



**CITIZEN ADVISORY BOARD MEETING**  
Zoom Webinar and/or Town Council Chamber  
3 S. Timber Ridge Parkway, Severance, CO 80550

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**AGENDA**  
**CITIZEN ADVISORY BOARD MEETING**  
**Wednesday, July 2, 2025, at 6:00 PM**

**A. CALL TO ORDER**

1. Roll Call
2. Pledge of Allegiance
3. Approval of Agenda
4. Approval of Minutes
5. Public Comment

*The purpose of the Public Comment is for members of the public to speak to the Town Council on any subject not scheduled on the agenda. To accomplish scheduled agenda items, comments should be limited to three minutes for those attending in person or an appropriate time as deemed by the Mayor. The Town Council is not obligated to make decisions or take action on comments but may choose to schedule the matter for a later discussion. Those addressing the Town Council, please state your name and address and sign-in.*

**B. REGULAR MEETING**

1. **Water Master Plan**
  - Discussion
  - Staff Presentation: Nicholas Wharton, Town Manager

**C. COMMUNICATIONS**

1. Town Staff
2. Board Members

**D. ADJOURN**

**Citizen Advisory Board MEETING**  
*Wednesday, July 2, 2025, 6:00 PM (MDT)*

*The Citizen Advisory Board reserves the right to adjourn to a virtual-only meeting at their discretion should the need arise.*

*Registration URL*

[https://us02web.zoom.us/webinar/register/WN\\_Mg9QsgE-RYa6TpighgRVuQ](https://us02web.zoom.us/webinar/register/WN_Mg9QsgE-RYa6TpighgRVuQ)

*The Town of Severance does not discriminate on the basis of race, color, national origin, sex, religion, age or disability in the provision of services. For disabled persons needing reasonable accommodation to attend or participate in a town service, program, public meeting, or activity, call 970-686-1218 at least 72 hours in advance. Disabled access is available from the front entrance of the Town Hall.*



**CITIZEN ADVISORY BOARD MEETING**  
Zoom Webinar and/or Town Council Chamber  
3 S. Timber Ridge Parkway, Severance, CO 80550

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**MEETING MINUTES**  
**Wednesday, June 4, 2025, at 6:00 PM**

**Chair:** Josh Green  
**Vice-Chair:**  
**Board Members:** Dale Garland  
Felicia Jarrett  
Marissa Riopelle  
Richard Vandenberg  
Chase Zajc  
**Audience:**  
**Staff:** Nicholas Wharton, Town Manager  
Lindsay Radcliff-Coombes, Deputy Town Manager  
Sarah Jacobsen, Town Clerk

**A. CALL TO ORDER**

**1. Roll Call**

PRESENT: Chair Josh Green, Member Dale Garland, Member Marissa Riopelle, Member Chase Zajc, Member Richard Vandenberg  
ABSENT: Member Felicia Jarrett

**2. Pledge of Allegiance**

**3. Approval of Agenda**

**MOTION WAS MADE BY Member Garland**, seconded by Member Riopelle to Approve the Agenda. All Members present voting Yes.

**MOTION PASSED**

**4. Approval of Minutes 5.7.25**

**MOTION WAS MADE BY Member Garland**, seconded by Member Zajc to Approve the May 7, 2025 meeting minutes. All Members present voting Yes.

**MOTION PASSED**

**5. Public Comment**

*The purpose of the Public Comment is for members of the public to speak to the Town Council*

*on any subject not scheduled on the agenda. To accomplish scheduled agenda items, comments should be limited to three minutes for those attending in person or an appropriate time as deemed by the Mayor. The Town Council is not obligated to make decisions or take action on comments but may choose to schedule the matter for a later discussion. Those addressing the Town Council, please state your name and address and sign-in.*

## **B. REGULAR MEETING**

### **1. Vice-Chair Selection**

- Legislative
- Staff Presentation: Nicholas Wharton, Town Manager  
Vice-Chair Karen Hessler was appointed by the Town Council to fill the Council Member vacancy, which presented the opening on the Citizen Advisory Board. Chair Josh Green nominated Member Chase Zajc for Vice-Chair.

**MOTION WAS MADE BY Chair Green**, seconded by Member Garland to appoint Chase Zajc as Vice-Chair. All Members present voting Yes.

**MOTION PASSED**

### **2. Home Rule Charter Discussion**

- Discussion
- Staff Presentation: Nicholas Wharton, Town Manager  
The Board discussed their review of the Charter and agreed that no changes need to be recommended.

## **C. COMMUNICATIONS**

1. Town Staff  
The two Citizen Advisory Board openings will be posted with a deadline for applicants on Thursday, June 26, 2025.
2. Board Members  
Chair Green spoke about member participation, professional representation, and communication.

## **D. ADJOURN**

**MOTION WAS MADE BY Member Zajc**, seconded by Member Garland to adjourn the meeting at 6:39 p.m. All Members present voting Yes.

**MOTION PASSED**

**TOWN OF SEVERANCE**

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Josh Green, Chair

**ATTEST:**

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Sarah Jacobsen, Town Clerk



## AGENDA ITEM SUMMARY

AGENDA ITEM	SUBMITTED BY	PRESENTED BY
Water Master Plan	Nicholas Wharton, Town Manager	Adam Jokerst, WestWater Reseach
<b>ACTION REQUESTED</b>		
Management is asking the board to provide feedback and comments on the draft phase one of the Water Master Plan.		<b><u>Presentation</u></b>
<b>BRIEF SUMMARY</b>		
Presentation on the first phase of the Severance Water Master Plan. Supplementals will be provided prior to the meeting.		
<b>PUBLIC SUPPORT/CONCERN</b>		
None.		
<b>ANALYSIS AND RECOMMENDATION</b>		
<b>MATERIALS SUBMITTED</b>		
The following materials were submitted and included in this packet: 1. Demand Analysis Technical Memo		

# Memorandum

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To: Nicholas Wharton  
From: WestWater Research  
Date: June 16, 2025  
Re: Demand Analysis Technical Memorandum

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## Introduction

The Town of Severance (“Severance” or “the Town”) is developing a Water Supply Master Plan (Master Plan) to estimate the Town’s future water demands, assess potential water supply opportunities, and provide recommendations regarding water project investments and water supply portfolio expansion. WestWater Research, LLC (WestWater) has been retained by Severance to facilitate and support the Master Plan’s development, including conducting technical assessments. In this technical memorandum, WestWater estimates Severance’s future water demands on a five-year timestep following a methodology deployed in other regional water demand studies<sup>1</sup> and utilizing the Town’s historic water use data. Understanding the Town’s future water demand is a requirement for long-term water supply planning as it will inform decisions around management and expansion of the Town’s water portfolio, the need (or lack thereof) for future infrastructure projects, and associated budgetary needs. The results of this study forecast the Town’s future water demand at build-out under a range of scenarios, allowing for planning based on risk tolerance, and supporting the establishment of intermediate planning targets.

## Methodology

To estimate the Town of Severance’s future water demands, WestWater took a land-based approach that considered the impact of local factors on water demand such as home size, lot size, climate, and price and adjusted demand projections based on a range of predicted future conditions. Demand estimates started on a per tap basis and then used the Town’s suggested future dwelling unit density ranges and future zoning designations within the Town’s Water Service Area (WSA) to predict the total number of taps served by the Town at build-out, again utilizing a range of potential future conditions. Finally, progression toward the total future demand was broken out on a five-year time-step utilizing the Town’s predicted growth rate and population projections. The data sources, summary statistics, data manipulation, and model development are described below with results discussed in the following section.

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<sup>1</sup> This demand analysis is modeled after the *Fort Collins Water Supply Vulnerability Study* (2019) and the *Greeley Integrated Water Resources Plan* (2023) and includes methodology deployed by WestWater in master planning efforts for the Town of Wellington and Town of Firestone.

## Data

Data for the demand analysis included water use data provided by the Town, home and lot size details sourced from parcel data from the Weld County Assessor's Office, climate projections from the Greeley Integrated Water Resource Plan (2023) and price elasticity coefficients from Sebri 2013.<sup>2,3</sup> Initial steps taken to clean and organize the data for analysis are described below.

### Water Use Data Preparations

Raw water use data was structured as monthly water use (in 10's of gallons) recorded by account from May 2019 through May 2025, with each account representing a single tap. Accounts were categorized as residential or commercial and were flagged where the account utilized non-potable water for irrigation. Seven accounts were removed from the original data set that were for lots which have not yet been developed and inaccurately reflected water readings (likely from when pipes/meters were first installed). Accounts were then matched to their respective Weld County parcel by address and building size (square feet) and lot size (square feet) data were joined to water use data. Prior to account removals, the raw water use data included records for 2,914 taps. After filtering, the data from 2,907 taps remained for analysis.

Total monthly water use was then separated into its seasonal components, referred to as indoor and outdoor water use, by estimating the typical indoor water use in a given year for a given account (averaging the water use for each account for the non-irrigation months of December, January, February, and March in a given year) and removing it from the total water use for that account for the months of April through November.<sup>4,5</sup>

### Water Use Data Overview

In **Figure 1**, the total annual water demand across the five complete years of data (2020-2024) is shown by customer type, ranging from 529 acre-feet (AF) in 2023 to 603 AF in 2022, and averaging 572 AF across the five-year period of record. On average, single-family residential use comprises 95% (544 AF) of total annual water demand in Severance, followed by commercial water demand at 4% (21 AF) and all other<sup>6</sup> use types at 1% (7 AF) of total demand.

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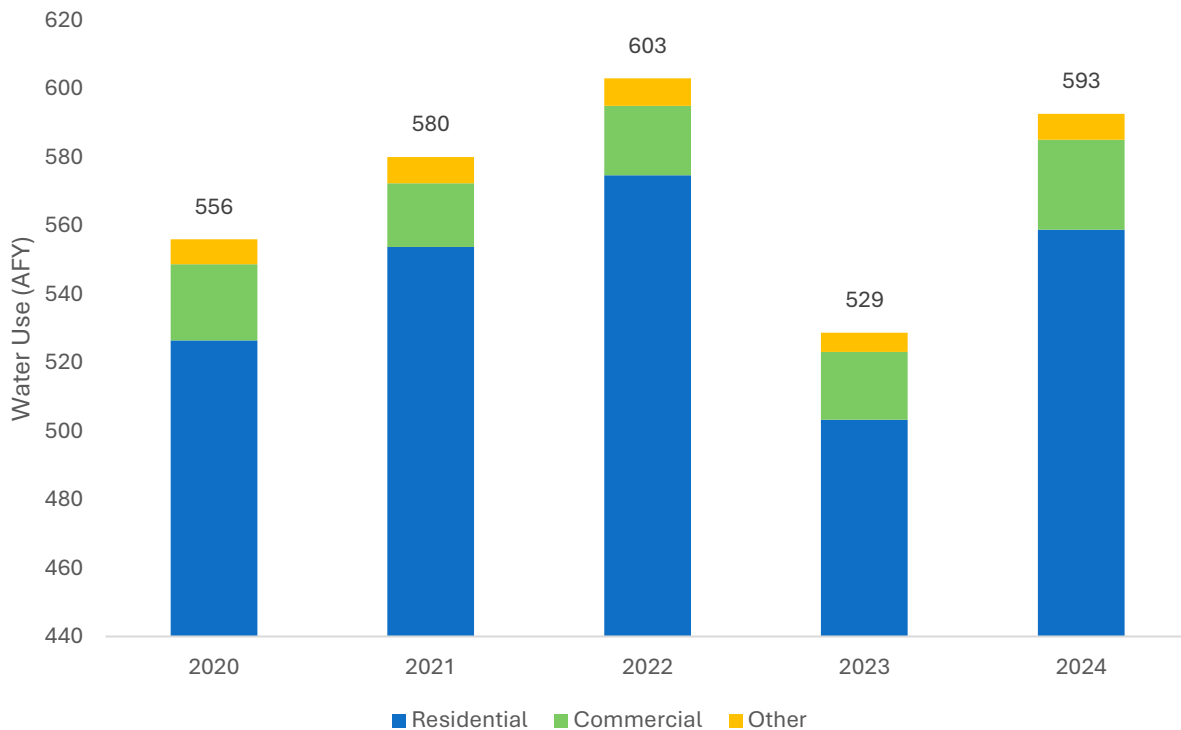
<sup>2</sup> Sebri, Maamar. (2013). A meta-analysis of residential water demand studies. *Environmental, Development and Sustainability*. 16(3), 499-520.

<sup>3</sup> A meta-analysis performed by Maamar Sebri in 2013 reviewed 100 studies which included 638 price elasticity estimates to better understand the relationship between residential water demand and price, among other variables. Coefficients from the reviewed studies ranged from -3.054 to -0.002, averaging -0.365 with a median of -0.291. The coefficients reflect a percent change in water demand per a percent change in price and suggest water use declines as price increases. The mean and median values from the meta-analysis are used in this study as the High Bookend and Most Probable price elasticity coefficients.

<sup>4</sup> In months April through November where the average indoor water use was greater than the total water use, no outdoor water use was assumed, and the month's total water use was taken as its indoor water use component to avoid introducing a negative outdoor water use and artificially deflating indoor water use. Likewise, in months April through November where total water use equaled zero, zero was maintained as the indoor and outdoor water use and the calculated average indoor use was not introduced. In the same way, this avoided introducing a negative outdoor water use and artificially inflating indoor water use.

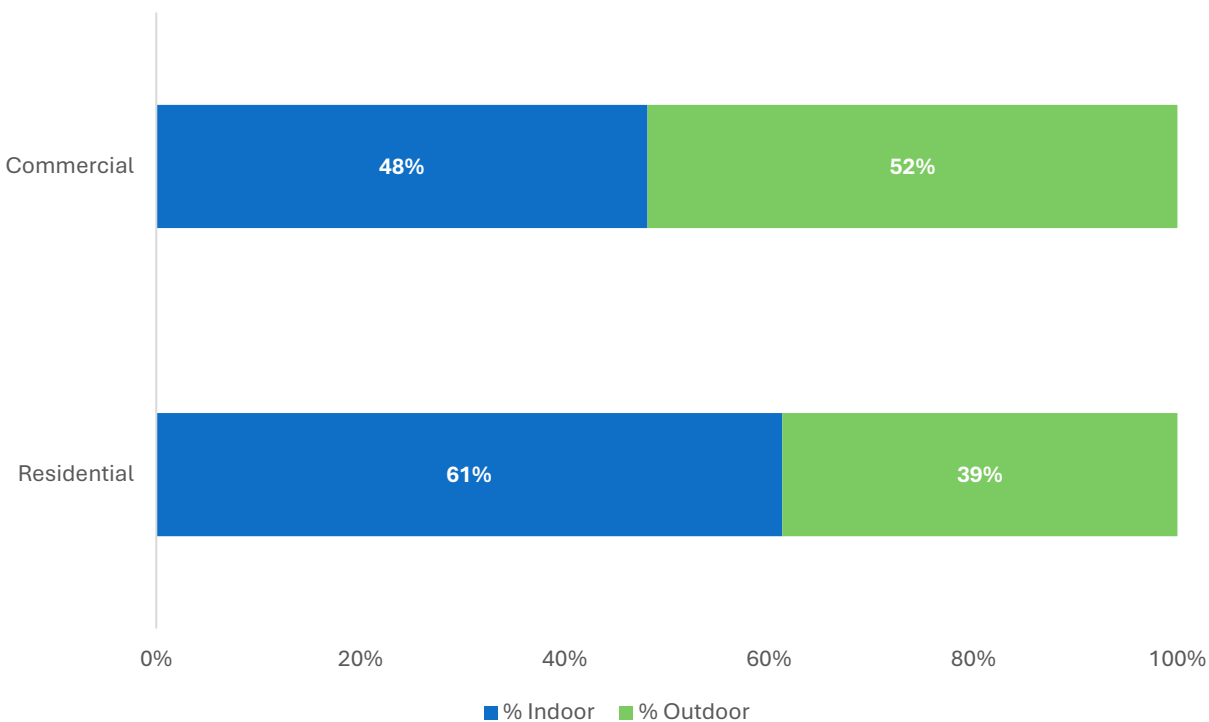
<sup>5</sup> Whereas this seasonal separation largely reflects indoor versus outdoor water use for residential customers, seasonal variation can occur for a variety of reasons in the commercial sector. Nonetheless, the terminology "indoor" versus "outdoor" water use is used throughout this memorandum.

<sup>6</sup> Hydrant and Irrigation taps were grouped with taps that were unable to match to a water use category to comprise the "Other" water use category.

**Figure 1: Total Annual Water Use by Customer Type**

Seasonal water use<sup>7</sup> also varies by customer type, with commercial water uses having the greatest proportion of seasonal (labeled as outdoor) water use (52% of total water use) compared to single-family residential water users using 39% of total water use for outdoor purposes. Additional seasonal water use for residential customers typically consists of outdoor water use for lawn and ornamental irrigation. Additional seasonal water use for commercial customers is not so clearly defined. This additional use can be related to increased production, increased services, and building cooling in addition to any outdoor watering. **Figure 2** shows the percentage split in seasonal water use, labeled as indoor and outdoor water use to account for the usage types typical of residential customers, by customer type for the 2019 to 2025 period.

<sup>7</sup> Seasonal water use is defined as additional water use above baseline levels and is typical of the months between April and November.

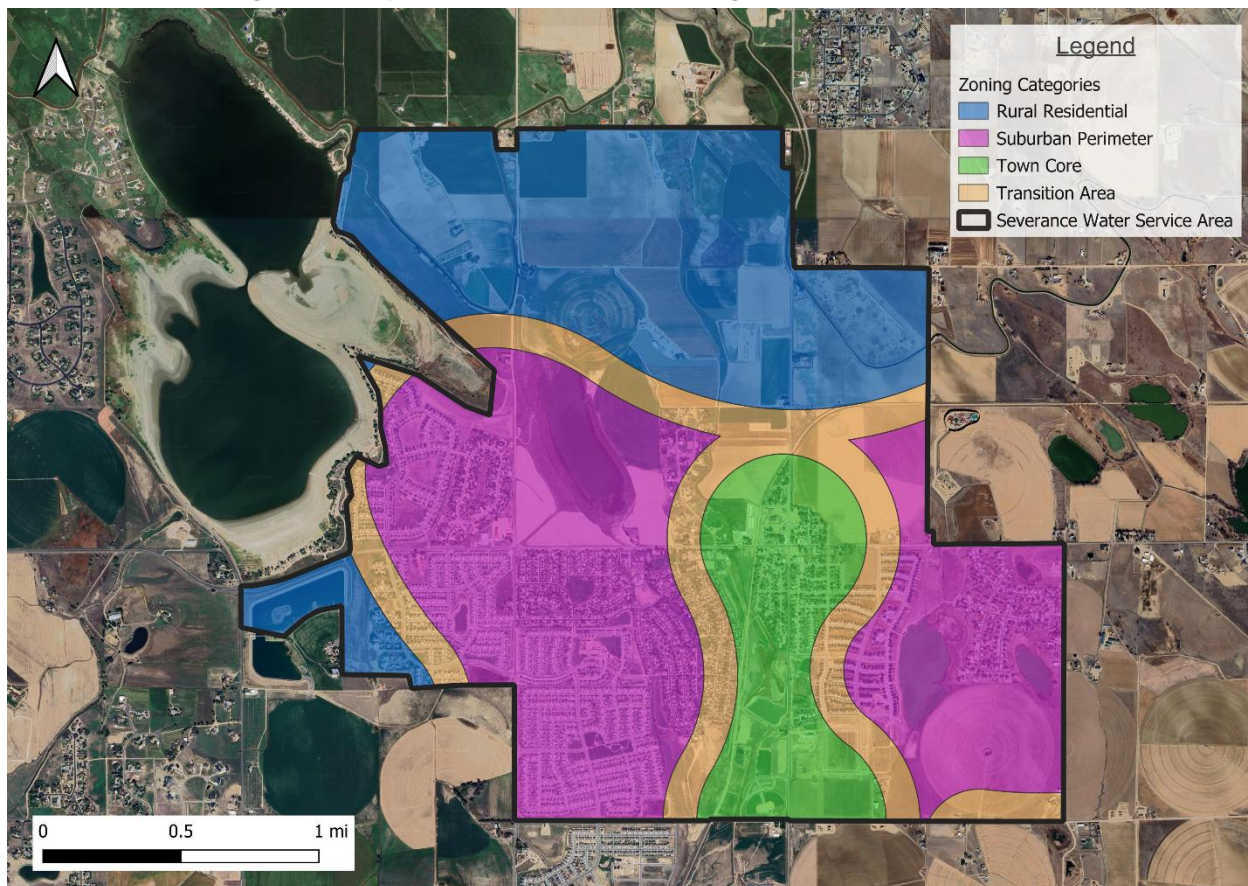
**Figure 2: Percent Indoor/Outdoor Use by Customer Type**

### Land Use Data Preparations and Overview

The Town's zoning designations were recategorized as residential or commercial in order to summarize the total number of acres expected to be developed under each water use type. The "Town Core" zoning category is assumed to be developed in the future as 60% residential and 40% commercial. The Rural-Residential and Suburban Perimeter zoning categories are projected to be developed entirely as single-family residential while Development Nodes are assumed to be entirely industrial. These future land use zoning categories within the Town's WSA are shown in **Figure 3**. The recategorization of each zoning category to its associated water use type in **Table 1** alongside the total number of acres within the WSA under each category. The Town's current developed areas are categorized as 98% residential (856 acres) and 2% commercial (20 acres). The total zoned lands across the WSA follow a similar distribution with 95% residential (3,092 acres), and 5% commercial (159 acres).

**Table 1: Summary of Total Acres by Zoning Category**

Zoning Category	Use Type	Total Acreage Within WSA	Acres With Existing Taps
Suburban Perimeter	Residential	1,830	600
	Commercial	6	6
Town Core	Residential	229	72
	Commercial	153	14
Rural Residential	Residential	1,033	184
<b>Total</b>		<b>3,251</b>	<b>876</b>

**Figure 3: Map of Future Land Use Categories in the Town WSA**

### ***Model Development***

The steps taken to estimate future municipal water demands at build-out for the Town of Severance are listed below and described in the following sections.

1. Estimate Current per Tap Water Use
2. Summarize Undeveloped Acres by Land Use Category
3. Build Range of Scenarios
4. Estimate Total Number of Taps at Build-out
5. Adjust per Tap Water Use for Future Conditions
6. Sum Demands at Build-out
7. Scale Demands to Population Growth

#### **Step One: Estimate Current per Tap Water Use**

Before water demands can be adjusted for future conditions, they must first be defined under current conditions. Using the raw water use data provided by the Town and Weld County parcel data, the number of taps and acres being served by existing taps is summarized in **Table 2**. From there, the average total annual water use (2020–2024) by customer type is used to estimate the Town's

current demand per tap and demand per acre. These demand estimates are further broken down into indoor and outdoor demands. Annual water demand per tap has historically been highest for commercial water users at 0.75 AF per tap, with residential users at 0.21 AF per tap. On a land-basis, water demand remains higher for commercial water users at 1.10 AF per acre, with residential users at 0.71 AF per acre.

**Table 2: Current Demand by Tap and by Acreage**

	Residential	Commercial
<b>Taps</b>		
Total Taps	2,838	31
Taps With Non-Pot	1,730	0
Taps without Non-Pot	1,108	31
<b>Acreage</b>		
Acres	856	20
Total Taps per Acre	3.32	1.56
Taps With Non-Pot Irrigation per Acre	2.02	0.00
Taps Without Non-Pot Irrigation per Acre	1.29	1.56
<b>Demand By Tap</b>		
Mean Metered Demand (AF) <sup>8</sup>	562	22
Total Demand per Tap (AF)	0.21	0.75
Indoor Demand per Tap (AF)	0.12	0.35
Outdoor Demand per Tap (AF)	0.21	0.39
<b>Demand by Acreage</b>		
Total Demand per Acre (AF)	0.71	1.10
Indoor Demand per Acre (AF)	0.42	0.52
Outdoor Demand per Acre (AF)	0.30	0.52

Note that indoor and outdoor demand per tap in **Table 2** do not sum to total demand per tap. This is the result of different subsets of data being used to calculate indoor and outdoor demand per tap respectively. For example, total residential demand per tap is calculated as the total residential demand divided by the total number of residential taps across the period of record. Since all residential taps use indoor water, indoor demand per tap is similarly calculated as the average total indoor demand divided by the total number of taps for a given customer type. Outdoor demand per tap, however, is calculated as the total outdoor demand divided by only the number of taps without non-potable water for irrigation. Likewise, total demand per acre is calculated as the average total demand divided by the total number of acres assigned to each customer type. The indoor and outdoor components are estimated using the percent distribution between indoor and outdoor use for each customer type shown in **Figure 2** above.

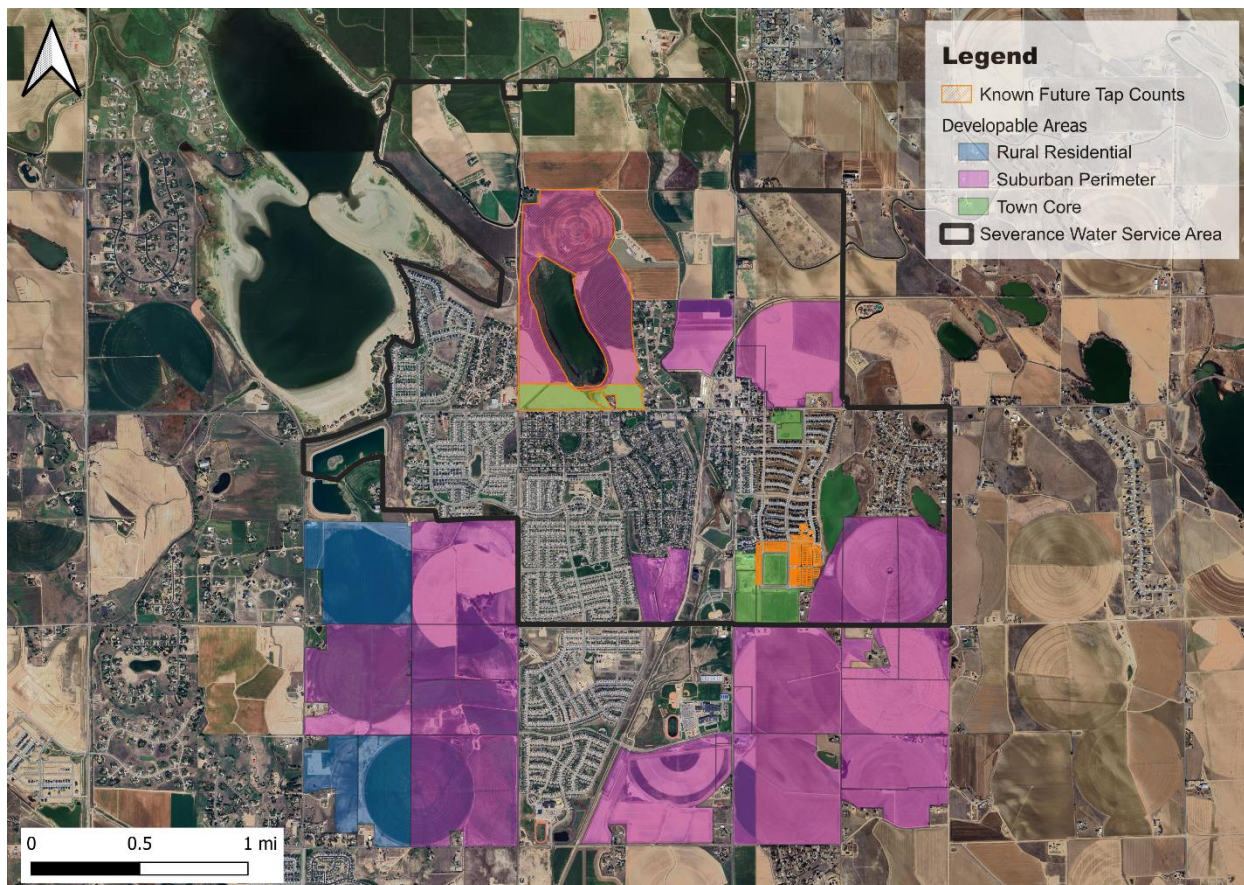
### **Step Two: Summarize Undeveloped Acres by Land Use Category**

Estimating Severance's total future water demand will ultimately involve modeling the water demand per tap for each customer type, separating indoor and outdoor water use, and extrapolating that water demand across the number of taps expected to be served by the Town at build-out. The total number of taps at build-out includes the 2,907 known taps as of 2025 plus taps that will be established in Severance's currently undeveloped areas. Undeveloped areas were identified within Severance's WSA as well as additional lands south of the Town's WSA but within the Town's Growth

<sup>8</sup> Weighted average by number of taps in a given year.

Management Area (GMA) that may potentially be annexed and served by the Town.<sup>9</sup> **Figure 4** shows the parcels identified as potentially developable for which future tap counts were estimated at build-out.

**Figure 4: Undeveloped Areas Potentially Served by Severance at Build-out**



The acreage totals under these parcels are summarized in **Table 3**. Acreages are broken into total and developable acres to denote the fact that some undeveloped acres will be reserved for other purposes. Here, it is assumed that 25% of undeveloped acres will be reserved for open space and another 20% of undeveloped acres will be used as right-of-way spaces. A 45% reduction was taken from the total future acres to obtain acreage estimates that will be developed with taps. In addition, the acreages for undeveloped areas that were already subdivided or have known future tap counts (e.g., Northgate Lakes) were subtracted out from the totals in **Table 3** and the actual number of taps expected under those acreages were utilized.

<sup>9</sup> Lands outside the Town of Severance's WSA are served by North Weld County Water District. Although the Town of Severance does not currently intend to service these lands, the parcels identified south of the Town's WSA in **Figure 4** were identified by Town staff as having some potential to be annexed and are included for consideration in this demand analysis.

**Table 3: Future Developable Acreage**

Land Use Category	Water Service Area	GMA	Water Service Area	GMA
	Future Total Acres		Future Developable Acres	
Town Core	50	0	27	0
Suburban Perimeter	403	1,350	222	742
Rural Residential	0	260	0	143
<b>Total</b>	<b>453</b>	<b>1,610</b>	<b>249</b>	<b>886</b>

### Step Three: Build Range of Scenarios

A range of scenarios were established to capture a Low Bookend, Most Probable, and High Bookend of future water estimates (**Table 4**). Under the Low Bookend, the lowest likely future water demand is estimated for a scenario with a decrease in home and lot size, the greatest increase in the cost of water, and no change in climate. Under the High Bookend, the highest likely future water demand is estimated for an alternate scenario with an increase in home size, no change in lot size or the cost of water, and the greatest increase in climate. Likewise, the Low Bookend scenario estimates future tap counts using the low-end density ranges while the High Bookend estimates tap counts in a high-density scenario. In between the bookends is the Most Probable scenario with no change in home size, a slight reduction in lot size, a moderate increase in climate and the cost of water, and moderate density for future taps. The developable areas used to estimate future tap counts were also brought into the range of scenarios. Under the Low Bookend and Most Probable scenarios, it is assumed that Severance will only serve future taps within their WSA. In the High Bookend scenario, tap counts served by the Town are expanded to include those immediately south of the Town's WSA boundary.

**Table 4: Scenario Descriptions**

Scenario	Description		
	Low Bookend	Most Probable	High Bookend
<b>Home Size<sup>10</sup></b>	1,500 ft <sup>2</sup>	1,900 ft <sup>2</sup>	2,400 ft <sup>2</sup>
<b>Lot Size<sup>11</sup></b>	6,300 ft <sup>2</sup>	8,400 ft <sup>2</sup>	9,750 ft <sup>2</sup>
<b>Price elasticity</b>	Elasticity = -0.3. Rates increase at 2x Most Probable increase	Elasticity = -0.2. Rates increase at 10% (2025-2029), then 5% (2030-2039), then 2.5%	No response
<b>Climate</b>	No change in outdoor water demand	Outdoor water demand increases in response to 2°F warmer climate	Outdoor water demand increases in response to 5°F warmer climate
<b>Tap Density</b>	Low Density	Moderate Density	High Density
<b>Development Area</b>	Development occurs only within WSA	Development occurs only within WSA	Development expands south into GMA

### Step Four: Estimate Total Number of Taps at Build-out

Returning to the process started in Step Two, for the remaining undeveloped acreages, future tap count estimates were established by multiplying the number of acres under each zoning category

<sup>10</sup> Most Probable home size was set as the average home size for homes built since 2010 in Severance. High and Low Bookends were set within the Town's minimum and maximums from municipal code and are based on likely sizes for future builds.

<sup>11</sup> Most Probable lot size was set as the average lot size for homes built since 2010 in Severance. High and Low Bookends were set within the Town's minimum and maximums from municipal code and are based on likely sizes for future builds.

(reclassified as residential or commercial (**Table 1**) by the Town's target tap densities (**Table 5**). These future tap counts for undeveloped areas were added to the known existing and known future tap counts to estimate the total number of taps at build-out. Tap density ranges, listed in **Table 5**, were established from the Town's municipal code and applied to each land use type reclassified as residential or commercial water use.

**Table 5: Tap Density Expressed in Taps per Acre by Land Use Type**

Land Use Category	Classification	Percent	Taps per Acre		
			Low Bookend	Most Probable	High Bookend
Rural Residential	Residential	100%	0.1	0.17	0.8
Suburban Perimeter	Residential	100%	4.5	5.2	7
Town Core	Total	100%	8	10	15
	Residential	60%	4.8	6	9
	Commercial	40%	3.2	4	6

### Step Five: Adjust per Tap Water Use for Future Conditions

To estimate per tap water demands in the future, the current indoor and outdoor demands for each customer type (**Table 2**) were adjusted based on likely future conditions. Adjustment factors included home size, lot size, price elasticity, and climate, and are summarized in **Table 6** below. Key assumptions behind the selection of these adjustment factors are that indoor water use is likely to decrease as home size decreases. Outdoor water use is likely to increase as lot size increases. Total water use is likely to decrease as the cost of water increases, and outdoor water use is likely to increase as average temperatures increase. These assumptions are supported by statistical analyses and by academic literature, described separately in the *Estimating Water Demands* section of this report.

**Table 6: Adjustment Factor Descriptions**

Adjustment Description	Factor Name	Rationale	Method	Use Classes	In/Out
Residential indoor demand a function of home area	Home Size	Indoor water use increases with home size	Regression of TOS mean indoor use per tap vs home size in square feet	SF, MF	Indoor
Residential outdoor demand a function of lot area	Lot Size	Outdoor water use increases with irrigable area	Regression of TOS mean outdoor use per tap vs lot size in square feet	SF	Outdoor
Total water use a function of water rates	Price Elasticity	Residential usage decreases with price	Literature values	SF, MF & Com	Indoor + Outdoor
Outdoor use a function of irrigation water demand	Climate	Outdoor water use increases with temperature	Literature (FC WSVS & Greeley IWRP)	SF, MF, & Com	Outdoor

### Step Six: Sum Demands at Build-out

Building on Steps Four and Five, total water demand at build-out was estimated by summing the products of tap count and water demand per tap for each customer type under each planning scenario. The general calculation for estimating total demand is expressed by **eq. (1)**. Total demand by customer type is expressed by **eq. (5)-(7)**, and is the sum of total demand for undeveloped areas estimated on a tap per acre basis plus total demand for existing taps or undeveloped areas with known future tap counts. **Equations (5)-(10)** outline how demands were estimated independently using the tap-density approach for undeveloped acres and using known tap counts for each customer type respectively.

$$Total\ Demand = \sum (totD_{SF}, totD_{MF}, totD_{Com}) \quad (1)$$

$$totD_{SF} = totAD_{SF} + totKD_{SF} \quad (2)$$

$$totD_{MF} = totAD_{MF} + totKD_{MF} \quad (3)$$

$$totD_{Com} = totAD_{Com} + totKD_{Com} \quad (4)$$

$$totAD_{SF} = Ac_{SF}(totT/Ac_{SF} \times inD/T_{SF} + nnpT/Ac_{SF} \times outD/T_{SF}) \quad (5)$$

$$totAD_{MF} = Ac_{MF}(totT/Ac_{MF} \times inD/T_{MF} + nnpT/Ac_{MF} \times outD/T_{MF}) \quad (6)$$

$$totAD_{Com} = Ac_{Com} \times totT/Ac_{Com}(inD/T_{Com} + outD/T_{Com}) \quad (7)$$

$$totKD_{SF} = (inT_{SF} \times inD/T_{SF}) + (outT_{SF} \times outD/T_{SF}) \quad (8)$$

$$totKD_{MF} = (inT_{MF} \times inD/T_{MF}) + (outT_{MF} \times outD/T_{MF}) \quad (9)$$

$$totKD_{SF} = (inT_{Com} \times inD/T_{Com}) + (outT_{Com} \times outD/T_{Com}) \quad (10)$$

Where:

*SF* = Single-family

*MF* = Multi-family

*Com* = Commercial

$totAD_{(custType)}$  = Total demand for new taps in undeveloped acres for each customer type

$totKD_{(custType)}$  = Total demand for existing or known future tap counts for each customer type

$totD_{(custType)}$  = Total demand for each customer type

$Ac_{(custType)}$  = Acres assigned to each customer type

$totT/Ac_{(custType)}$  = Total taps per acre by customer type

$nnpT/Ac_{(custType)}$  = Taps without non-potable water use per acre by customer type

$inD/T_{(custType)}$  = Indoor demand per tap by customer type

$outD/T_{(custType)}$  = Outdoor demand per tap by customer type

$inT_{(custType)}$  = Known number of existing and planned future taps with indoor water use

$outT_{(custType)}$  = Known number of existing and planned future taps with outdoor water use

### Step Seven: Scale Demands to Population Growth

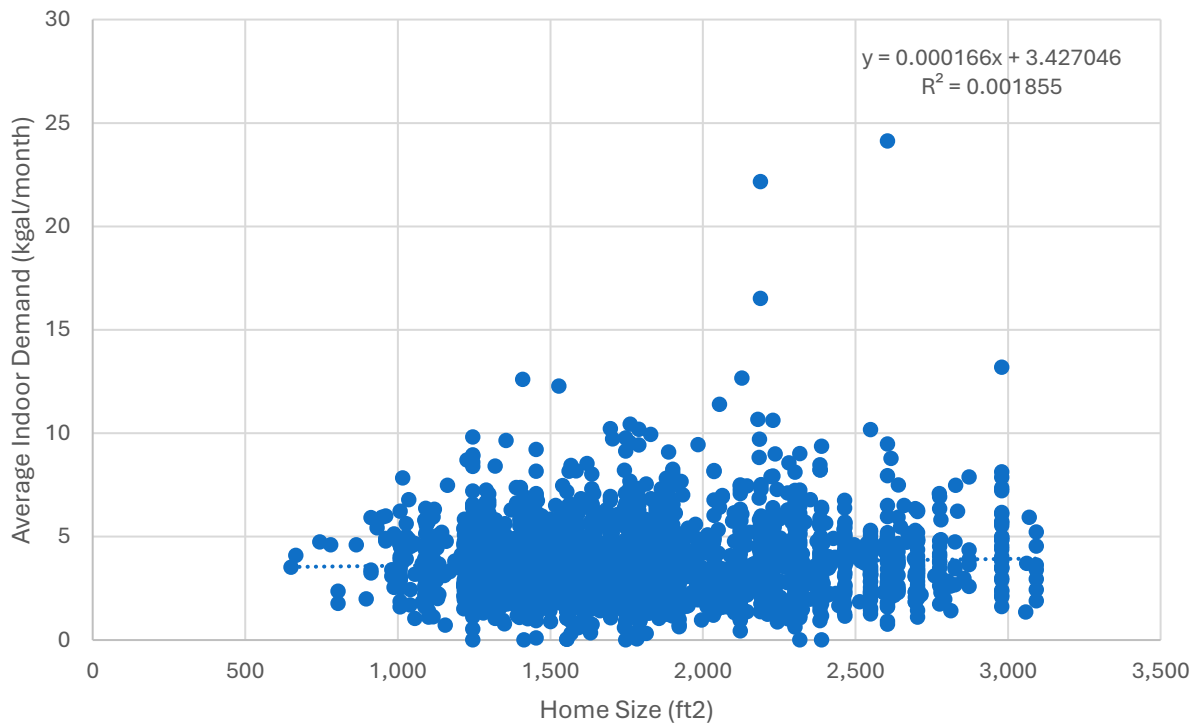
To estimate how total water demand evolves over time, the forecasted demand at build-out was scaled to the Town's projected population using five-year intervals. This was done by first estimating the number of residential taps in each year based on the historical ratio of residents per tap. The proportion of residential taps in each interval relative to the total number of residential taps at build-out was then used to scale the total water demand for that year. Commercial and multi-family demands were assumed to grow proportionally with residential development. Finally, the resulting annual demand values—expressed initially at the customer tap—were adjusted upward to account

for water losses in the treatment and distribution system, producing a total projected demand at the treatment plant for each interval.

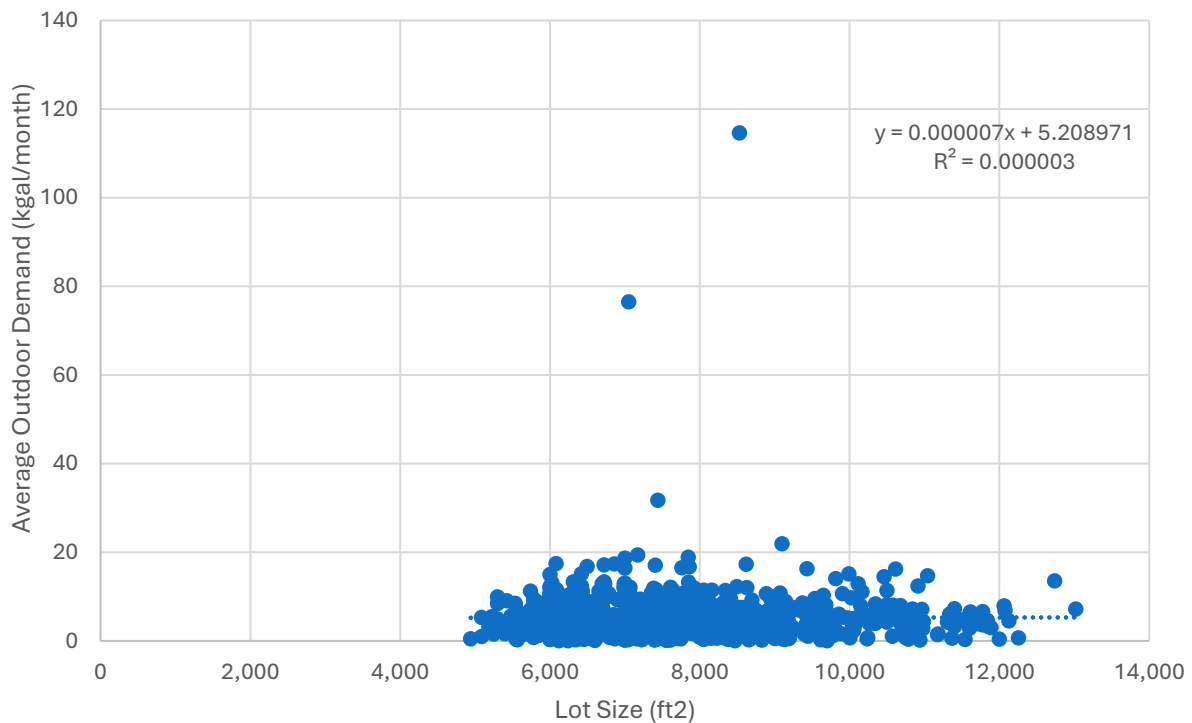
### ***Estimating Water Demands***

To estimate future water demands per tap, introduced in Step Five, relationships were defined between water use and home size, lot size, price (water rates), and climate. Linear regressions were built to determine the relationship between home size and indoor water demand for different customer types in Severance as well as for the relationship between lot size and outdoor water demand. Upon analysis, it was determined that there was an insufficient sample size to return meaningful results for commercial customer types (indoor  $n = 26$ , outdoor  $n = 24$  after removing outliers). However, models were built for residential indoor and outdoor water use, the data and regressions for which are shown in **Figure 5** and **Figure 6** respectively. Prior to building each regression, outliers were removed using the interquartile range for home size and lot size data.

**Figure 5: Single-family Residential Indoor Water Use**



In **Figure 5**, the relationship between home size and average indoor water use for residential accounts is shown, with each point representing the average monthly indoor water use across the period of record (May 2019 – May 2025) for a given account. In **Figure 6**, the relationship between lot size and average outdoor water use for residential accounts is shown for the same period of record. Although each regression had a low R-squared (0.002 and 0.000003 respectively), they provide insight into the relationship between home and lot size and water use to an extent that can be utilized as an adjustment factor when estimating the Town’s future water demand on a per tap basis.

**Figure 6: Single-family Residential Outdoor Water Use**

The regression coefficients from the above trendlines are summarized in **Table 7**. The coefficients suggest, for example, that for every square footage increase in home size, single-family residential indoor water use increases 0.0000061 AF per year per tap. Likewise, for every square footage increase in lot size, single-family residential outdoor water use increases by 0.0000003 AF per year per tap.

**Table 7: Regression Coefficients**

Model	Model Coefficients	Units	Adjusted Coefficient	Adjusted Units
Residential (Indoor)	0.000166	kgal/mo/tap/bldg ft <sup>2</sup>	0.0000061	AF/yr/tap/bldg ft <sup>2</sup>
Residential (Outdoor)	0.000007	kgal/mo/tap/lot ft <sup>2</sup>	0.0000003	AF/yr/tap/lot ft <sup>2</sup>

Using the residential regression coefficients from **Table 7** and the adjustment factors and scenarios described in **Table 4**, adjustments were made to the current indoor and outdoor water demands per tap shown in **Table 2**, to generate estimates of per tap water demand under the future Low Bookend, Most Probable, and High Bookend scenarios. In a stepwise fashion, a percent change in indoor and outdoor water use for each customer type was calculated by:

1. **Home Size:** A typical home size was set for each of the modeled scenarios, and the indoor regression coefficient was then used to estimate the associated change in water use per residential tap based on the change in home size from the current average (1,900 ft<sup>2</sup>). A percent change in water demand from the current indoor water demand per tap could then be calculated for residential water users. Building size was assumed to have no effect on

commercial water demand and was not used as an adjustment factor when estimating future indoor commercial water demand.

2. **Lot Size:** A typical lot size was set for each of the modeled scenarios, and the outdoor regression coefficient was then used to estimate the associated change in water use per residential tap based on the change in lot size from the current average (8,400 ft<sup>2</sup>). A percent change in water demand from the current outdoor water demand per tap could then be calculated for residential water users. Lot size was assumed to have no effect on commercial water demands and was not used as an adjustment factor when estimating future outdoor water demand for these customer types.
3. **Price Elasticity:** Insufficient data were available to statistically model the relationship between Severance's water rates and water demand (n=5 years) and instead the median coefficient (representing the percent change in water demand for every percent increase in price) from the Sebri meta-analysis (2013)<sup>12</sup> on price elasticity of demand was used as the adjustment factor for price in this study. Price elasticity was assumed to be uniform across customer types.
4. **Climate:** A 0%, 12%, and 25% increase in outdoor water demand was applied to the low, most probable, and high bookend scenarios respectively for each customer type.<sup>13</sup>

The percent change components were then added together and applied to current indoor and outdoor water demands for each customer type to get the Low Bookend, Most Probable, and High Bookend water demands per tap expected at build-out. The results of the adjustment process and final demand projections are discussed in the *Results*.

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<sup>12</sup> Sebri, Maamar. (2013). A meta-analysis of residential water demand studies. *Environmental, Development and Sustainability*. 16(3), 499-520.

<sup>13</sup> Percent change in future outdoor water demand under different scenarios was taken from the Greeley Integrated Water Resources Plan (2023).

## Results

The final steps for forecasting the Town of Severance's projected future water demands involve taking the results of the adjustment process and applying the demand estimates (demand/tap) to the total number of taps classified for each customer type at build-out, as outlined in Step Six. Total demand at build-out is then scaled to the Town's forecasted population at five-year intervals and expressed in terms of total demand at the treatment plant.

### ***Demand per Tap***

The results of the adjustment process described in the *Step Seven: Scale Demands to Population Growth*

To estimate how total water demand evolves over time, the forecasted demand at build-out was scaled to the Town's projected population using five-year intervals. This was done by first estimating the number of residential taps in each year based on the historical ratio of residents per tap. The proportion of residential taps in each interval relative to the total number of residential taps at build-out was then used to scale the total water demand for that year. Commercial and multi-family demands were assumed to grow proportionally with residential development. Finally, the resulting annual demand values—expressed initially at the customer tap—were adjusted upward to account for water losses in the treatment and distribution system, producing a total projected demand at the treatment plant for each interval.

Estimating Water Demands section above are shown in **Table 8**. Indoor and outdoor water demands are reported separately instead of as a total water demand per tap to account for the fact that not all taps currently utilize potable water for outdoor water use. This report solely estimates the Town's future potable water needs and operates under the assumption that future non-potable water needs will be met by developers bringing agricultural water for outdoor irrigation. Under the Most Probable scenario, future per tap demands for single-family residential water use was estimated at 0.33 AF per tap where potable water is required for both indoor and outdoor water use. These estimates, however, represent water use directly at the consumer's tap and not the amount of water that needs to be dedicated for treatment to meet the per tap demand. A larger volume amount, estimated in the following sections, is needed at the Town's water treatment facility to account for non-revenue water losses (18%).<sup>14</sup>

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<sup>14</sup> Total non-revenue water is estimated at 18.1%, a combination of 10% losses through the North Weld County Water District system and an additional 9% losses through the Town of Severance's distribution system.

**Table 8: Estimated Future Water Demands per Tap by Customer Type**

Use Category	Demand per Tap (AF)			
	Current	Low Bookend	Most Probable	High Bookend
<b>Residential</b>				
Indoor	0.12	0.08	0.11	0.13
Outdoor	0.22	0.15	0.22	0.27
<b>Multi-family<sup>15</sup></b>				
Indoor	0.13	0.09	0.12	0.13
Outdoor	0.00	0.00	0.00	0.00
<b>Commercial</b>				
Indoor	0.35	0.24	0.31	0.35
Outdoor	0.40	0.27	0.40	0.50

### **Forecast Future Demand**

To use the future per tap demand estimates to forecast total future demand, the demand per tap ranges were multiplied by a range of expected future taps at build-out. Calculating the quantity of future taps under different build-out scenarios began with multiplying tap densities from **Table 5** by developable acreage values from **Table 3** to determine the number of future taps for undeveloped parcels under each growth scenario. The resulting value were then added to the number of existing taps plus the number of taps associated with known planned developments to determine total projected tap counts at build-out.

This process resulted in commercial tap count estimates that were higher than reasonably expected for the Town of Severance (200 to 380 commercial taps within the WSA at build-out). An alternative approach for estimating commercial tap counts using the existing population per commercial tap was explored. In 2025, there is an estimated 350 residents per commercial tap in Severance. This demand analysis uses a 30-year planning horizon and assumes build-out will be achieved by 2055, at a projected population of almost 16,000. Using the same proportion of residents to commercial taps as in 2025 would suggest 46 commercial taps will be established in Severance at build-out. This estimate likely underpredicts the number of future commercial taps but sets a reasonable scale for tap count. Assuming that commercial tap count will grow at a faster rate than population but reach a lower density than predicted based on acreage, a range of commercial tap counts of 50, 75, and 100 commercial taps were used for the Low Bookend, Most Probable, and High Bookend Scenarios.

To summarize total tap counts estimated at build-out, under the Most Probable scenario, roughly 5,250 total taps are expected within the Severance WSA, as shown in **Table 9**, including already existing taps. The High Bookend scenario is proportionally higher compared to Most Probable than the Low Bookend scenario is lower than Most Probable because it includes an expanded service area, with some future taps serviced by the Town of Severance in the Town's GMA south of the existing WSA boundary (**Figure 4**).

<sup>15</sup> Multi-family developments typically have one tap per building. Here, water demands were estimated on a per unit basis instead of a per tap basis using the regression for indoor residential use and an average unit size of 953 ft<sup>2</sup> for units likely to be developed at Northgate Lakes. This enabled a "current demand" or baseline to be set for multi-family water use in the Town of Severance which was then adjusted using adjustment multi-family factors from a similar demand analysis completed for the Town of Wellington in 2024. Since all multi-family units in Severance will be future developments, and all future developments must use non-potable water for outdoor irrigation, multi-family outdoor water use is set to zero.

**Table 9: Estimated Number of Future Taps by Scenario**

Land Use Category	Classification	Total Taps at Build-out			Total Taps at Build-out Without Non-potable		
		Low Bookend	Most Probable	High Bookend	Low Bookend	Most Probable	High Bookend
Town Core	Residential	573	606	688	104	104	104
Town Core	Multi-family	195	195	195	0	0	0
Town Core	Commercial	50	75	100	31	31	31
Suburban Perimeter	Residential	4,187	4,342	4,741	999	999	999
Rural Residential	Residential	31	31	146	5	5	5
<b>Totals</b>	<b>Total</b>	<b>5,035</b>	<b>5,249</b>	<b>5,870</b>	<b>1,139</b>	<b>1,139</b>	<b>1,139</b>
	<i>Residential</i>	<i>4,790</i>	<i>4,979</i>	<i>5,575</i>	<i>1,108</i>	<i>1,108</i>	<i>1,108</i>
	<i>Multi-family</i>	<i>195</i>	<i>195</i>	<i>195</i>	<i>0</i>	<i>0</i>	<i>0</i>
	<i>Commercial</i>	<i>50</i>	<i>75</i>	<i>100</i>	<i>31</i>	<i>31</i>	<i>31</i>

From there, the Low Bookend, Most Probable, and High Bookend water demands per tap estimated in **Table 8** can be applied to forecast the total water demand by customer type across a range of scenarios for the Town of Severance. Crossing three additional scenarios with the ranges of taps expressed above results in a matrix of estimates. In **Table 10**, the low bookend tap density-low bookend water demand combination is shown for the overall Low Bookend scenario. The most probable tap density-most probable water demand combination is shown for the overall Most Probable scenario, and the high bookend density-high bookend water demand combination is shown as the overall High Bookend Scenario. The Most Probable scenario forecasts a future at-the-tap water demand at build-out of 850 AF within a range of 591 AF to 1,085 AF if more conservative assumptions are made and service is expanded to lands south of the existing WSA.

**Table 10: Summary of Forecasted Total at-the-tap Water Demands at Build-out**

Classification	Current	Projected at Build-out		
		Low Bookend	Most Probable	High Bookend
Residential	543	553	791	1,009
Commercial	21	20	36	51
Multi-family	0	17	23	26
Other	7	N/A	N/A	N/A
<b>Total</b>	<b>572</b>	<b>591</b>	<b>850</b>	<b>1,085</b>

### **Water Demands Over Time**

Thus far, the demand analysis has projected total at-the-tap future water demand at build-out for the Town of Severance using the land-based approach described above. For planning purposes, this total demand is broken into annual demand at five-year intervals and expanded to cover non-revenue water losses. First, to estimate demand over time, the total water demand for Severance is scaled to follow the Town's expected population growth.<sup>16</sup> The ratio of the number of residents per

<sup>16</sup> Population projections were provided at five-year intervals through 2055 for the Town of Severance and are shown and extrapolated on an annual basis in **Appendix A**.

tap is used to estimate the number of residential taps expected at five-year intervals.<sup>17</sup> It is assumed that commercial demands will proportionally increase alongside residential demands, and therefore demand is scaled based on the residential tap counts. The proportion of residential taps estimated in a given year to the total number of residential taps estimated at build-out is taken and applied to the total water demand forecasted at build-out. This results in a proportional at-the-tap water demand estimate for a given year based on residential tap count. These demands are converted to a total water demand at Severance's water treatment plant, assuming an 18% loss of water through the treatment and distribution processes. In **Table 11**, the total forecasted water demand at the treatment plant is summarized in five-year intervals.

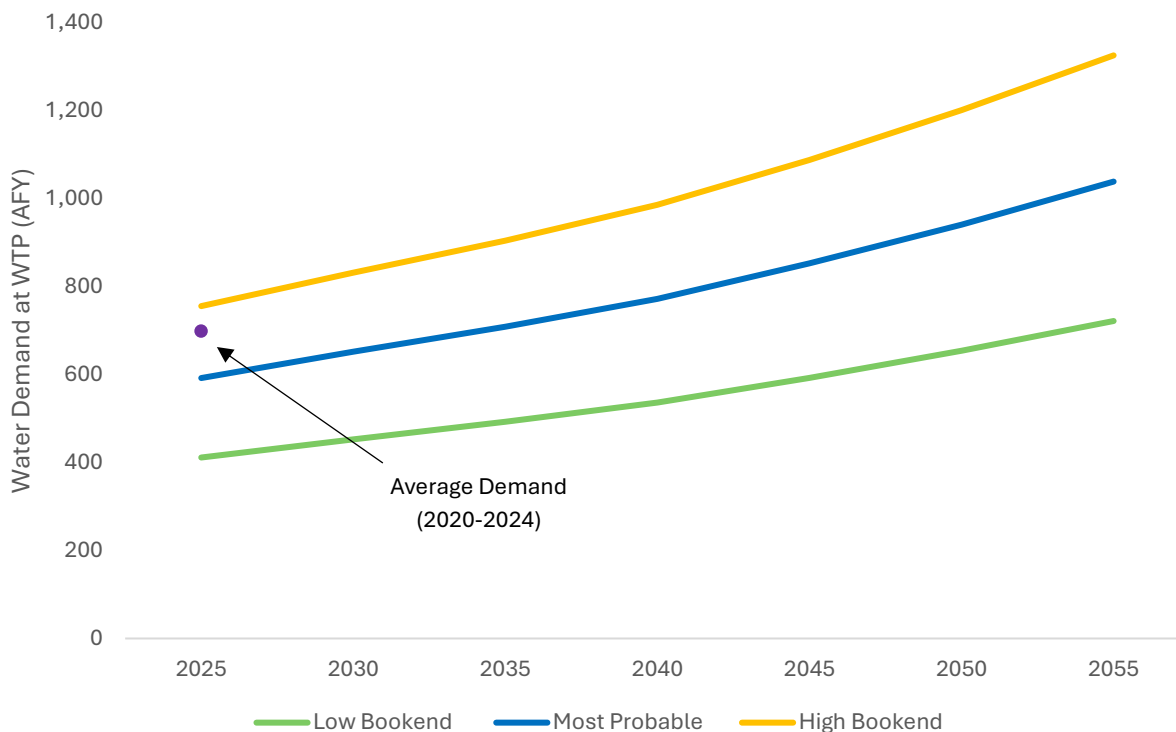
**Table 11: Forecasted Total Water Demand at the Treatment Plant**

Year	Population	Residential Taps	Demand (AFY)		
			Low Bookend	Most Probable	High Bookend
2025	10,859	2,838	411	592	755
2030	11,609	3,133	453	652	831
2035	12,262	3,417	492	709	904
2040	12,977	3,735	537	772	985
2045	13,911	4,122	592	852	1,088
2050	14,912	4,530	654	941	1,201
2055	15,985	4,979	722	1,038	1,325

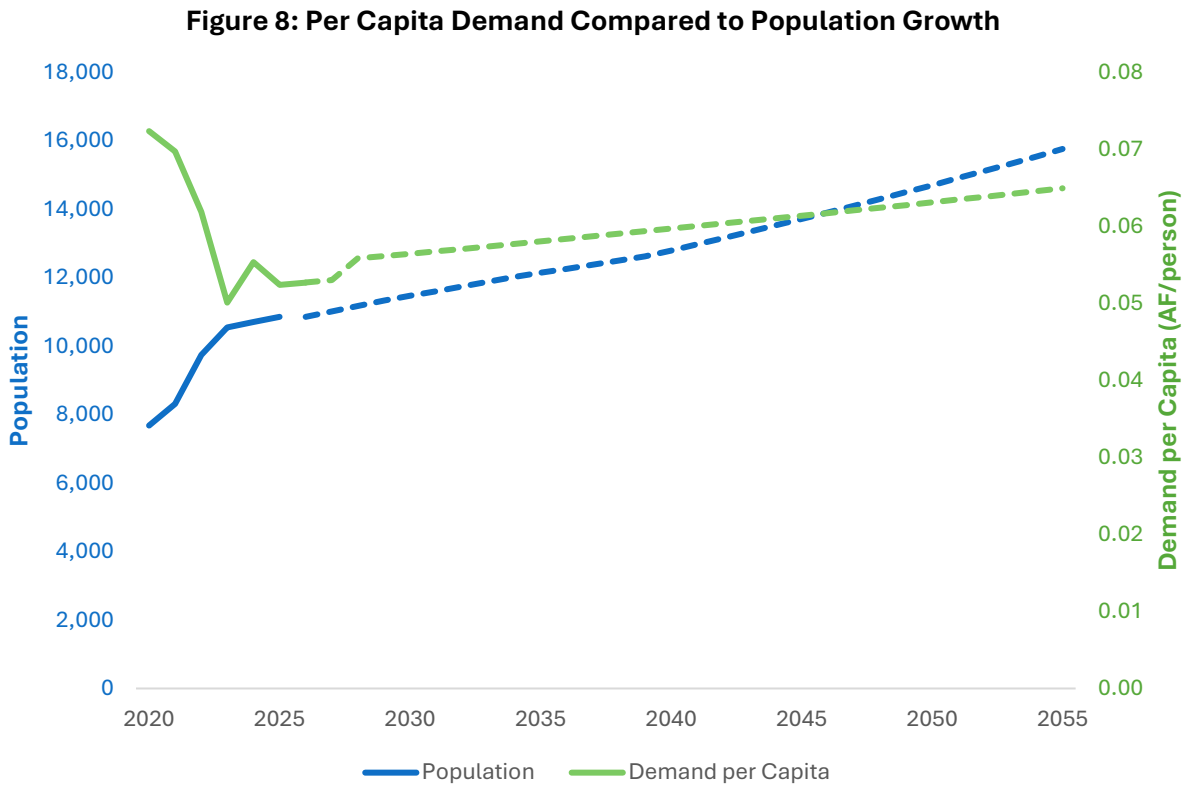
Using these estimates, the Town can expect a Most Probable water demand at the treatment plant of approximately 1,040 AF at a population of 15,985. **Table 11** and **Figure 7** show projections through 2055, with **Figure 7** providing a visual representation of the range of future water demands across planning scenarios. Future water demands are expected to range from roughly 720 AF to 1,325 AF per year as the Town reaches a population of approximately 15,985 in 2055.

<sup>17</sup> Using the Town's 2025 population estimate of 10,859 and the current number of residential taps (2,838) gives a population per residential tap of 3.83. At build-out, a total of 4,979 residential taps are predicted under the Most Probable scenario. Assuming build-out is achieved in thirty years, or in 2055, and given the 2055 population estimate of 15,985 residents provides a future population per tap of 3.21. Scaling this ratio over time and applying it to the Town's population gives the number of residential taps expected at five-year intervals.

**Figure 7: Range of Future Water Demands at the WTP**



Over the planning period, the Town of Severance is expected to experience a 47% increase in population. During this time, however, demand is projected to increase 75%, with per capita demands increasing from 0.052 AF/person in 2025 to 0.065 AF/person in 2055. The increase in per capita demand is the result of an increase in commercial taps during the planning period and a rise in average temperatures leading to an increase in outdoor water use. **Figure 8** shows population and water demand per capita trends for the Town of Severance.



## Conclusions and Planning Implications

The demand forecast presented in this memorandum provides a comprehensive outlook on Severance's future water needs, highlighting the sensitivity of demand to development patterns, climate, and pricing strategies. Under the Most Probable scenario, water demand at build-out is expected to reach 1,040 AF per year. Compared to the Town's current average demand at the water treatment facility of 700 AF (572 AF at the tap), this constitutes an increase in annual demand of 340 AF by 2055. This technical memorandum is intended to give a detailed overview of the data, methodology and assumptions that went into the Town's future demand projections. An evaluation of this future demand with respect to the Town's existing water supply portfolio will be provided in the complete Water Supply Master Plan. These findings should be revisited periodically as development progresses and more data becomes available.

# Appendix A: Population Projections

Year	Population	Growth Taper %
2023	10,552	NA
2024	10,705	1.45%
2025	10,859	1.45%
2026	11,016	1.45%
2027	11,176	1.45%
2028	11,337	1.45%
2029	11,472	1.19%
2030	11,609	1.19%
2031	11,747	1.19%
2032	11,887	1.19%
2033	12,029	1.19%
2034	12,145	0.97%
2035	12,262	0.97%
2036	12,381	0.97%
2037	12,501	0.97%
2038	12,622	0.97%
2039	12,798	1.40%
2040	12,977	1.40%
2041	13,159	1.40%
2042	13,343	1.40%
2043	13,529	1.40%
2044	13,718	1.40%
2045	13,911	1.40%
2046	14,105	1.40%
2047	14,303	1.40%
2048	14,503	1.40%
2049	14,706	1.40%
2050	14,912	1.40%
2051	15,121	1.40%
2052	15,332	1.40%
2053	15,547	1.40%
2054	15,765	1.40%
2055	15,985	1.40%

Note: Estimates were provided by the Town of Severance in five-year increments starting with 2023. Blue values indicate WestWater extrapolation.