments must install automatic irrigation systems that detect rainfall or high soil moisture and signal a sprinkler system's controller to stop the irrigation cycle. The systems shall also include high-efficiency or precision spray heads for ground cover and drip irrigation for shrubs and trees.

RECC 6: Irrigation Plan Reviews

A preliminary irrigation plan shall be submitted in conjunction with the Official Development Plan. The preliminary irrigation plan must indicate location and size (area) of each hydrozone – including any zones using non-potable water, total water budget broken down by each hydrozone, location and size of water tap and meter, and type of irrigation technique (such as drip, microspray, spray, rotor, underground, etc.)

Irrigation system construction plans shall be submitted for review and approval at the time of landscape construction drawings and will be required to indicate design and layout.

To ensure irrigation systems were properly installed and can efficiently irrigate the landscape, the irrigation ordinance could also require that post-install Landscape Water Audits are performed and approved by an Irrigation Association Certified Irrigation Auditor.

Development Review / Special Uses

RECC 7: Classifying Water-Intensive Land Uses

The County should consider classifying greenhouses, data centers, nurseries, car washes, and and/or hydroponic farms as water-intensive users. These classifications must be reviewed and must receive a conditional use permit subject to calculations of estimated water use and additional impact fees. This would allow the County to examine the impact the use will have on water supplies and could enable the County to place certain mitigative restrictions on the operation of the facility.

RECC 8: Mitigation for Recharge Exceedance

The County should consider an ordinance specifying that any land uses and subdivisions where outdoor water consumption exceeds natural recharge are allowed only by special permit (except in the case of conflicting state or federal regulations, which control). The recharge rate is to be calculated using the ordinance's stipulated water budget methods. The ordinance would set forth conditions for the issuance of a special permit, including a requirement that projects demonstrate, as part of the required environmental review process, how the water budget and water-quality impacts will be mitigated.

Mitigation measures may include identifying compensatory recharge or augmentation to permanently prevent adverse water supply impacts. The ordinance could also bolster the County's existing special permit application requirements, adding that applicants must identify, among other things, the source of the water being used, water quantity required, water-use minimization measures to be implemented, water recycling measures to be implemented, and measures used to enhance onsite recharge.

RECC 9: Graywater Program Permanence

The County should extend its current graywater pilot program into a permanent program. Graywater treatment systems should be allowed in new construction projects, pursuant to Colorado House Bill 24-1362. The County should enter into a memorandum of understanding with the local board of health and water and wastewater service providers to ensure the proper installation and operation of graywater treatment systems.

RECC 10: Stormwater Collection Requirements

Require newly proposed subdivisions to be laid out to enable stormwater collection that can be used for irrigation, subject to water rights considerations. The requirement should encourage the use of cisterns and other water-harvesting techniques that maximize the use of rainwater on-site for irrigation.

RECC 11: Update Building Codes for Conservation

Adopt new standards or update existing standards in the building code so they are at or above national model codes, such as the International Plumbing Code, that encourage water efficiency for all new construction developments. For example, faucets and lavatories located in public restrooms must be "of the metering type or self-closing." Special purpose showerheads and faucets necessary for health and safety purposes can be exempted from this requirement when approved through the development review process.

RECC 12: Bonus Density Zoning

Consider updates to the zoning code to include bonus density zoning. Developers can be awarded additional density over that allowed as-of-right in exchange for implementing water conservation practices such as xeriscaping, water efficient plumbing fixtures, or even water-recycling facilities.

Additional density may come in the form of additional dwelling units, increased floor area ratio, relaxed requirements for minimum lot size, lot width, setback, parking, and height limitations.

RECC 13: PUD Conservation Requirements

Amend planned unit development (PUD) requirements in Section 15 of the zoning resolution to allow or require water conservation features and design elements not required by existing zoning such as:

- Individual rainwater harvesting systems;
- Enhanced open space to increase permeation of groundwater;
- Xeriscape features; and
- Graywater systems

County Infrastructure / Protocols / Procedures

RECC 14: Tiered Irrigation Program

Douglas County Division of Parks, Trails, and Building Grounds should rank all public parks according to purpose, such as high-use athletic facilities, low use areas without programmed activities, and greenbelts/right of ways. Over a 10-year period, staff should reduce irrigation at parks ranked as low(er) use and plant native landscaping to reduce water use.

RECC 15: Soil Amendment Application

For new (County) projects and all landscaped areas in the County, the county should amend the soil to reduce runoff, reduce irrigation needs, and promote healthier plant growth. A minimum of five cubic yards (cy) of organic amendment per 1,000 sf of landscape area should be tilled 8 inches in depth into the soil.

RECC 16: Rain Barrels

To reduce stormwater runoff and promote efficient use, Douglas County should initiate and promote a rain barrel discount program available to county residents.

Figure 4. Rainwater or snow melt harvested in collection barrels can be used to irrigate plants and lawns

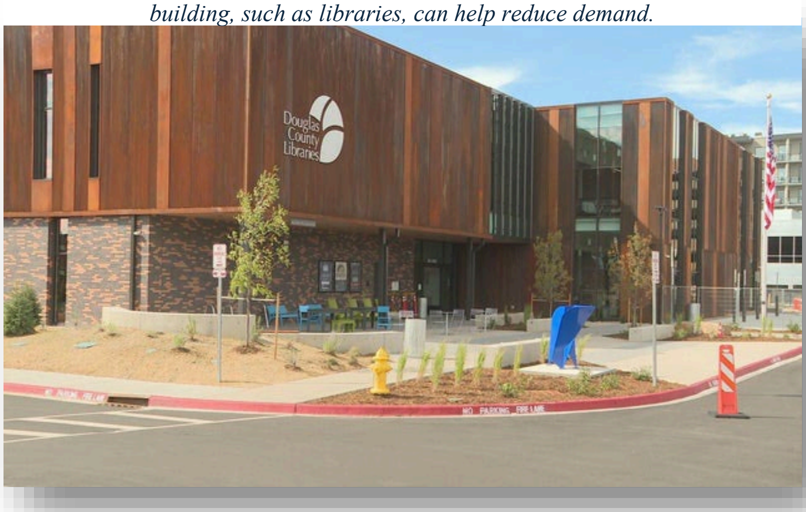
RECC 17: Turf Replacement Program

To reduce residential demand for irrigation, Douglas County should initiate a turf replacement program or support existing programs by the county's water providers. For county residents who commit to removing a specified amount of lawn and replacing it with water-wise xeriscape, they would be eligible to receive a significant discount toward lawn removal services and procurement/planting of xeriscaping.

RECC 18: County Buildings

Ensure that construction of new County buildings meets the water-efficiency elements in Leadership in Energy and Environmental Design (LEED) standards for new construction, and upgrade systems in existing County buildings to meet the water-efficiency requirements in the LEED for Existing Buildings standards.

Figure 5. Inclusion of water-efficient systems and xeriscaping at County-owned building, such as libraries, can help reduce demand.



RECC 19: County Grounds and Infrastructure

Develop and pursue a program of upgrades to County-owned buildings, grounds, and infrastructure to reduce water consumption, including:

- Reduce exterior watering to two times per week;
- Wash vehicles only at facilities using 100% recirculated water;
- Convert 85 percent of public golf course acreage irrigation to recycled water;
- Convert road medians and parkway strips to low- or no-water-use landscaping;
- Proactively plan for and run tests to identify leaks and replace leaking water pipes;
- Expand purple pipe infrastructure to allow for increased conveyance and use of recycled water;
- Encourage the development of new water efficiency, conservation and reuse technologies by providing opportunities for pilot testing and evaluation in construction of new County buildings or retrofits of existing buildings; and
- Consider use of permeable pavement on County-owned parking lots / roads during resurfacing to increase permeability and reduce stormwater runoff.

RECC 20: Education / Social Media.

Over time, produce and release a series of educational installments on water conservation via the County's communication and social media channels. These could include:

- Videos of County engineers or other staff describing the purpose and benefits associated with water conservation projects being undertaken by the County.
- Testimonial videos of residents who have converted water-intensive landscaping to xeriscaping and/or those using rain barrels or cisterns on their property.
- Videos and/or literature where the County can partner with water providers serving the county to disseminate information on tiered water rates, making clear that conservation has economic benefits.

RECC 20: Participation in Regional / State Forums

County staff should engage regularly in regional water meetings such as the South Platte, Metro and Arkansas River Basin Roundtables (facilitated by the Colorado Water Conservation Board) and participate in Colorado Water Congress; a good forum for understanding and taking action on water legislation of statewide interest.

RECC 21: Update 2040 Comprehensive Plan

Consistent with Colorado Senate Bill 24-174, amend the County Comprehensive Plan by December 31, 2026 such that it acknowledges the County's 2026 WMP.

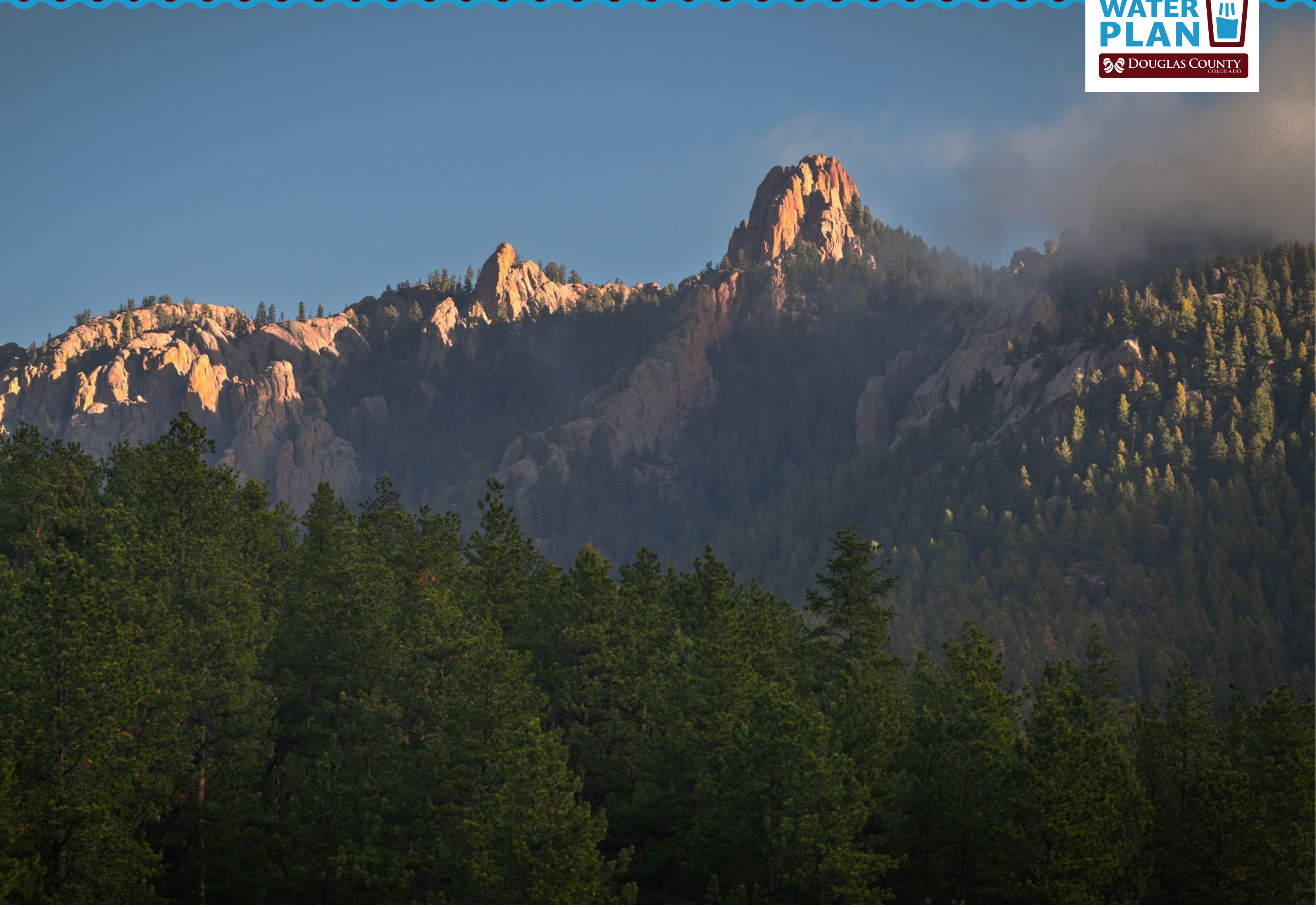
RECC 22: Partner with Providers

Support water providers serving Douglas County in their efforts to identify and construct additional infrastructure improvements to increase water storage and available supply, and their continued research into development of renewable water sources, expansion of reuse strategies, and aquifer storage and recovery.

Figure 6. Increasing areas for water storage in Douglas County could play an important part in sustaining a reliable supply through 2050.

RECC 23: Support Provider Consolidation

Support water providers in their ongoing efforts to consolidate their operations to improve efficiency, reduce leakage, and improve monitoring.



GLOSSARY

GLOSSARY

A

Acre-foot- The volume of water required to cover one acre to a depth of one foot. Equal to 43,560 cubic feet or 325,851 gallons, or 1,233 cubic meters.

Adjudication—Judicial process to determine the extent and priority of the rights of persons to use water in a river or aquifer system.

Alluvial aquifer—An aquifer formed by material laid down by physical processes in a stream channel or on a floodplain.

Alluvium—Unconsolidated clay, silt, sand, or gravel deposited during recent geologic time by running water in the bed of a stream or on its floodplain.

Appropriation—The right to use water for a beneficial use or the acquisition of such a right gained through the process of diverting water and putting it to a beneficial use.

Appropriative rights— Appropriative water rights, generally found in western states, are created by diversion of water and putting it to beneficial use. Appropriative water rights have a priority based on the date of first usage. In times of shortage, junior appropriators are cut off while senior appropriators receive their full allotment.

Aquifer—A saturated water-bearing formation, or group of formations, which yield water in sufficient quantity to be of consequence as a source of supply.

Aquifer system—Heterogeneous body of interbedded permeable and poorly permeable material that functions regionally as a water-yielding unit. It consists of two or more permeable beds separated at least locally by confining beds that impede vertical ground-water movement, but do not greatly affect the regional hydraulic continuity of the system; includes both saturated and unsaturated parts of permeable materials.

Aquifer yield— Maximum rate of withdrawal that can be sustained by an aquifer. See ***Yield***

Artesian well or artesian spring —A well or spring that taps ground water under pressure beneath an aquiclude so that water rises (though not necessarily to the surface) without pumping. If the water rises above the surface, it is known as a flowing artesian well.

Artificial recharge— Deliberate act of adding water to a ground-water aquifer by means of a recharge project. Artificial recharge can be accomplished via injection wells, spreading basins, or in-stream projects.

Augmentation plan—A court-approved plan that allows a water user to divert water out of priority so long as adequate replacement is made to the affected stream system and water right in quantities and at times so as to prevent injury to the water rights of other users.

B

Basin yield— Maximum rate of withdrawal that can be sustained by the complete hydrogeologic system in a basin without causing unacceptable declines in hydraulic head anywhere in the system or causing unacceptable changes to any other component of the hydrologic cycle in the basin. See ***Yield***.

Bed— A layer of rock in the earth. Also the bottom of a body of water such as a river, lake, or sea.

Bedrock— The solid rock that underlies any unconsolidated sediment or soil. Shale and granites are common types of bedrock in Colorado.

Beneficial use— Use of water, such as domestic, municipal, agricultural, mining, industrial, stock watering, recreation, wildlife, artificial recharge, power generation, or contamination remediation, that provides a benefit. Water rights not put to beneficial use are subject to forfeiture. Historically, very few uses of water have been declared non-beneficial by courts.

C

Capture— water withdrawn artificially from an aquifer derived from a decrease in storage in the aquifer, a reduction in the previous discharge from the aquifer, an increase in the recharge, or a combination of these changes. The decrease in discharge plus the increase in recharge is termed capture. Capture results in reduced surface flows.

Certification— the process whereby a permit to appropriate water is finalized based on the completion of the diversion work and past application of water to the proposed use in accordance with the approved wateroright application. A certified water right has a legal, stateoissued document that establishes a priority date, type of beneficial use, and the maximum amount of water that can be used annually.

Clean Water Act— The federal law that establishes how the United States will restore and maintain the chemical, physical, and biological integrity of the country's water (oceans, lakes, streams and rivers, ground water, and wetlands). The law provides protection for the country's water for both point and non-point sources of pollution.

Colorado Water Quality Control Act— Legislation to prevent injury to beneficial uses made of state waters, to maximize the beneficial uses of water, and to achieve the maximum practical degree of water quality in Colorado.

Commercial water use— water for motels, hotels, restaurants, office buildings, other commercial facilities, and institutions. The water may be obtained from a public supply or may be self-supplied.

Community water system— A public system that serves a year-round residential population such as a group of homes receiving water from the same source.

Conditional water right— legal preservation of a priority date that provides a water user time to develop a water right while reserving a more senior date. A conditional water right becomes an absolute right water is actually put to beneficial use.

Cone of depression— A cone-shaped depression in the water table around a well or a group of wells. The cone is created by withdrawing ground water more quickly than it can be replaced.

Confined aquifer— An aquifer that is bounded above and below by confining layers. Because of the pressure created in a confined aquifer, the water level in a well drilled into a confined aquifer will rise above the top of the aquifer and, in some instances, above the land's surface.

Conservation— Management of water resources to eliminate waste or maximize efficiency of use.

Conservation storage— storage of water in a reservoir for later release for useful purposes such as municipal and industrial water supply, water quality, or irrigation.

Consumptive use— That portion of water withdrawn from and lost to the immediate surface or ground-water storage environment. Typical withdrawals or uses included evaporation, transpiration, incorporation into products or crops, consumption by humans or livestock, or other removals.

Contaminant— A substance not naturally occurring in water or occurring in an amount that presents a health risk.

Cubic foot per second (cfs) — Rate of discharge representing a volume of cubic foot (28.317 x 10^{-3} m^3) passing a given point during one second. This rate is equivalent to approximately 7.48 gallons (0.0283 m^3) per second.

D

Decree —An official document issued by the court defining the priority, amount, use, and location of water right.

Depletion— Use of water in a manner that makes it no longer available to other users in the same system.

Depletion time— Time indicating how long it would take the watershed or the groundowater system to dry out if surface runoff or groundowater replenishment (recharge) were stopped from an instant onward, and if outflow water maintained at the rate it had at that instant. Depletion times of surficial waters usually are on the order of hours to weeks. They may run into month or years if the river basin includes large lakes. Depletion times of aquifers are usually on the order of tens to hundreds, and often thousands of years. As a consequence, rivers react quickly to precipitation and to abstraction of water, whereas ground-water systems react very sluggishly to these events.

Depth to water—The depth of the water table below the Earth's surface.

Designated basin—An area in which the use of ground water is assumed not to impact the major surface river basin to which the designated basin would otherwise be tributary. Much of eastern Colorado is in designated basins.

Discharge— The volume of water passing a particular point in a unit of time. Units of discharge commonly used include cubic feet per second (cfs) or gallons per minute (gpm).

Disinfection by-products— Chemicals, such as total trihalomethanes, formed from naturally occurring humic or fulvic acids and the disinfectant used to treating water.

Diversion— Physical removal of surface water from a channel. Also, the act of bringing water under control by means of a well, pump, or other device for delivery and distribution for a proposed use.

Domestic well use—Water used for drinking and other purposes by a household, such as from a rural well. Domestic use permits normally allow limited irrigation and outside watering uses.

Drainage basin— Hydrologic unit consisting of a part of the surface of the earth covered by a drainage system made up of a surface stream of body of impounded surface water plus all tributaries. The runoff in a drainage basin is distinct from that of adjacent areas. A river basin is similarly defined.

E

Effluent—Any substance, particularly a liquid, that enters the environment from a point source. Generally, refers to waste-water from a sewage-treatment or industrial plant.

Evaporation—Process of liquid water becoming water vapor, including vaporization from water surfaces, land surfaces, and snowfields, but not through leaf surfaces. Compare with transpiration.

Evapotranspiration—A collective term for water that moves

F

Flow—The volume of water moving past a point during a specified time. Also known as discharge.

Freshwater— Water containing only small quantities (generally less than 1,000 milligrams per liter) of dissolved materials.

G

Goal— Brief, clear statement of an outcome to be reached.

Gravel pack— Coarse sand and gravel placed in the annular space between the borehole and the well casing in the vicinity of the well screen. The purpose of the gravel pack is to minimize the entry of fine sediment into the well, stabilize the borehole, and allow the flow of ground water into the well.

Ground water— Underground water that is generally found in the pore space of rocks or sediments and that can be collected with wells, tunnels, or drainage galleries, or that flows naturally to the Earth's surface via seeps or springs.

Ground-water basin— Geologically and hydrologically defined area that contains one or more aquifers that store and transmit water and will yield significant quantities of water to wells.

Ground-water mining— Pumping ground water from a basin at a rate that exceeds safe yield, thereby extracting ground water that had accumulated over a long period of time.

Ground-water storage— 1) Quantity of water in the saturated zone, or 2) water available only from the storage as opposed to capture.

H

Hydraulic head of (static) head— Height that water in an aquifer can raise itself above an arbitrary reference level (or datum), generally measured in feet or meters. When a borehole is drilled into an aquifer, the level at which the water stands in the borehole (measured with reference to a horizontal datum such as sea level) is, for most purposes, the hydraulic head of water in the aquifer at that location. Ground water possesses energy mainly by virtue of its elevation (elevation head) and of its pressure (pressure head). When ground water moves, some energy is dissipated and therefore a head loss occurs.

Hydraulically connected— A condition in which ground water moves easily between aquifers that are in direct contact. An indication of this condition is that the water levels in both aquifers are approximately equal.

Hydrologic budget or balance— Accounting of the inflow to, outflow from, and storage in a hydrologic unit such as a drainage basin, aquifer, soil zone, lake, or reservoir; the relationship between evaporation, precipitation, runoff, and the change in water storage, expressed by the hydrologic equation.

Hydrologic cycle— The complete cycle that water can pass through, beginning as atmospheric water vapor, turning into precipitation and falling to the earth's surface, moving into aquifers or surface water, and then returning to the atmosphere via evapotranspiration.

Hydrology— the study of the characteristics and occurrence of water, and the hydrologic cycle. Hydrology concerns the science of surface water and ground water, whereas hydrogeology principally focuses on ground water.

Hydrostatic pressure— The pressure exerted by the water at any given point in a body of water or aquifer.

I

Impervious— Resistant to penetration by water or plant root.

Industrial uses— Water used for a wide range of purposes by industries, including cooling water for electrical power generation, manufacturing, food preparation, washing of wastes, etc. The quality needed ranges substantially depending on the use.

Infiltration (soil) — Movement of water from the ground surface into the soil.

Injection well— Well used for injecting water or other fluid into a ground-water aquifer. See ***Artificial recharge.***

Inorganic— Not made of or derived from living matter. Minerals are inorganic.

Instream use— Use of water that does not require withdrawal or diversion from its natural watercourse; for example, the use of water for navigation, recreation, and support of fish and wildlife.

Intermittent flow— Surface water flowing only during periods of seasonal runoff.

Irrigation use— Water applied to the soil surface by center pivots, ditches, or other means or to the soil subsurface by tubes to add to the water available for plant growth.

L

Livestock water use— Water for livestock watering, feed lots, dairy operations, fish farming, and other on-farm needs. Livestock as used here includes cattle, sheep, goats, hogs, and poultry.

M

Monitoring well— Non-pumping well used primarily for taking water-quality samples and measuring ground-water levels. See ***Observation well.***

N

Nonconsumptive use— Use that leaves the water available for other uses. Examples are hydroelectric power generation and recreational uses.

Non-potable— Water not suitable for drinking.

Nontributary ground water— Underground water in an aquifer that neither draws from nor contributes to a natural surface stream in any measurable degree.

Not-nontributary ground water— Ground-water that is hydrologically connected to a surface stream system.

O

Objective— Specific, measurable, realistic, and timebound condition that must be attained in order to accomplish a particular goal. Objectives define the actions must be taken within a year to reach the strategic goals.

Observation well— Non-pumping well used primarily for observing the elevation of the water table or the piezometric pressure; also to obtain water-quality samples.

Organic— Pertaining to or relating to a compound containing carbon. For example, petroleum products contain organic compounds derived from plant and animal remains.

P

Percolation— Laminar-gravity flow through unsaturated and saturated earth material.

Permeability— 1) Ability of a material (generally an earth material) to transmit fluids (water) through its pores when subjected to pressure of a difference in head. Expressed in units of volume of fluid (water) per unit time per cross section area of material for a given hydraulic head; 2) description of the ease with which a fluid may move through a porous medium; abbreviation of intrinsic permeability. It is a property of the porous medium only, in contrast to hydraulic conductivity, which is a property of both the porous medium and the fluid content of the medium.

Point source— Source of pollution that originates from a single point, such as an outflow pipe from a factory.

Policy— Deliberate system of principles to guide decisions and achieve rational outcomes

Pollution— Contamination from human activities that restricts the uses of water.

Porosity— Fraction of bulk volume of a material consisting of pore space. Porosity determines the capacity of a rock formation to absorb and store ground water.

Porous— Geologically, this term describes rock that permits movement of fluids through small, often microscopic openings, much as water moving through a sponge. Porous rocks may contain gas, oil, or water.

Precipitation— Water in some form that falls from the atmosphere. It can be in the form of liquid (rain or drizzle) or solid (snow, hail, sleet).

Prior appropriation— Doctrine for prioritizing water rights based upon dates of appropriation (“first in time, first in right”). Common method for allocating water rights in the western United States.

Priority— Seniority date of a water right or conditional water right to determine their relative standing to other mater rights and conditional water rights and conditional water rights deriving water from a common source. Priority is a function of both the appropriation date and the relevant adjudication date to the right.

Priority date— The date a water right is established.

R

Raw water— Untreated water.

Recharge— The replenishment of ground water in an aquifer. It can be either natural, through the movement of precipitation into an aquifer, or artificial in the pumping of water into an aquifer.

Recharge area— A geographic area where water enters (recharges) an aquifer. Recharge areas usually coincide with topographically elevated regions where aquifer units crop out at the surface. In these areas infiltrated precipitation is the primary source of recharge. The recharge area also may coincide with the area of hydraulic connection where one aquifer receives flow from another adjacent aquifer.

Reclaimed wastewater— Wastewater treatment plant effluent that has been diverted for beneficial use before it reaches a natural waterway or aquifer.

Recycled water— Water that is used more than one time before it passes back into the natural hydrologic system.

Return flow— Part of water that is not consumed and returns to its source or another body of water.

S

Safe drinking Water Act (SDWA) — Federal legislation passed in 1974 that regulates the treatment of water for human consumption and requires testing for and elimination of contaminants that might be present in the water.

Saturated thickness— The vertical thickness of an aquifer that is full of water. The upper surface is the water table. The height of the hydrogeologically defined aquifer unit in which the pore spaces are filled (saturated) with water. For the High Plains aquifer and similar unconfined, unconsolidated aquifers, the saturated thickness is equal to the difference in elevation between the base of the aquifer and the water table. The predevelopment saturated thickness is based on the best available estimate of the elevation of the water table prior to human altercation by ground-water pumping.

Saturated zone— A subsurface zone in which all the interstices are filled with water under pressure greater than atmospheric. The upper surface of the saturation zone is the water table.

Specific storage— Volume of water released from or taken into storage per unit volume of the porous medium per unit change in head. It is the three-dimensional equivalent of storage coefficient or storativity, and is equal to storativity divided by aquifer saturated thickness.

State Engineer— The person charged by state law with the supervision and administration of water and the enforcement of decreed priority and legislative enactments. The State Engineer discharges the obligations of the state of Colorado imposed by compact or judicial orders and coordinates the work of the Division of Water Resources with other departments of state government. The State Engineer has rule-making obligations and supervisory control over measurements, record keeping, and distribution of the public water of the state and all employees under his direction and any other such acts as may be reasonable necessary to enable the performance of his duties.

Strategy— The art of devising or employing plans or stratagems toward a goal

Streamflow— Discharge that occurs in a natural channel. A more general term than runoff, streamflow may be applied to discharge whether or not it is affected by diversion or regulation.

Surface water— Water found at the Earth's surface, usually in streams or lakes.

T

Transmissivity— Flow capacity of an aquifer measured in volume per unit time per unit width. Equal to the product of hydraulic conductivity times the saturated thickness of the aquifer.

Treated water— Water that has been filtered and disinfected.

Tributary— A tributary is generally regarded as a surface water drainage system which is interconnected with a river system. Under Colorado law, all surface and ground water, the withdrawals of which would affect the rate or direction of flow of a surface stream within 100 years, is considered to be tributary to a natural stream.

U

Unconfined aquifer— An aquifer that is not bounded above by a confining bed; water levels in wells screened in an unconfined aquifer coincide with the elevation of the water table.

Unsaturated zone— Also known as the vadose zone, this is the area of soil or rock just above the water table.

V

Void— Pore space or other openings in rock. The openings can be very small to cave-size and are filled with water below the water table.

W

Wastewater— Water that carries wastes from homes, businesses, and industries.

Water court— A specific district court that has exclusive jurisdiction to hear and adjudicate water matters. There are seven water courts in Colorado, a judge, who is also district court judge, presides over each court.

Water level— The level of water in a well or aquifer. It can be measured as depth below the ground surface or as an elevation related to a datum, such as sea level.

Water quality— Physical, chemical, and biological characteristics of water and how they relate to it for a particular use.

Water Quality Control Act— Colorado statute enacted in 1981 to protect, maintain, and improve the quality of state waters through prevention, abatement, and control of water pollution. This act created the nine member Water Quality Control Commission that is responsible for developing specific water quality policy.

Water right— Any vested or appropriation right under which a person may lawfully divert and use water. It is a real property right appurtenant to and severable from the land on or in connection with which the water is used. Water rights pass as an appurtenance with a conveyance of the land by deed, lease, mortgage, will, or inheritance.

Watershed— An area from which water drains and contributes to a given point on a stream or river.

Water table— A fluctuating demarcation line between the unsaturated (vadose) zone and the saturated (phreatic) zone that forms an aquifer. It may rise or fall depending on precipitation (rainfall) trends. The water table is semi-parallel to the land surface above but is not always a consistent straight line. Because of impervious beds of shale, etc., local water tables can be perched above the area's average water table.

Water year— Twelve-month period in which the U.S. Geological Survey reports surface water supplies. Water years begin October 1 and end the following September 30, and are designated by the calendar year in which the water year ends.

Well— A vertical excavation into an underground rock formation.

Well permit— the granting of permission by the State Engineer allowing the digging of a hole in search of ground water to apply to a beneficial use. A written permit obtained from the State giving permission to dig a hole to find ground-water.

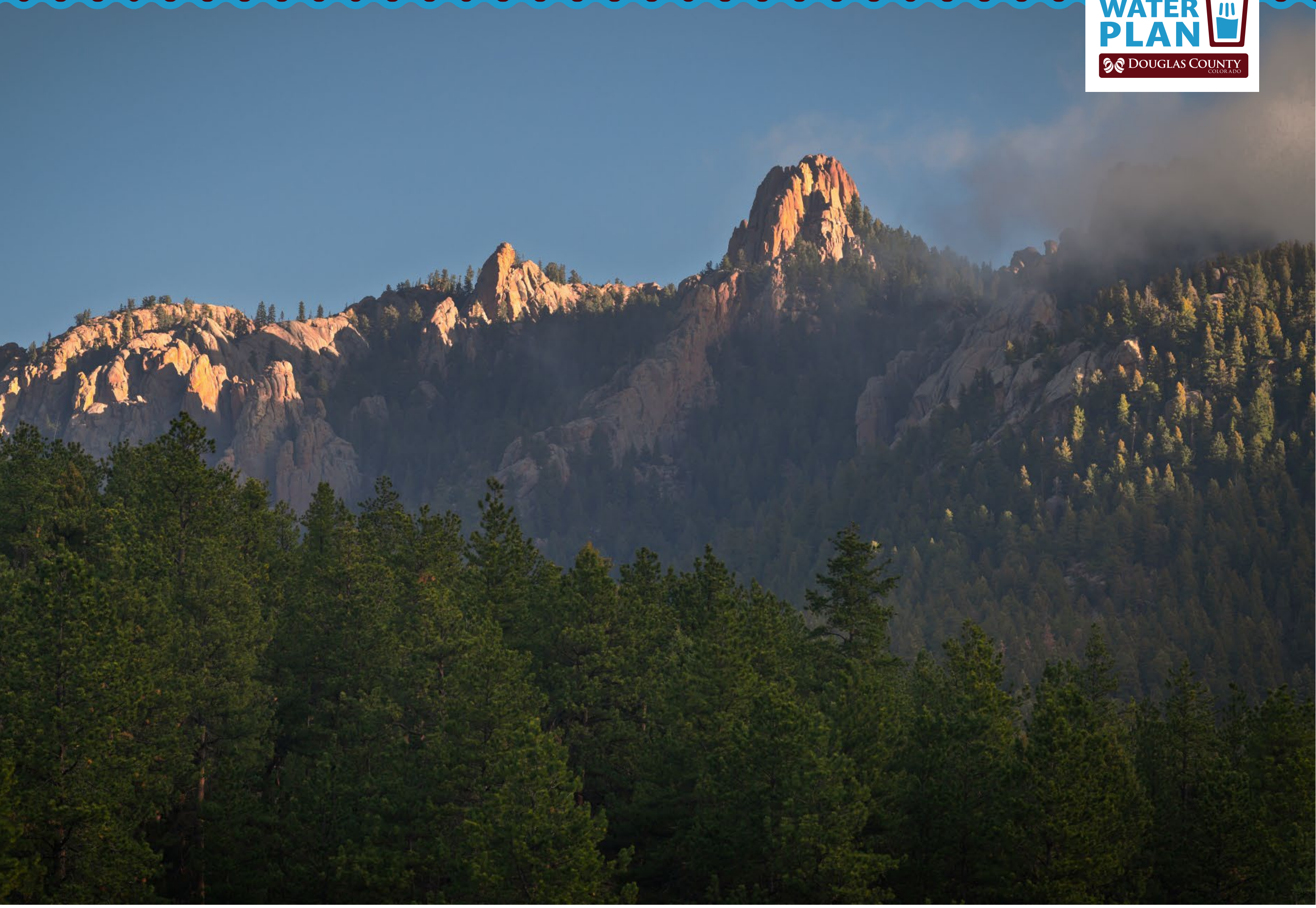
Well yield— Pumping rate that can be supplied by a well without drawing the water level in the well below the pump intake. See ***Yield.***

Y

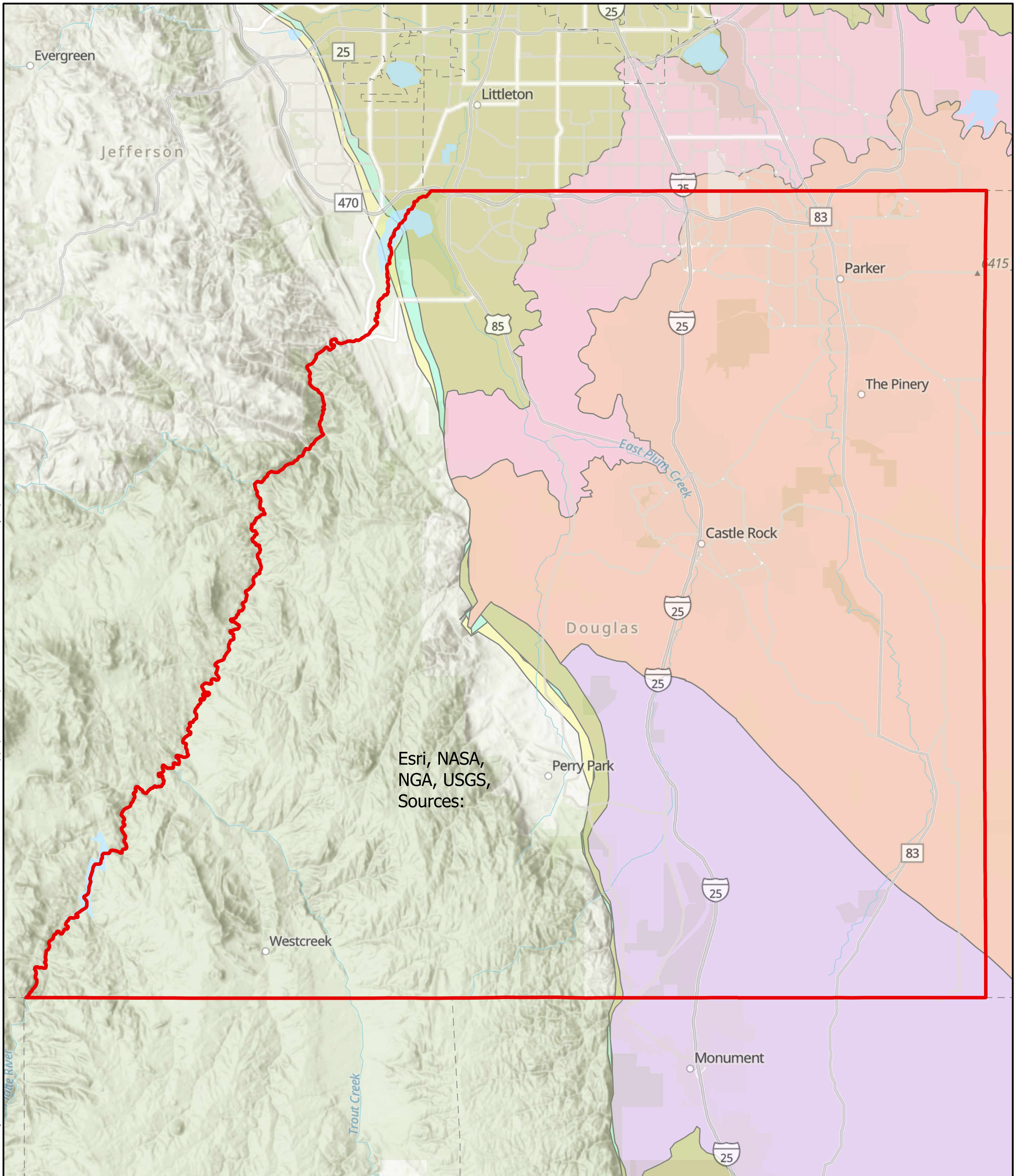
Yield— Amount of water that can be supplied from a reservoir, aquifer, basin, or other system during a specified interval of time. This time period may vary from a day to several years depending upon the size of the system involved.

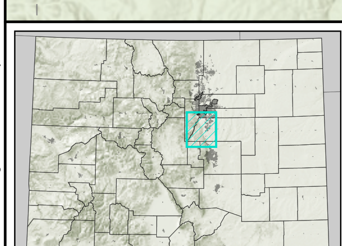
SOURCES

Topper, R., K. L. Spray, W. H. Bellis, J. L. Hamilton, and P. E. Barkmann. SP-53 Ground Water Atlas of Colorado. Special Publications, SP-53. Denver, CO: Colorado Geological Survey, Division of Minerals and Geology, Department of Natural Resources, 2003.



APPENDIX A





- Upper Dawson Aquifer
- Lower Dawson Aquifer
- Dawson Aquifer
- Denver Aquifer
- Arapahoe Aquifer
- Laramie-Fox Hills Aquifer
- Douglas County

1543FGA05 | NOVEMBER 2025

1 0 1 2 3 4 5 Miles

SCALE: 1:300,000

N

FIGURE 1
DOUGLAS COUNTY ALLUVIAL AND BEDROCK AQUIFERS

LRE WATER

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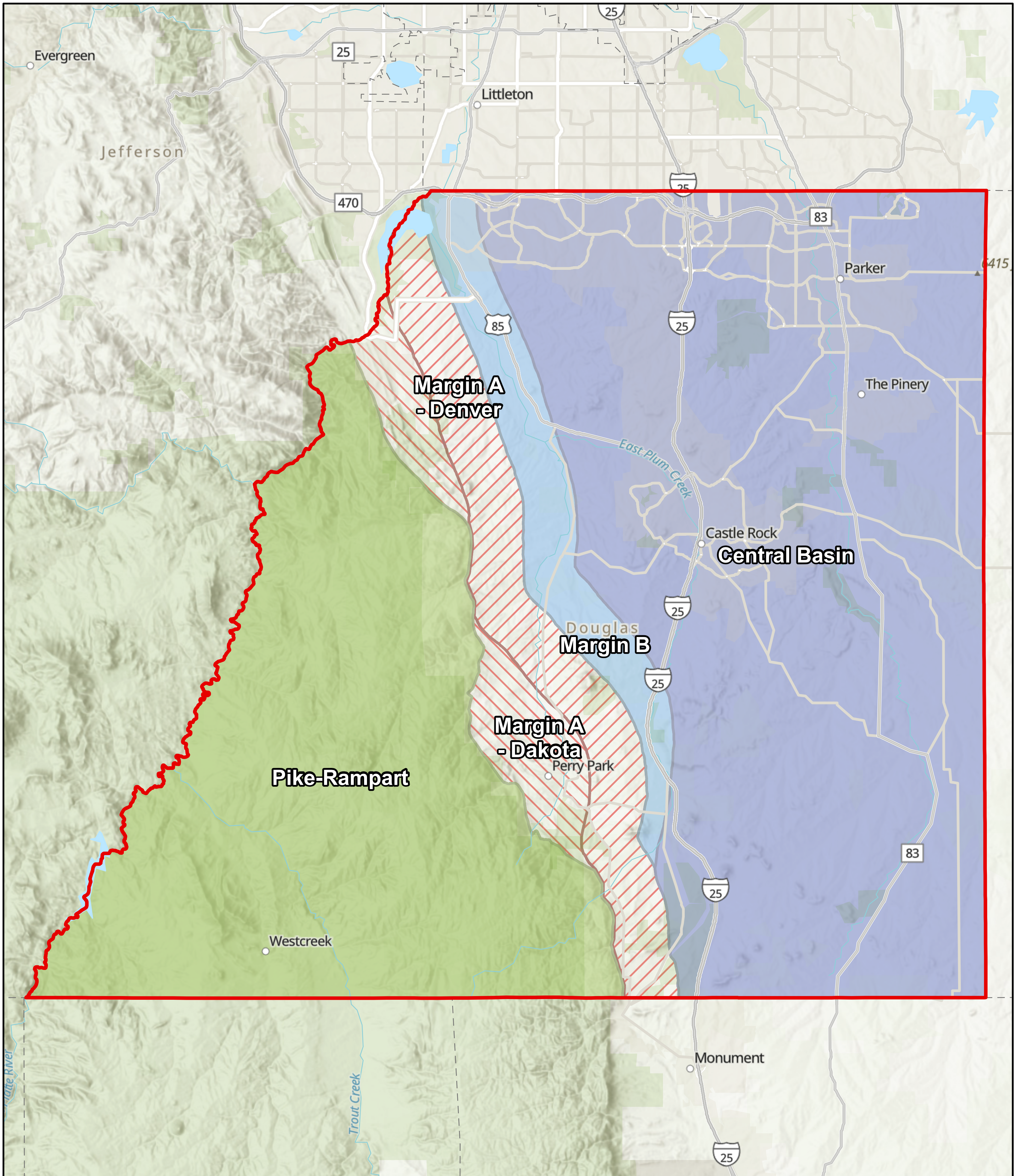

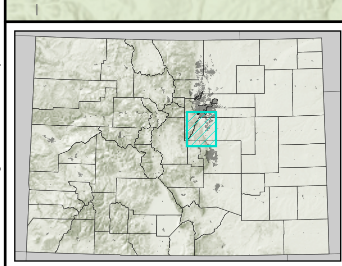

Water Supply Zones

- Margin A - Dakota
- Margin A - Denver
- Margin B
- Central Basin
- Pike-Rampart

Douglas County

1543FGA05 | NOVEMBER 2025

1 0 1 2 3 4 5
SCALE: 1:300,000 Miles

N

FIGURE 2
DOUGLAS COUNTY WATER SUPPLY ZONES

LRE WATER

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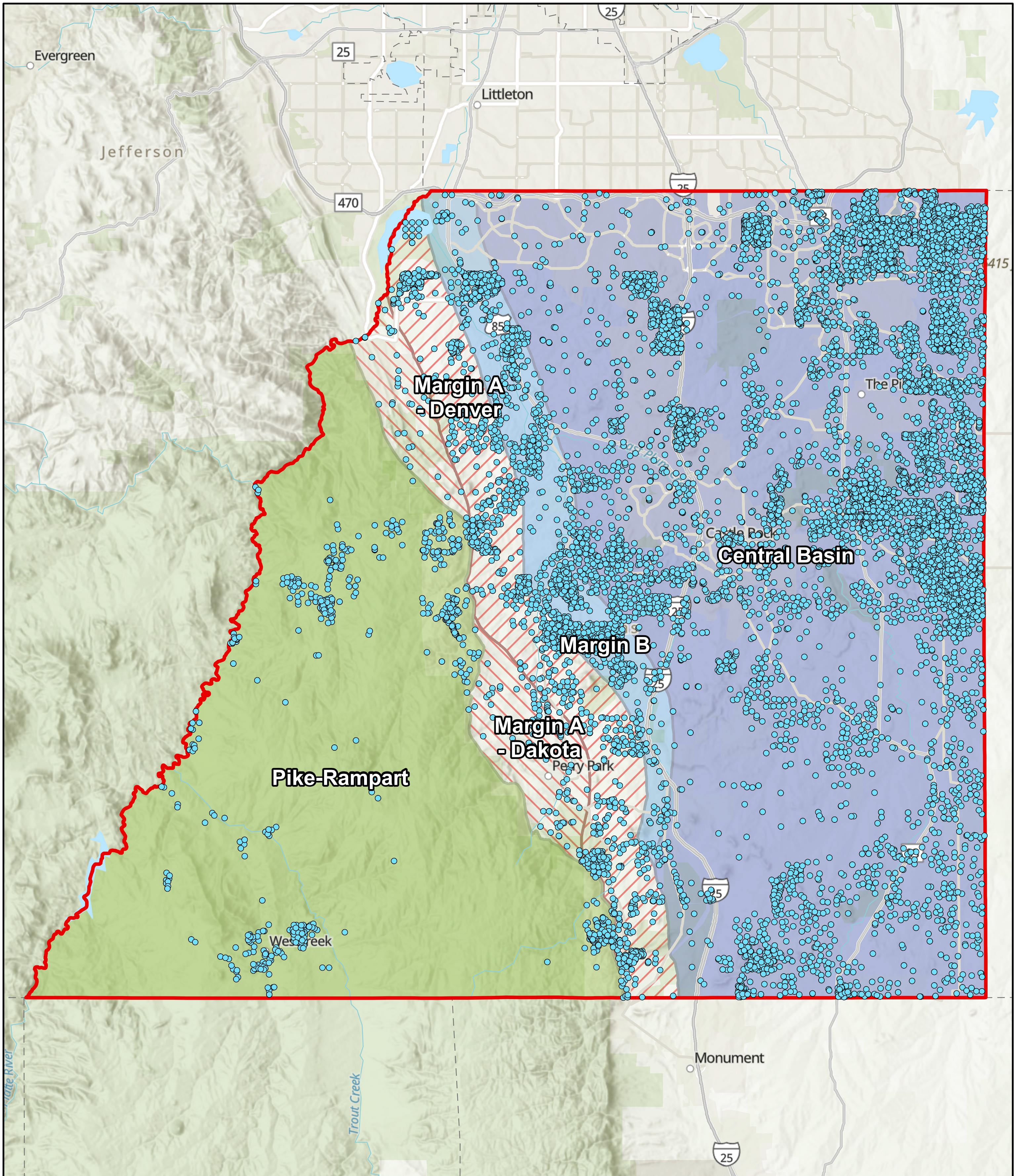
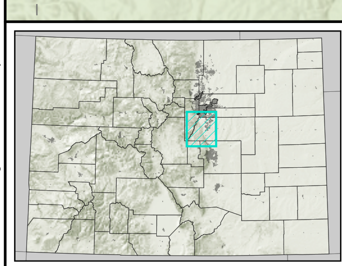




Water Supply Zones

- Margin A - Dakota
- Margin A - Denver
- Margin B
- Central Basin
- Pike-Rampart

- Production Wells
- Douglas County

1543FGA05 | NOVEMBER 2025

1 0 1 2 3 4 5 Miles

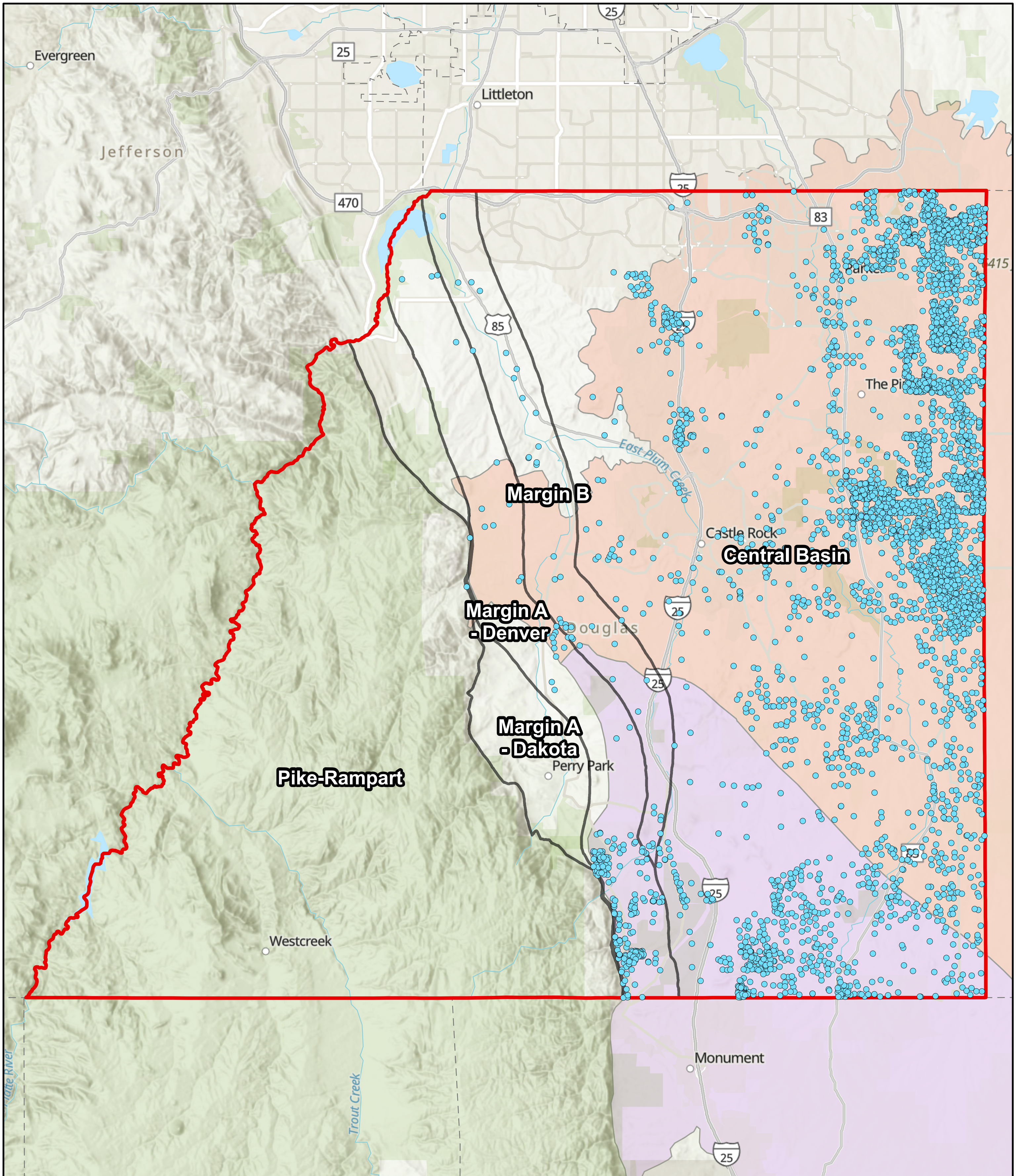
SCALE: 1:300,000

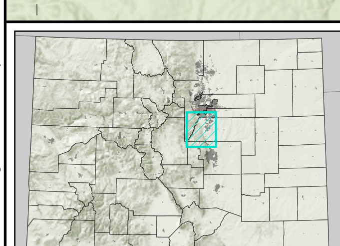
N

FIGURE 3
DOUGLAS COUNTY WATER SUPPLY ZONES WITH CONSTRUCTED WELLS

LRE WATER

Service Layer Credits: Esri, NASA, NGA, USGS, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, (c) OpenStreetMap contributors, and the GIS User Community. Aquifer data from CDSS.





Upper Dawson and Dawson Wells
Water Supply Zones
Douglas County
Upper Dawson Aquifer
Dawson Aquifer

Note: Wells displayed outside the aquifer extent are permitted and recognized as Upper Dawson wells by the DWR. These wells are displayed based on the DWR's designation.

1543FGA05 | NOVEMBER 2025

1 0 1 2 3 4 5 Miles

SCALE: 1:300,000

N

FIGURE 4
DOUGLAS COUNTY UPPER DAWSON / DAWSON WELLS WITH ZONES

LRE WATER

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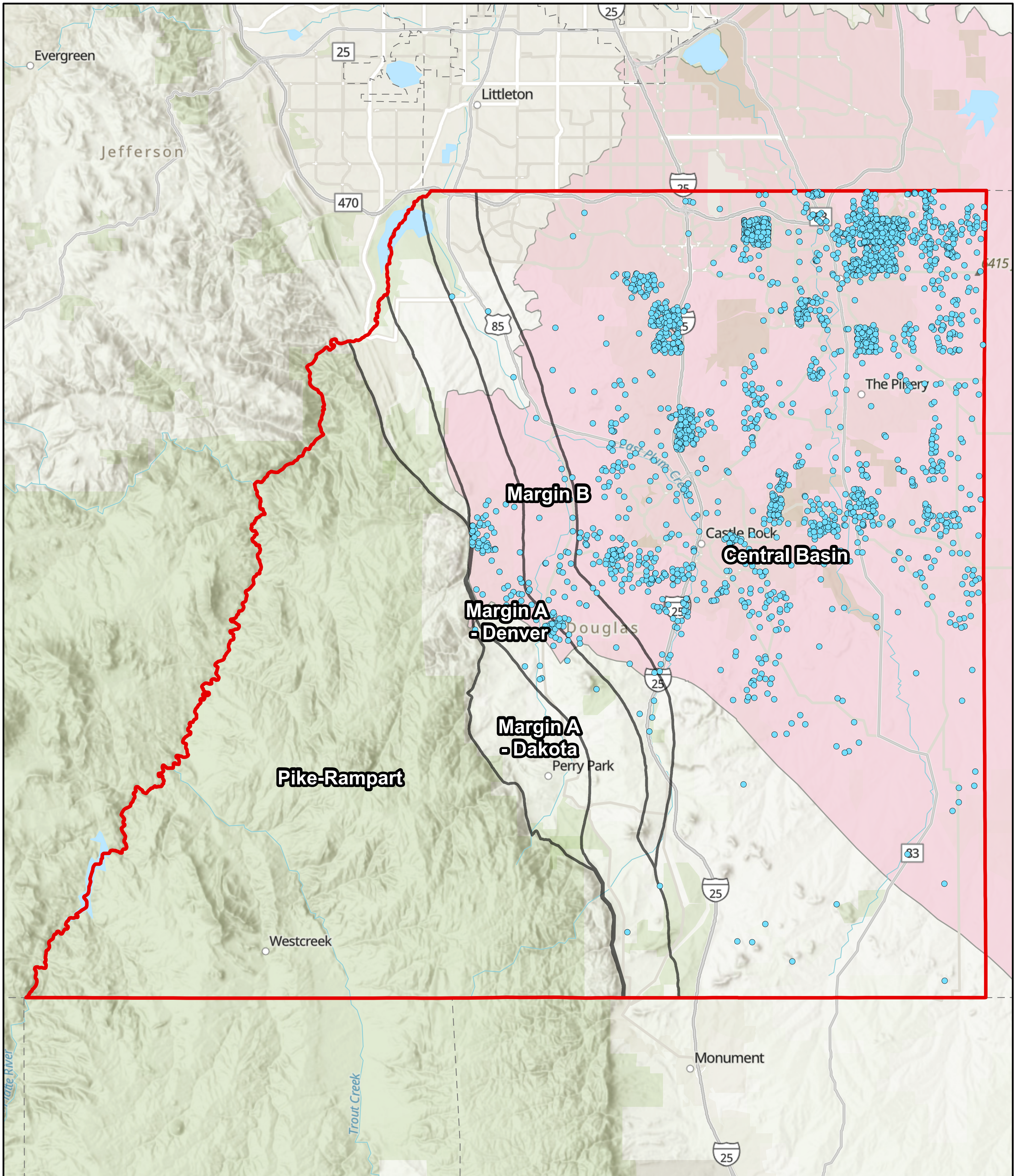


Lower Dawson Wells
Water Supply Zones
Douglas County
Lower Dawson Aquifer

Note: Wells displayed outside the aquifer extent are permitted and recognized as Lower Dawson wells by the DWR. These wells are displayed based on the DWR's designation.

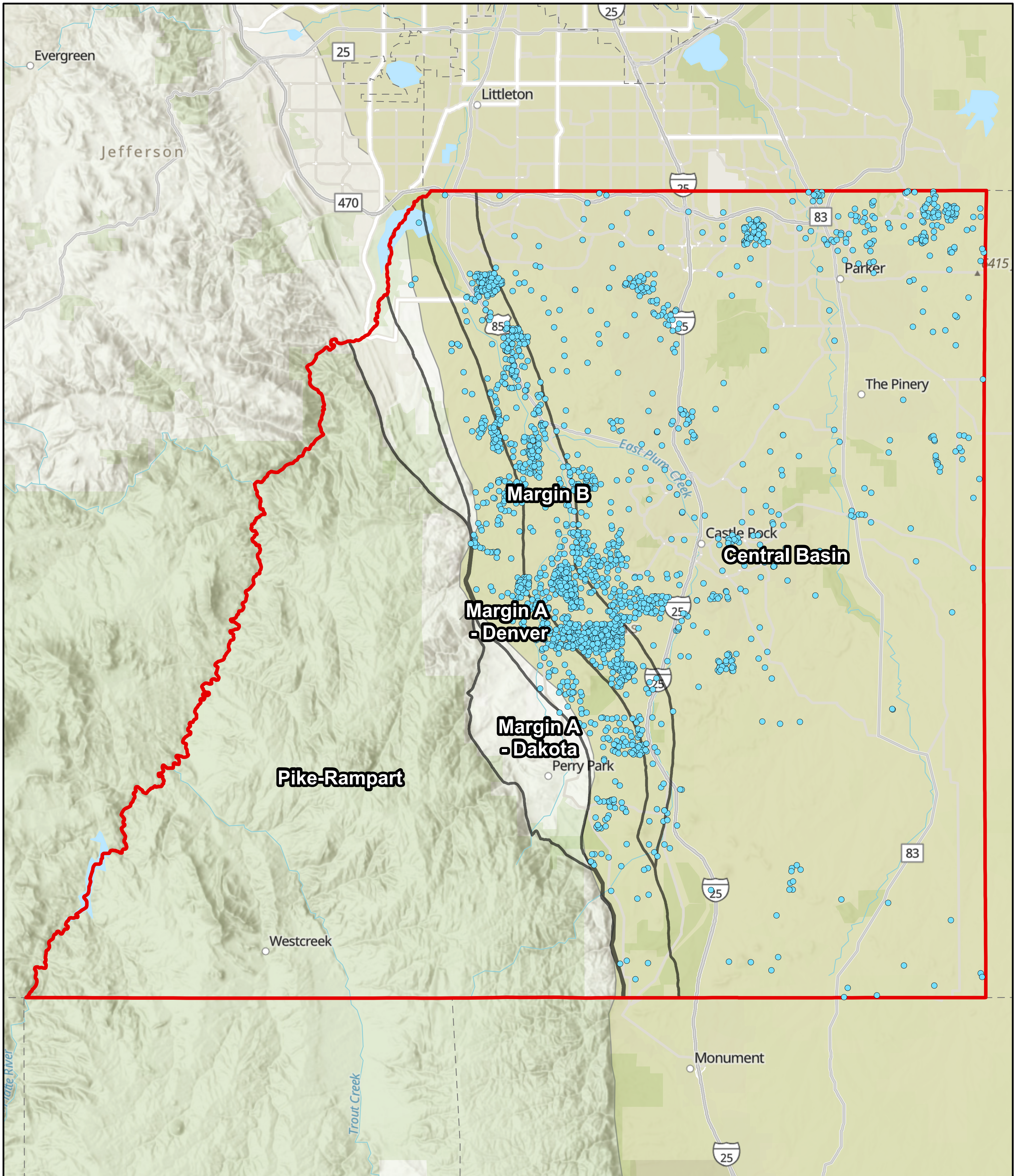
1543FGA05 | NOVEMBER 2025

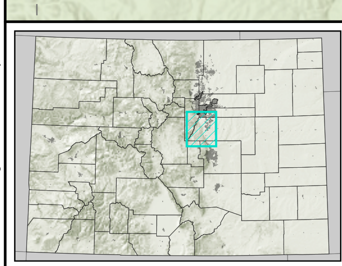
1 0 1 2 3 4 5 Miles
SCALE: 1:300,000

N

FIGURE 5
DOUGLAS COUNTY LOWER DAWSON WELLS WITH ZONES

LRE WATER





Denver Wells
Water Supply Zones
Douglas County
Denver Aquifer

Note: Wells displayed outside the aquifer extent are permitted and recognized as Denver wells by the DWR. These wells are displayed based on the DWR's designation.

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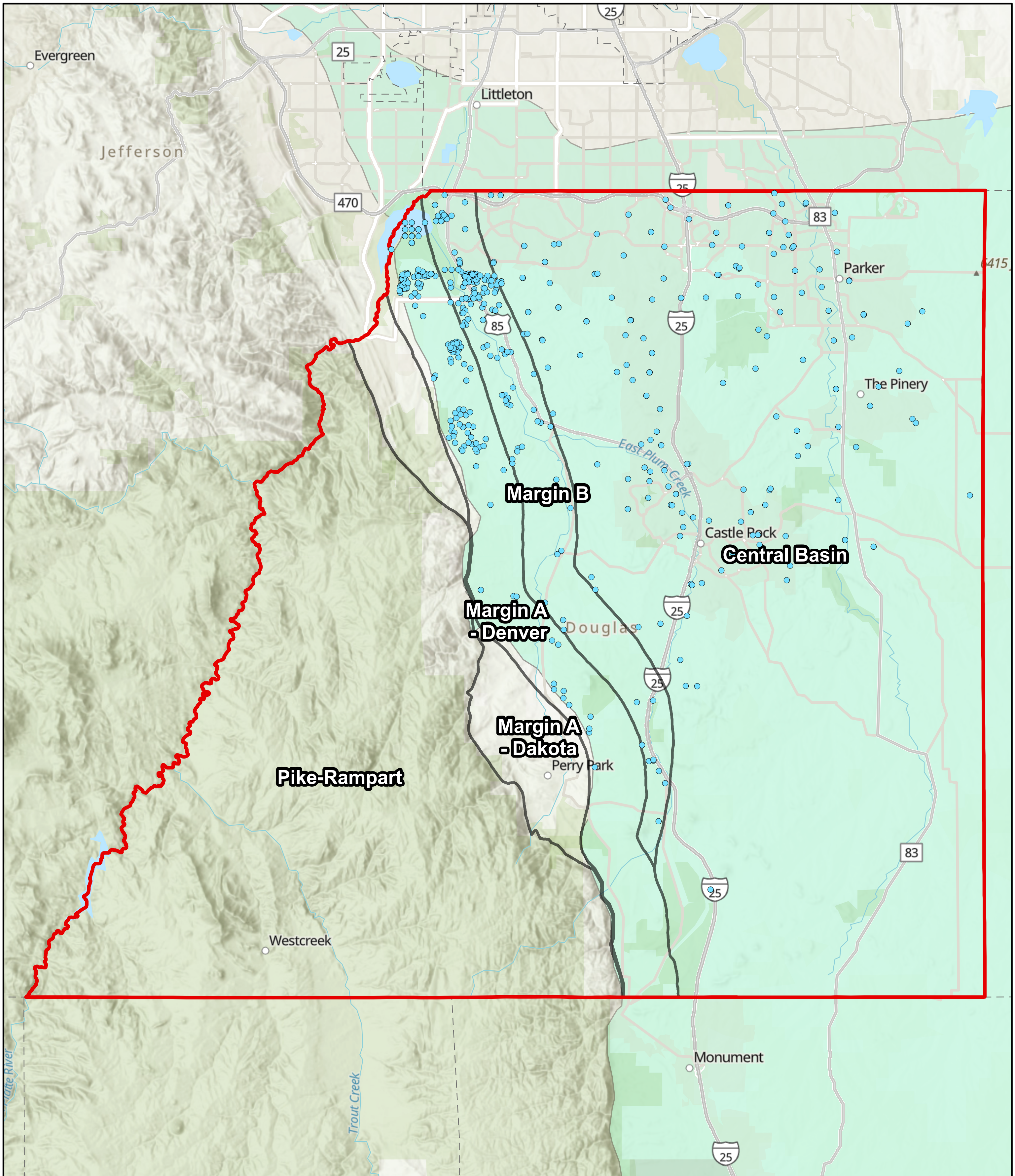
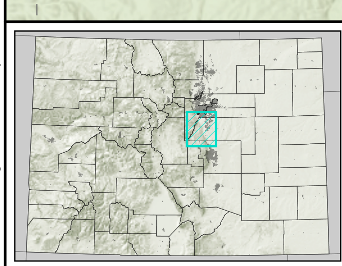
1 0 1 2 3 4 5
SCALE: 1:300,000 Miles

FIGURE 6
DOUGLAS COUNTY DENVER WELLS WITH ZONES

LRE WATER





Arapahoe Wells
Water Supply Zones
Douglas County
Arapahoe Aquifer

Note: Wells displayed outside the aquifer extent are permitted and recognized as Arapahoe wells by the DWR. These wells are displayed based on the DWR's designation.

1543FGA05 | NOVEMBER 2025

1 0 1 2 3 4 5 Miles

SCALE: 1:300,000

FIGURE 7
DOUGLAS COUNTY ARAPAHOE WELLS WITH ZONES

LRE WATER

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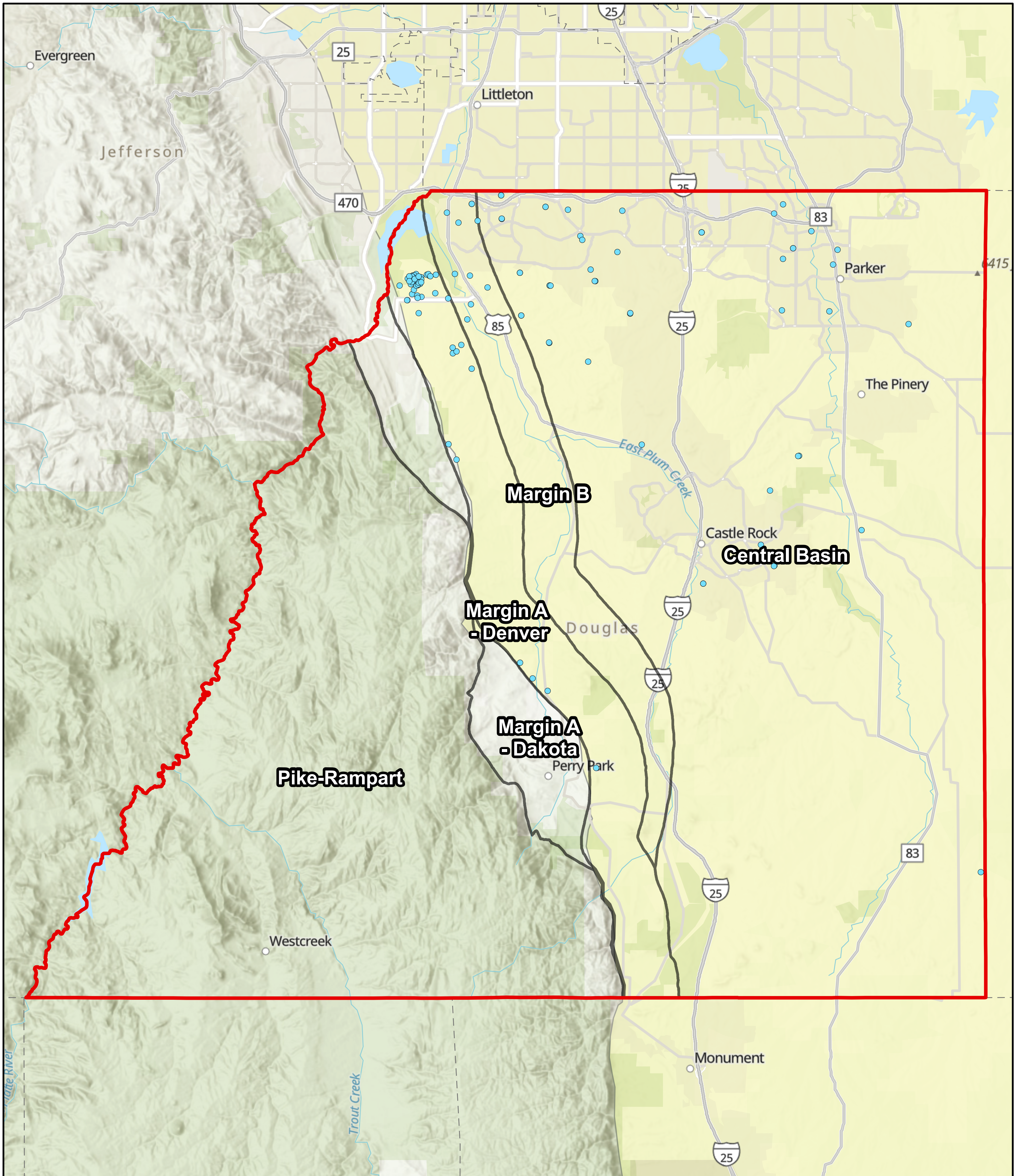
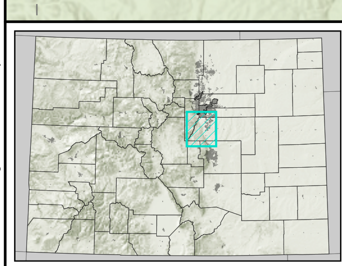




Laramie-Fox Hills Wells
Water Supply Zones
Douglas County
Laramie-Fox Hills Aquifer

Note: Wells displayed outside the aquifer extent are permitted and recognized as Laramie-Fox Hills wells by the DWR. These wells are displayed based on the DWR's designation.

1543FGA05 | NOVEMBER 2025

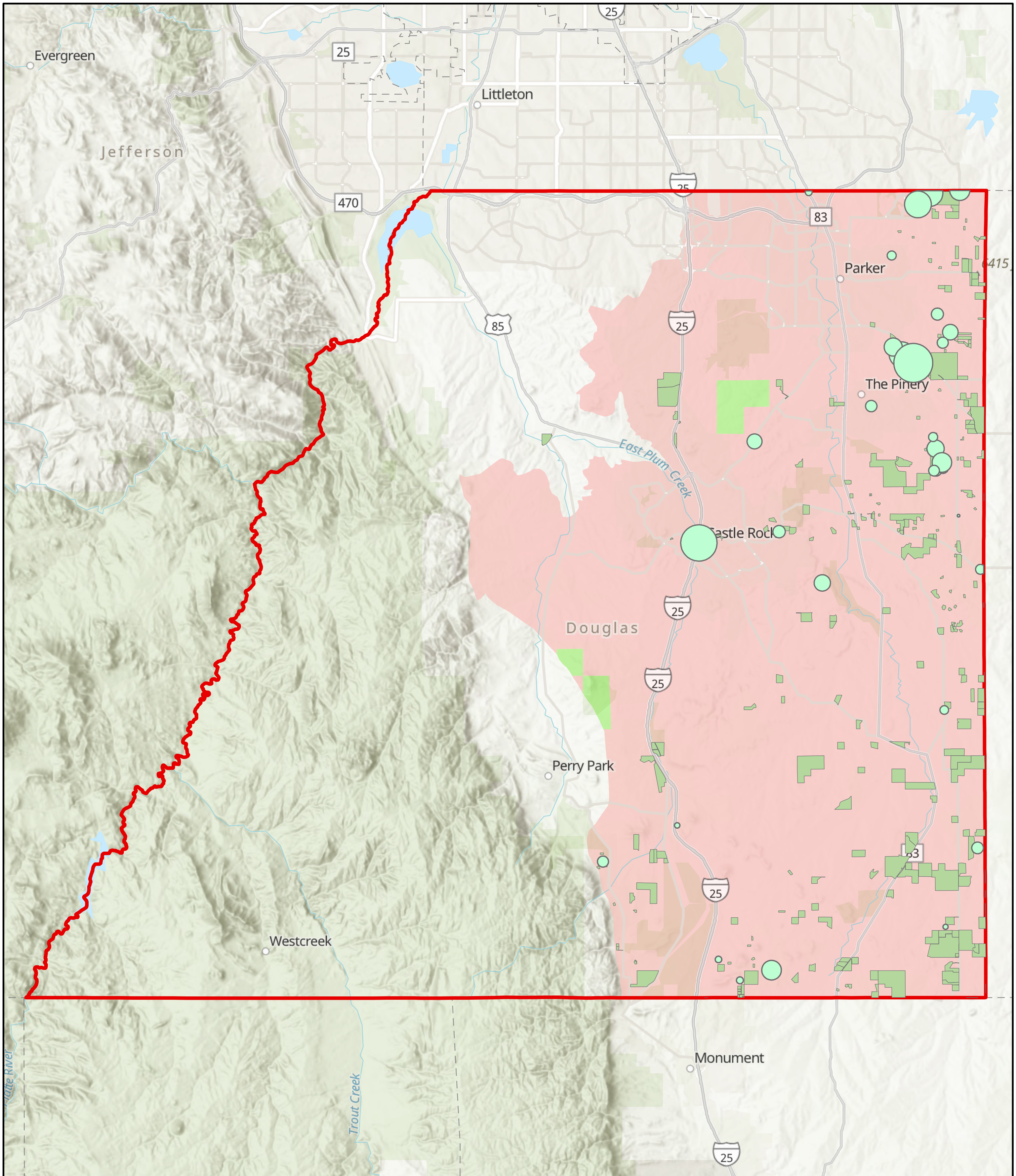
1 0 1 2 3 4 5 Miles

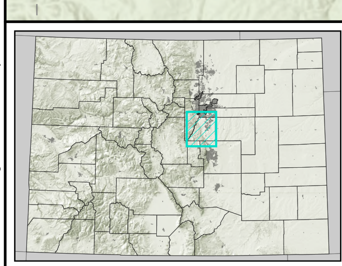
SCALE: 1:300,000

N

FIGURE 8
DOUGLAS COUNTY LARAMIE-FOX HILLS WELLS WITH ZONES

LRE WATER





Pre-213 Cylinder - Upper Dawson / Dawson (UTDW)
Decreed Water Right
Upper Dawson NT/NNT Boundary
NNT ACTUAL
NON TRIBUTARY
Douglas County

1543FGA05 | NOVEMBER 2025

1 0 1 2 3 4 5
SCALE: 1:300,000 Miles

FIGURE 9
UPPER DAWSON / DAWSON AQUIFER TRIBUTARY BOUNDARIES WITH PRE-213 CYLINDERS OF APPROPRIATION AND DECREES

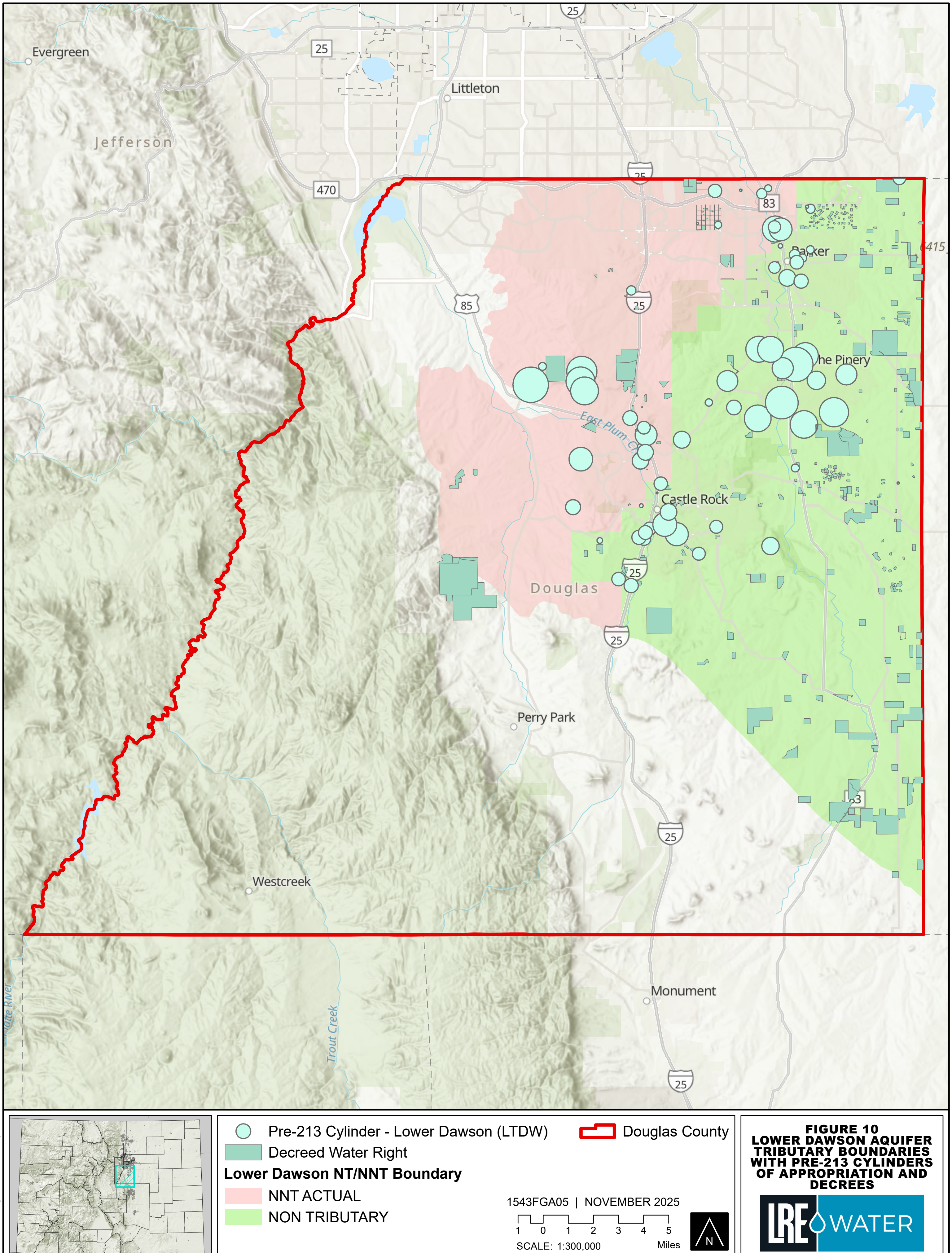


FIGURE 10
LOWER DAWSON AQUIFER TRIBUTARY BOUNDARIES WITH PRE-213 CYLINDERS OF APPROPRIATION AND DECREES

LRE WATER

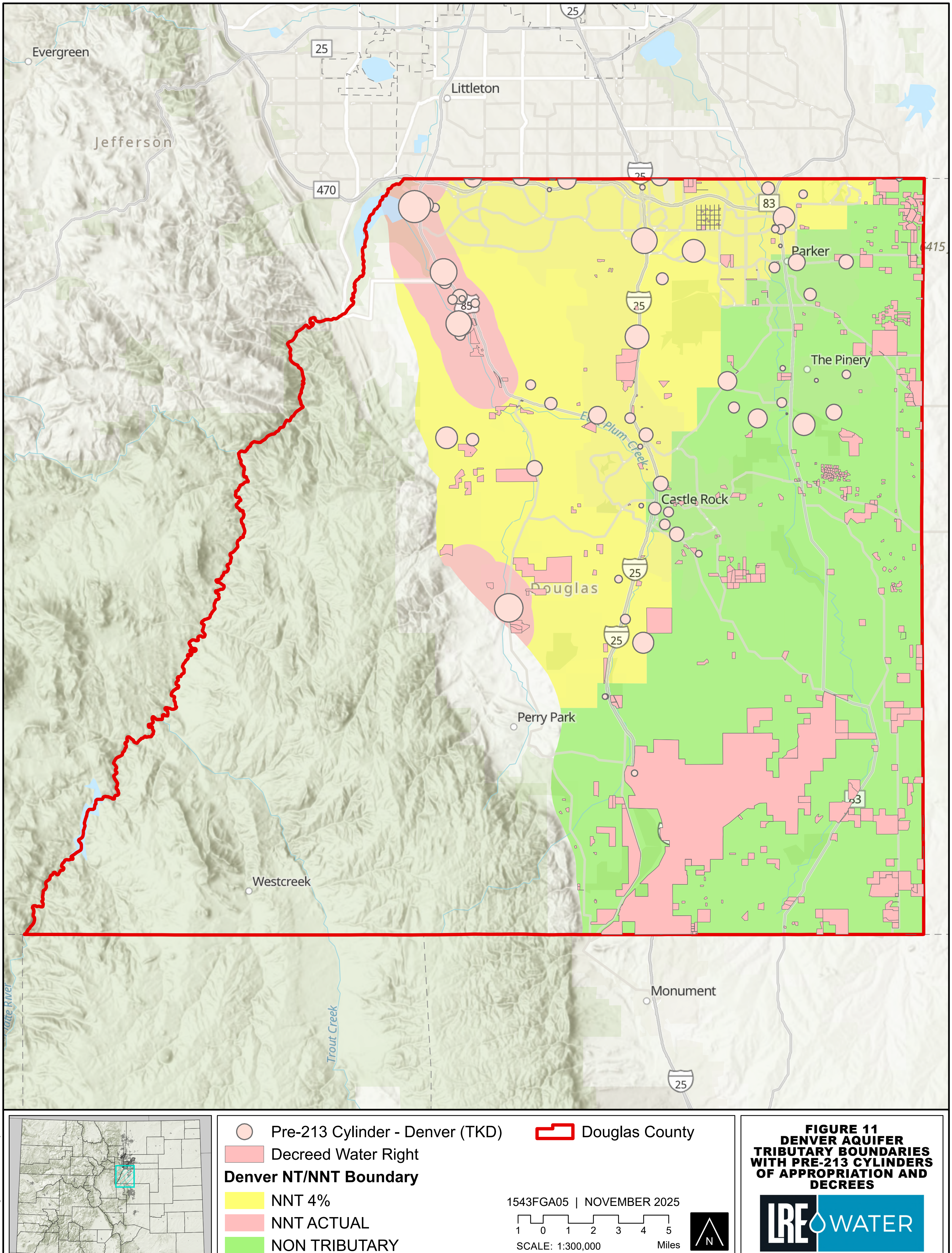


FIGURE 11
DENVER AQUIFER TRIBUTARY BOUNDARIES WITH PRE-213 CYLINDERS OF APPROPRIATION AND DECREES

LRE WATER

Service Layer Credits: Esri, NASA, NGA, USGS, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, (c) OpenStreetMap contributors, and the GIS User Community, Aquifer data from CDSS,

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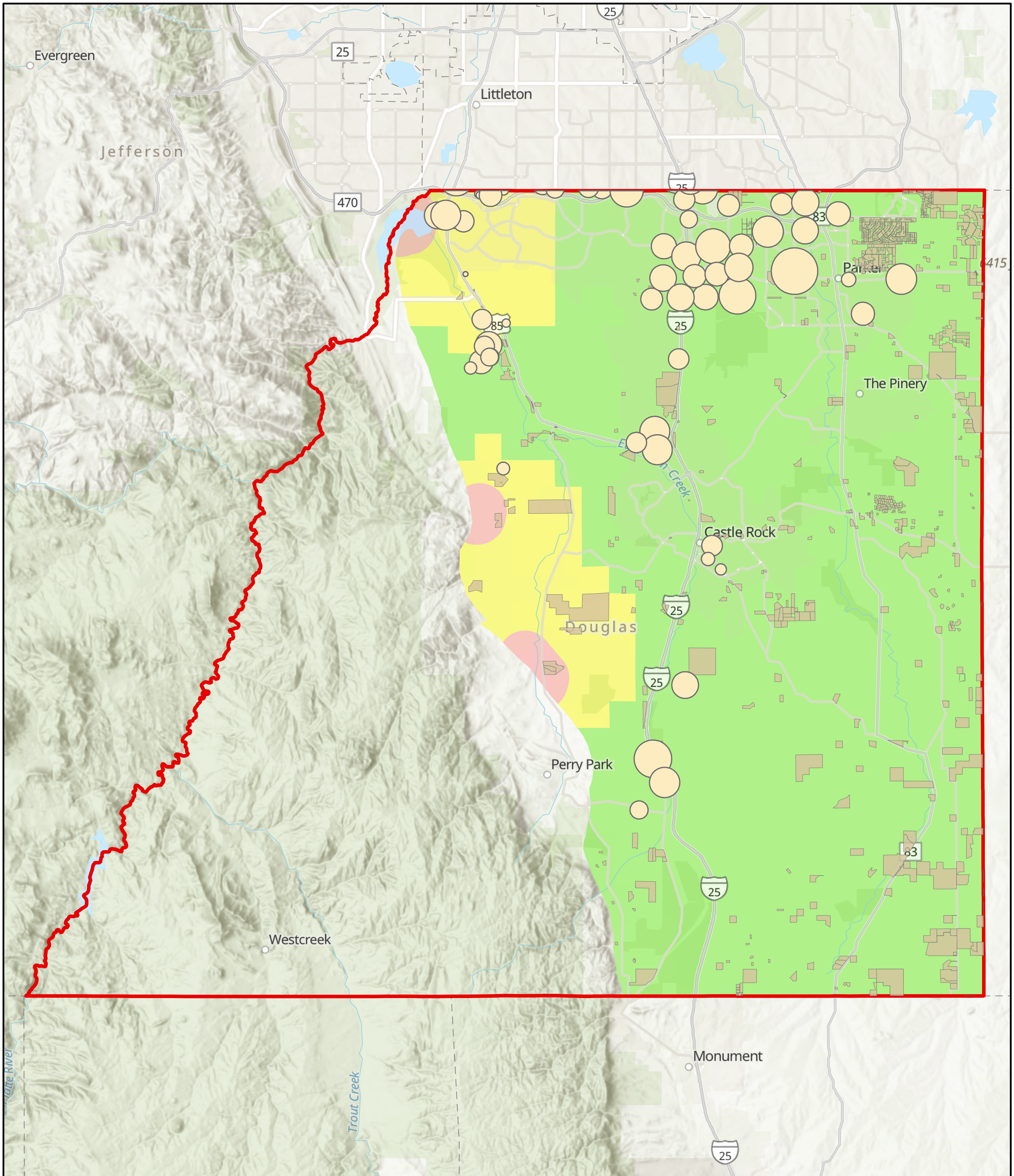
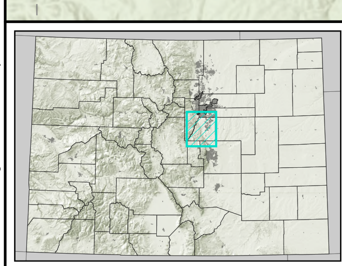




Pre-213 Cylinder - Upper Arapahoe (UKA)
Decreed Water Right
Douglas County

Upper Arapahoe NT/NNT Boundary

- NNT 4%
- NNT ACTUAL
- NON TRIBUTARY

1543FGA05 | NOVEMBER 2025

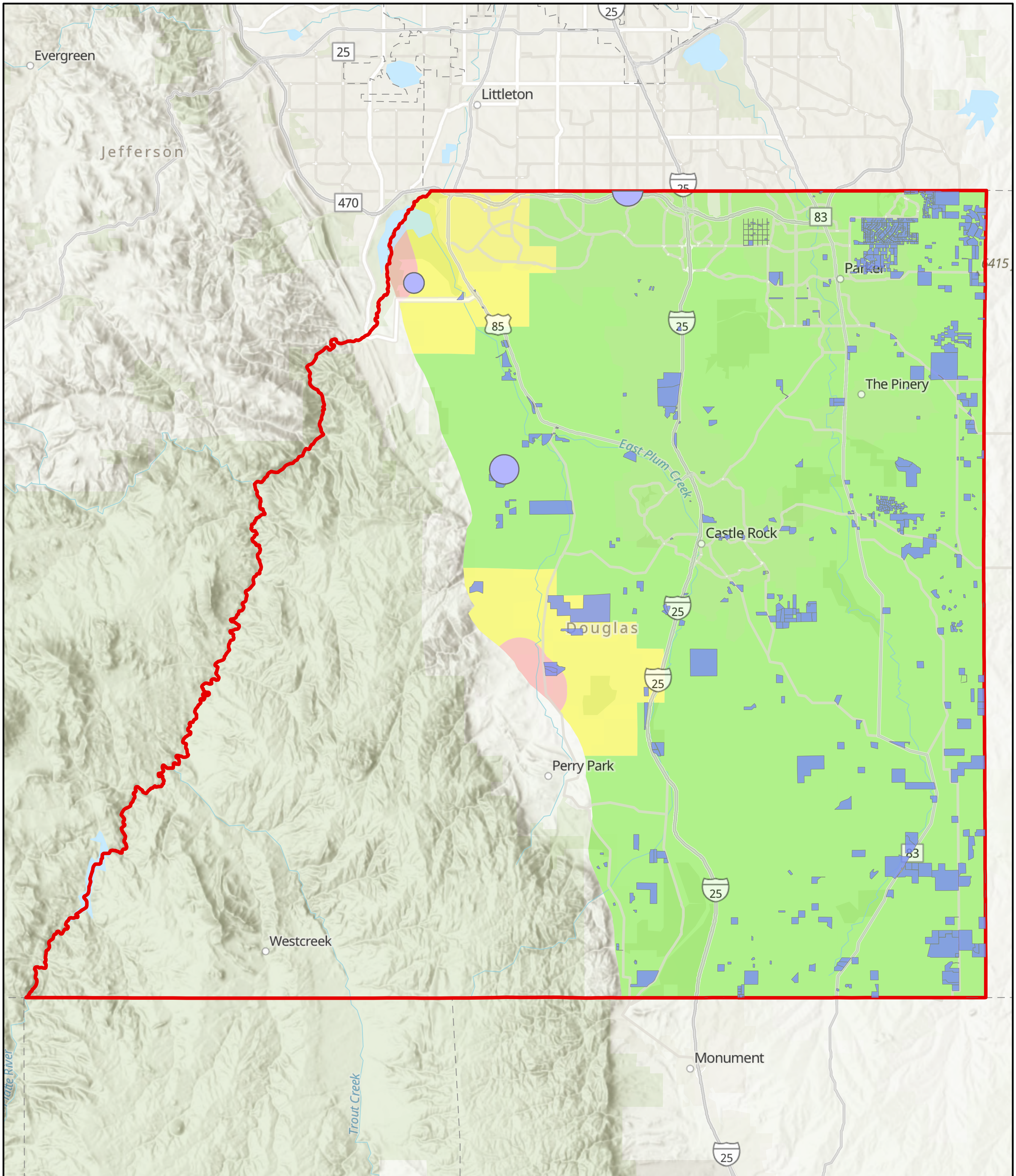
1 0 1 2 3 4 5 Miles

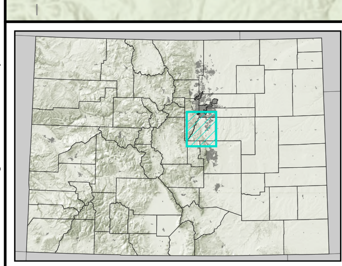
SCALE: 1:300,000

N

FIGURE 12
ARAPAHOE AQUIFER TRIBUTARY BOUNDARIES WITH PRE-213 CYLINDERS OF APPROPRIATION AND DECREES

LRE WATER





Pre-213 Cylinder - Laramie-Fox Hills (KLF)

Decreed Water Right

Laramie-Fox Hills NT/NNT Boundary

NNT 4%

NNT ACTUAL

NON TRIBUTARY

Douglas County

1543FGA05 | NOVEMBER 2025

1 0 1 2 3 4 5
SCALE: 1:300,000 Miles

N

FIGURE 13
LARAMIE-FOX HILLS AQUIFER PRE-213 CYLINDERS OF APPROPRIATION AND DECREES

LRE WATER

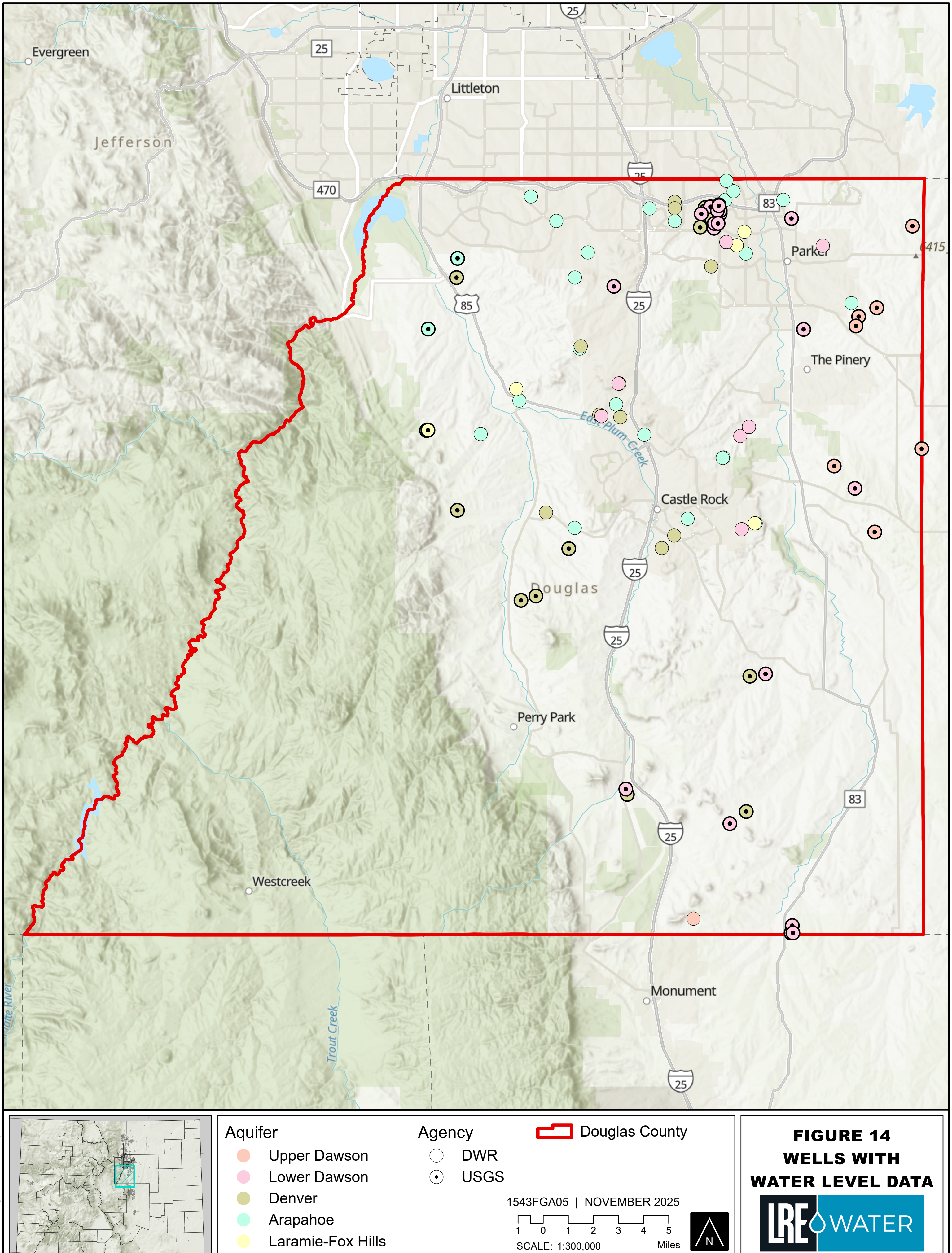


FIGURE 14
WELLS WITH WATER LEVEL DATA

LRE WATER

2050 WATER PLAN
DOUGLAS COUNTY COLORADO

APPENDIX B

Table 1 : Production Wells per Douglas County Zone

Designation		Dakota or Fractured Hard Rock	Alluvial*	Dawson	Upper Dawson	Lower Dawson	Denver	Arapahoe	Laramie Fox-Hills
Low Capacity Wells	Low Capacity - All	727	203	1017	3104	2373	1885	390	90
	Central	0	69	836	3008	2236	742	57	22
	B	0	18	33	10	48	814	149	7
	A_Denver	0	6	142	85	88	327	184	61
	A_Dakota	111	35	4	1	1	1	0	0
	Forest	616	75	2	0	0	1	0	0
High Capacity Wells	High Capacity - All	15	46	30	36	79	117	134	35
	Central	0	25	25	36	76	98	110	30
	B	0	7	0	0	1	10	20	3
	A_Denver	0	4	5	0	2	9	4	2
	A_Dakota	6	7	0	0	0	0	0	0
	Forest	9	3	0	0	0	0	0	0
Irrigation Wells	Irrigation - All	0	24	7	76	35	27	18	0
	Central	0	13	4	75	29	10	13	0
	B	0	4	0	0	4	12	5	0
	A_Denver	0	1	3	1	2	5	0	0
	A_Dakota	0	6	0	0	0	0	0	0
	Forest	0	0	0	0	0	0	0	0
Totals	Total - All	742	273	1054	3216	2487	2029	542	125
	Central	0	107	865	3119	2341	850	180	52
	B	0	29	33	10	53	836	174	10
	A_Denver	0	11	150	86	92	341	188	63
	A_Dakota	117	48	4	1	1	1	0	0
	Forest	625	78	2	0	0	1	0	0

***High-capacity contains use designations: Commercial, Industrial, Augmentation, and similar use production wells.**

***Low-Capacity designation includes: In house use, small capacity, livestock, domestic**

***Irrigation wells are wells only permitted as an irrigation wells in the CDWR database**

Table 2. Physically Available Denver Basin Water Based on Net Sands Calculations in PETRA geological analysis

Type		Upper Dawson*	Lower Dawson	Denver Aquifer	Arapahoe Aquifer*	Laramie Fox-Hills Aquifer
		(acre-ft/year)**	(acre-ft/year)**	(acre-ft/year)**	(acre-ft/year)**	(acre-ft/year)**
Gross Water Availability	Total Allocated	73,626	67,929	237,097	230,750	100,758
	NNT - 4%	0	0	78,593	23,463	10,364
	NNT - Actual	72,770	26,278	12,282	2,420	1,131
	NT	856	41,651	146,223	204,867	89,262
Pre-213 (removed)	Total Pre-213 Removed	1,518	5,018	20	39	2
	NNT - 4%	0	0	8	6	0
	NNT - Actual	1,518	1,926	7	1	0
	NT	0	3,091	5	32	1
Portion Required to Return to Stream (removed)	Total Return	17	833	6,068	5,036	2,200
	NNT - 4%	0	0	3,144	939	415
	NNT - Actual	TBD	TBD	TBD	TBD	TBD
	NT	17	833	2,924	4,097	1,785
Estimated Current in Use by Landowners (removed)***		3,345	1,780	1,414	293	68
Total Available		**68,881**	**60,704**	**229,596**	**225,383**	**98,489**
Total Available without Augmentation Plan (NNT Actual Removed)		**839**	**37,727**	**143,294**	**200,738**	**87,476**

*** Includes Upper Arapahoe and Undifferentiated Arapahoe**

****Acre-ft/year allotment based on 100 years of use**

*****Assumes that 0.75 acre foot/year is allocated to domestic wells**

Table 3. Physically Available Denver Basin Water Based on Net Sands Calculations in PETRA geological analysis For Unincorporated Areas

Type		Upper Dawson*	Lower Dawson	Denver Aquifer	Arapahoe Aquifer*	Laramie Fox-Hills Aquifer
		(acre-ft/year)**	(acre-ft/year)**	(acre-ft/year)**	(acre-ft/year)**	(acre-ft/year)**
Unincorporated Areas	Total Allocated	56,174	38,313	166,126	155,730	67,804
	NNT - 4%	0	0	36,517	15,099	5,826
	NNT - Actual	55,709	8,995	9,074	2,228	978
	NT	465	29,319	120,536	138,403	61,000
Total Availible in County	Total Allocated	73,761	68,335	237,097	230,750	100,758
	NNT - 4%	0	0	78,593	23,463	10,364
	NNT - Actual	72,905	26,684	12,282	2,420	1,131
	NT	856	41,651	146,223	204,867	89,262
Estimated Current in Use by Landowners (removed)		3,345	1,780	1,414	293	68
Total Available in Unincorporated Areas without Augmentation Plan (NNT Actual and 4% Removed) and Approximate from Low-Capacity Well Owners		**Likely None**	**27,539**	**119,122**	**138,110**	**60,933**

Table 4 - Comparison of Petra Computation of Physically Available Groundwater Versus Denver Basin Rule Groundwater Computations (SB-5)

Aquifer	Denver Basin Rule Calculations (SB5)	PETRA Groundwater Calculations	% Increase over SB5
	Acre-ft	Acre-ft	
Upper Dawson	72,981	73,761	1%
Lower Dawson	47,590	68,335	44%
Denver	177,499	237,097	34%
Upper Arapahoe	177,184	230,750	30%
Laramie Fox-Hills	97,885	100,758	3%
Total	**573,139**	**710,160**	**36%**

Table 5. Portion of Denver Basin Water in Douglas County That Has Been Decreed

Aquifer	Total Area	Decreed Portion	
	Acres	Acres	% of Total
***Upper Dawson Aquifer**	298,058	14,745	4.9%
Lower Dawson Aquifer	253,427	15,467	6.1%
Denver Aquifer	348,807	83,845	24.0%
Arapahoe Aquifer	352,337	24,317	6.9%
Laramie Fox-Hills Aquifer	354,904	21,541	6.1%
Total	**1,607,532**	**159,913**	**9.9%**

*** Includes Undifferentiated Dawson and Upper Dawson**

****No Water Right Determinations exist in Douglas County, only Decreed**