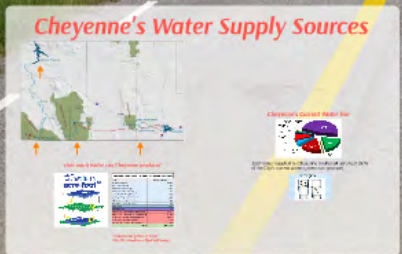
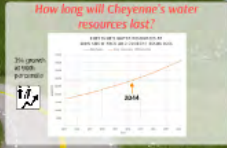


A Landscape View of Water Sustainability through Conservation



Cheyenne Board of Public Utilities
Dena Egenhoff
Water Conservation



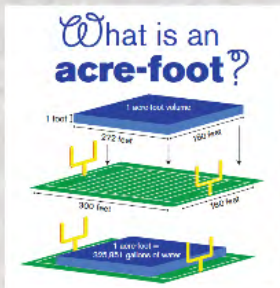
A Landscape View of Water Sustainability through Conservation

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Cheyenne's Water Supply Sources



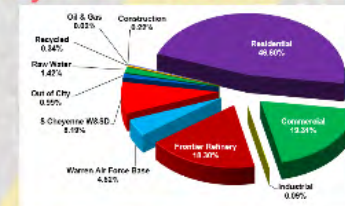
How much water can Cheyenne produce?



Source	Water (acre-foot)
Rob Roy Reservoir	24,427
Horse Creek Inflow	2,988
Douglas Creek Diversion	1,549
Lake Owen Natural Inflow	367
Granite Reservoir Natural Inflow	3,676
Crystal Reservoir Natural Inflow	505
Upper North Crow Reservoir	1,746
Old North Crow Reservoir Inflow	276
Smith Fork Reservoir Inflow	971
Well Fields	4,000
Recycle Water	180
Evaporation/Transmission Medicine Bow R	(1,427)
Evaporation/Transmission Laramie Range	(1,546)
Minimum Flows Medicine Bow Range	(5,032)
Minimum Flows Laramie Range	(726)
Flushing Flows Medicine Bow Range	(900)
Total	28,682

9,346,058,382 gallons of water
 (326,785 school buses filled with water)

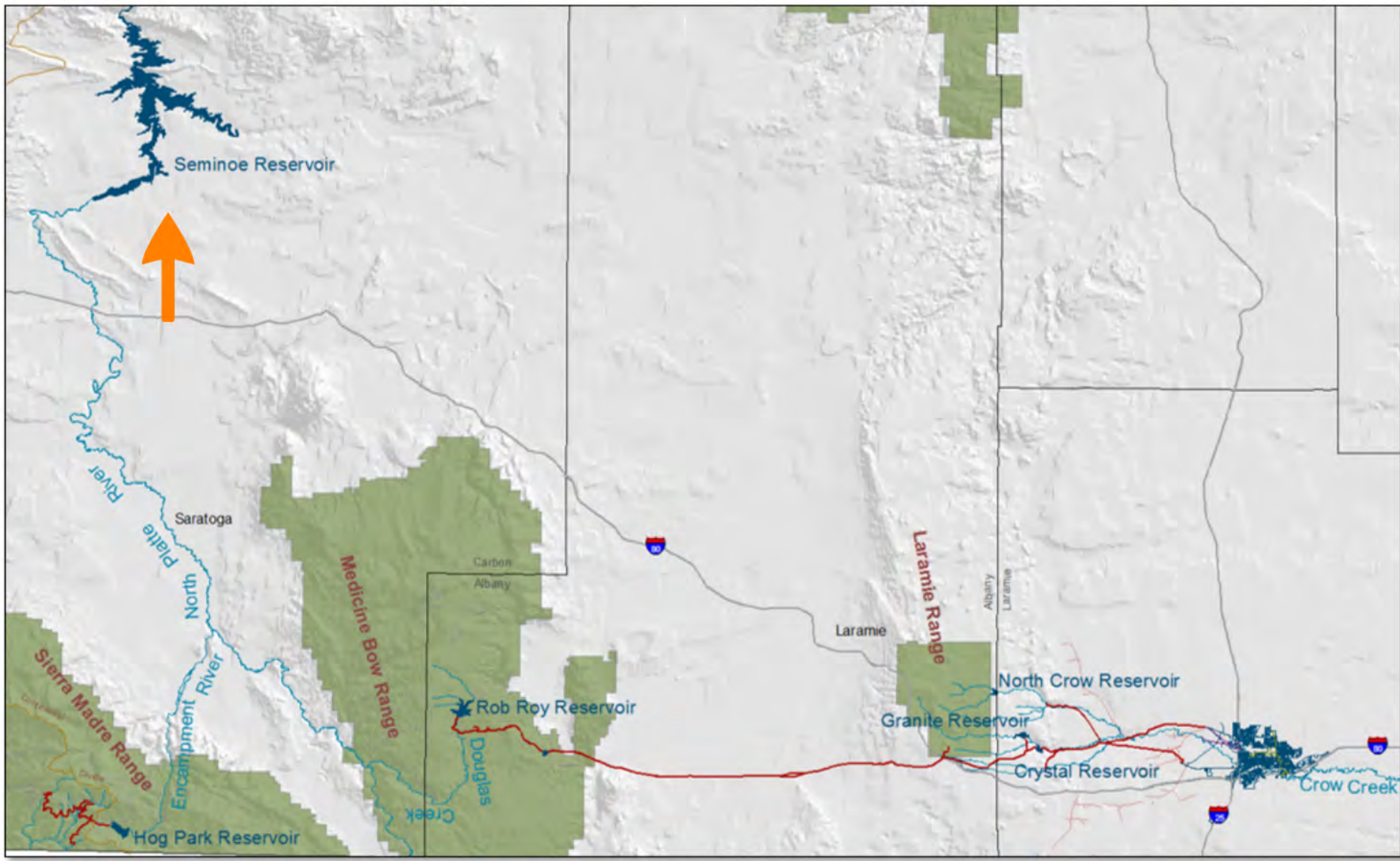
Cheyenne's Current Water Use



2017 water supplied to Cheyenne 14,450.04 acre-feet (50% of the City's current water system can produce)

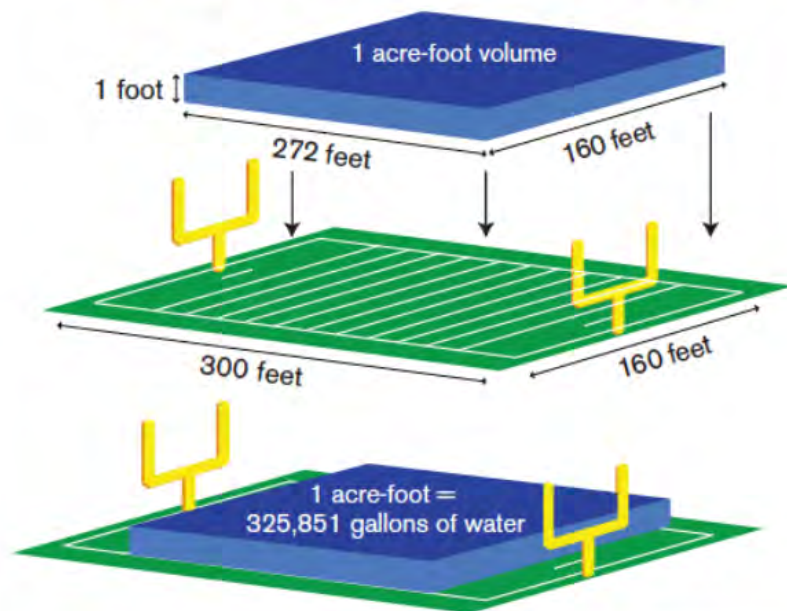


Energy Corridor



How much water can Cheyenne produce?

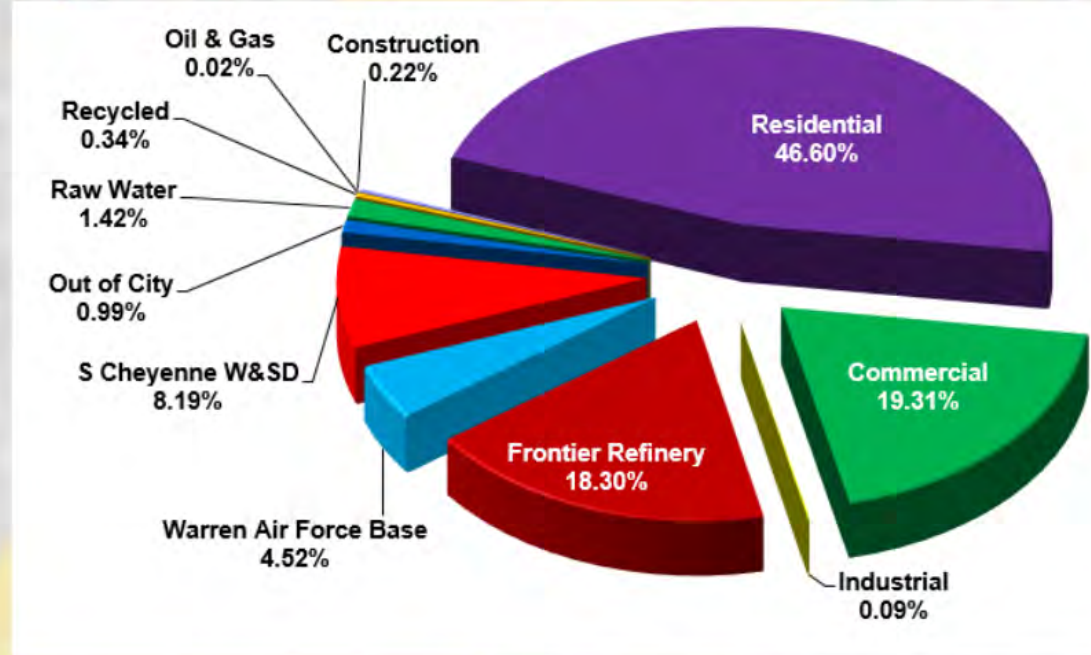
What is an acre-foot?



Available Water Supply at 100% snow pack conditions	
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Horse Creek Inflow	2,988
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South Crow Reservoir Inflow	971
Well Fields	4,000
Recycle Water	180
Evaporation/transmission Medicine Bow R	(3,427)
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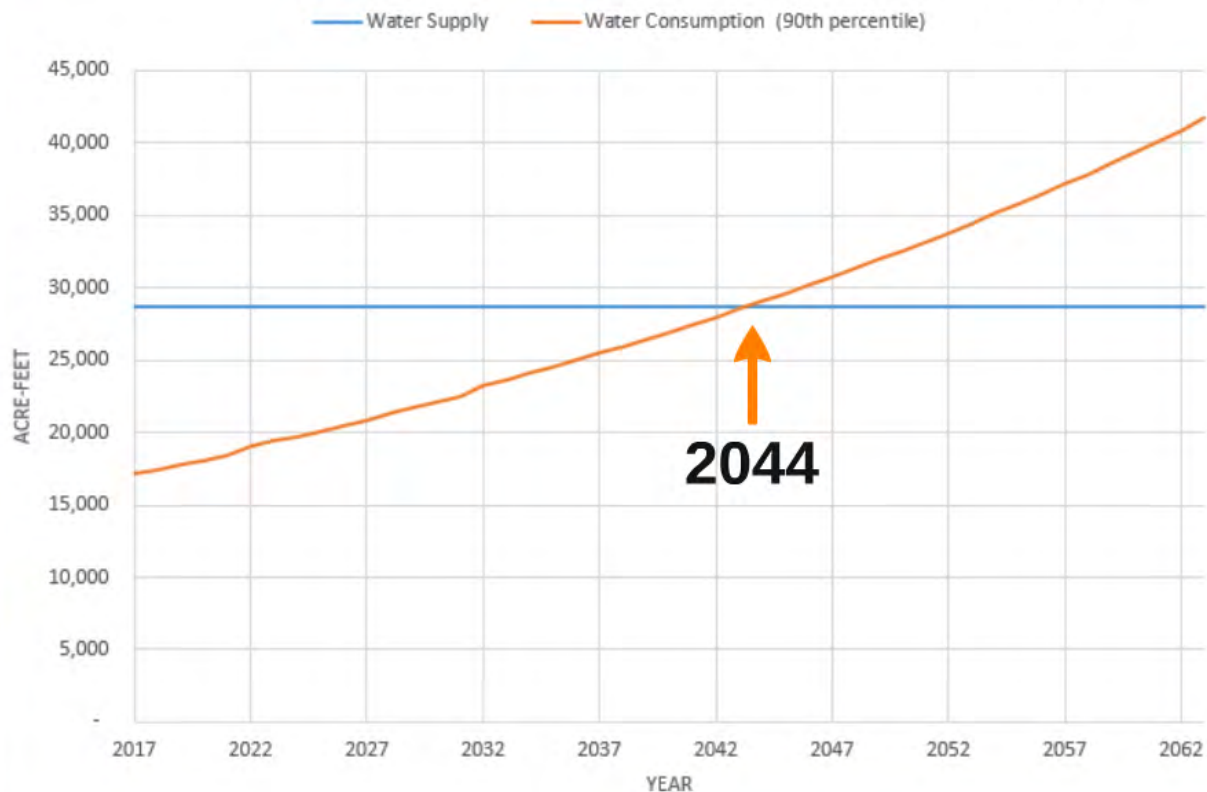


How long will Cheyenne's water resources last?

1% growth
at 90th
percentile



**CHEYENNE'S WATER RESOURCES AT
100% SNOW PACK AND CURRENT RESOURCES**



Board of Public Utilities Reduce Our Use

Cheyenne's Wise Water Conservation Plan

Resolution for the Board to Determine

- Water Supply Status
- Water Conservation Measures

Violation of Wise Water Use Plan and/or Conservation Program Violation:

- 1st (Warning)
- 2nd **\$427.00**
- 3rd **\$710.00**

Summer Water Conservation Measures

The City of Cheyenne Board of Public Utilities (BOPU) implements the following water conservation measures this summer:

Lawns and Turf

- From May 1 to September 1, no watering between 10 am to 5 pm.
- Water no more than 3 days per week.

Gardens and Flowers

- From May 1 to September 1, no watering between 10 am to 5 pm.

BOPU crews will enforce these rules. A first violation may result in a warning. Additional violations may result in fines added to the water bill. For more information visit www.cheyennebopu.org

Wasting Water-such as allowing water to run down the street is prohibited.

Washing Vehicles is permitted any time, any day, as long as customers use automatic shut-off nozzles on hoses.

Washing Hard Surfaces-such as sidewalks, parking lots or driveways-with a hose is prohibited except for safety, health or construction reasons.

Board of Public Utilities Reduce Our Use

Wise Water Conservation Plan

Educational Outreach

Smart Meters

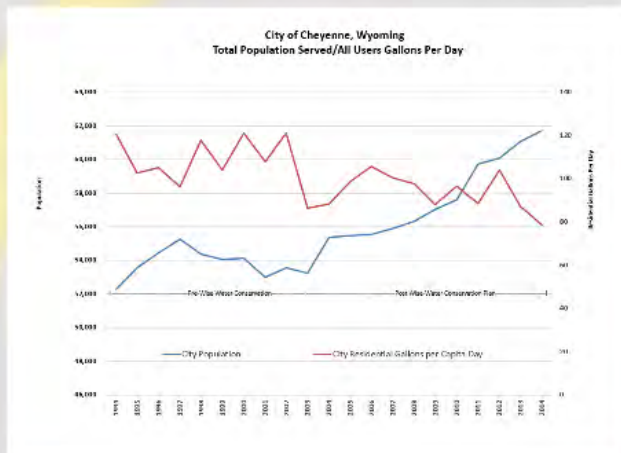
Operations and Maintenance

Recycle Water Since 2007

-Class A (most stringent classification)

- Irrigate parks, athletic fields, cemeteries and green areas.

-Used 163.09 million gallons in 2017



Cheyenne's Wise Water Conservation Plan

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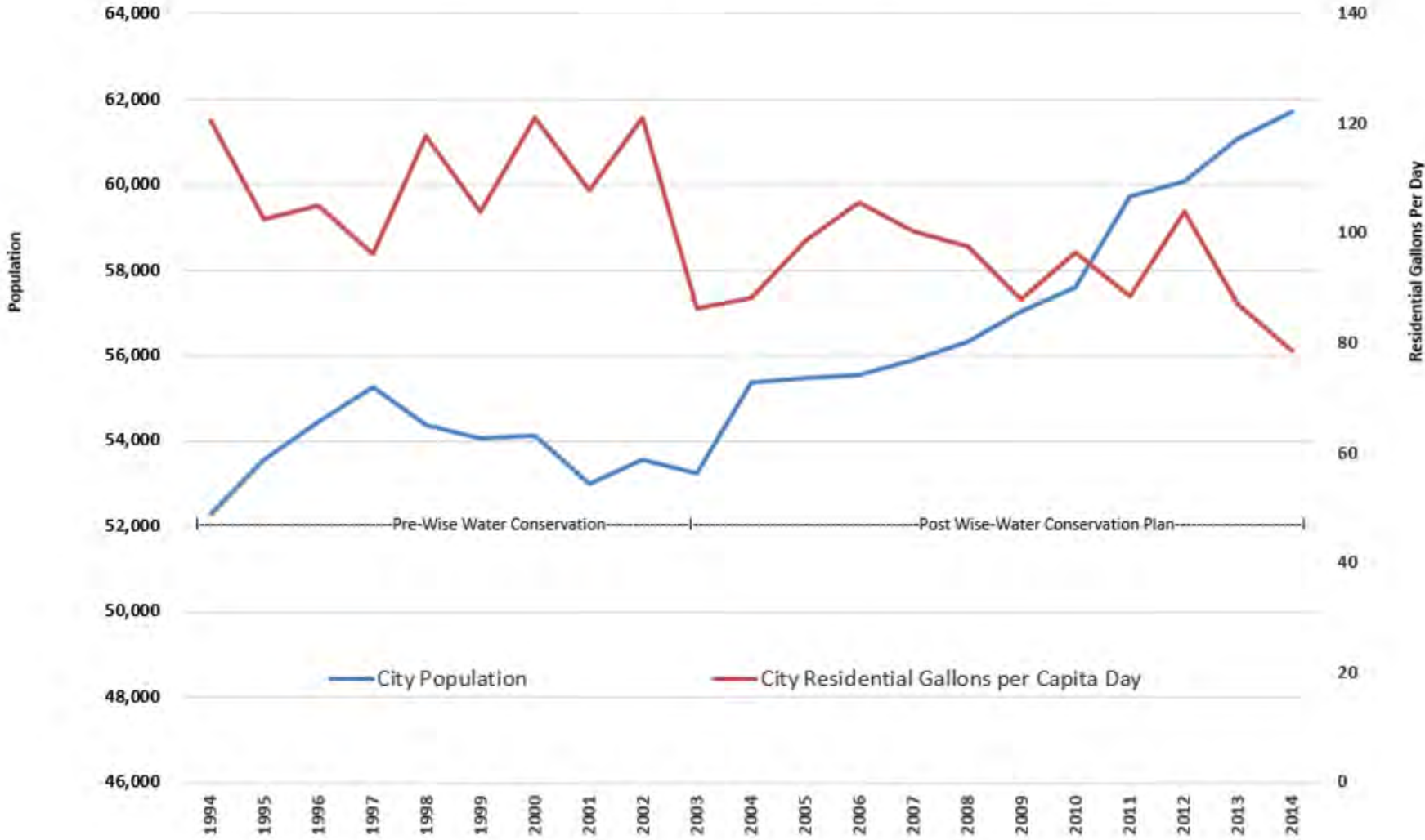
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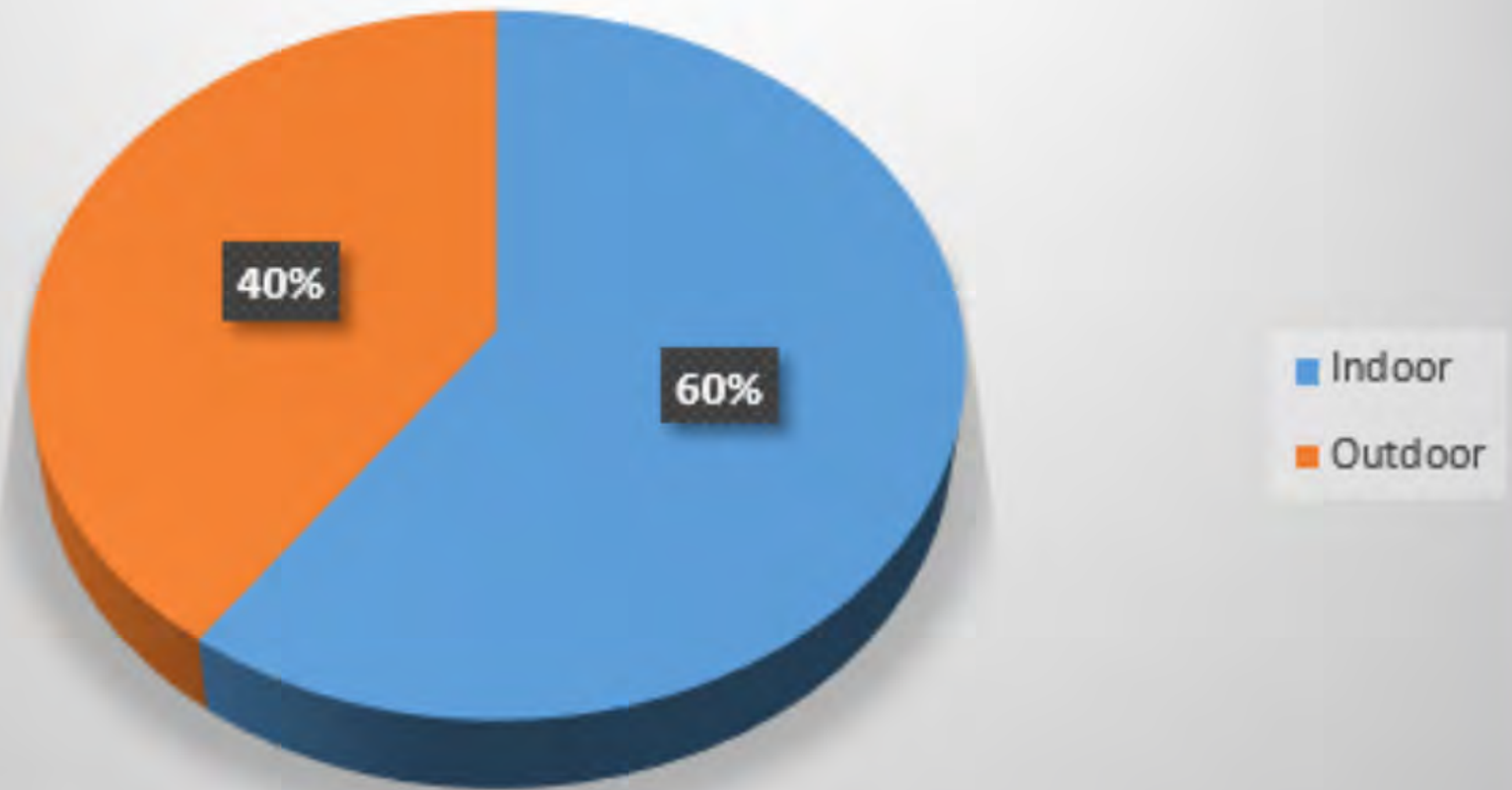
- Used 163.09 million gallons in 2017



City of Cheyenne, Wyoming Total Population Served/All Users Gallons Per Day



Indoor vs Outdoors usage



Landscape View



Water-saving Landscape (Xeriscape)

Benefits of Xeriscape

- Drought resistant
- Resource conservation
- Lowers water bills
- Reduces landscape maintenance
- Enhances attractiveness
- Habitat

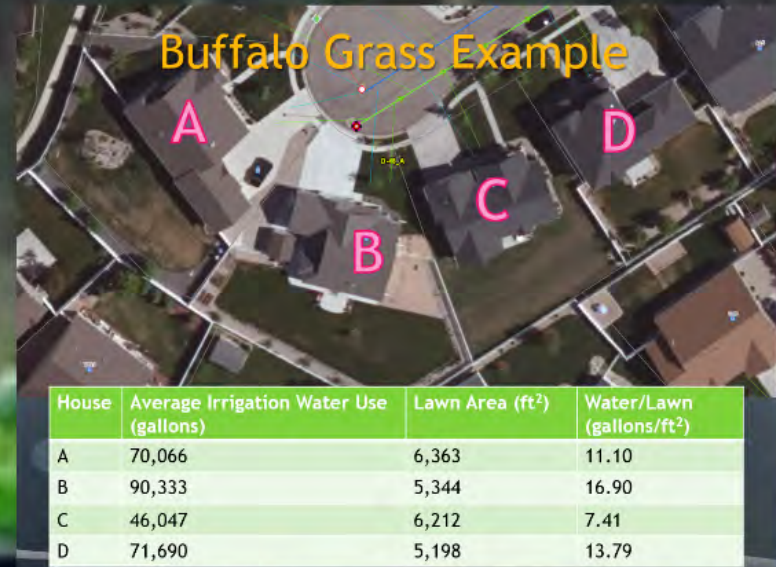
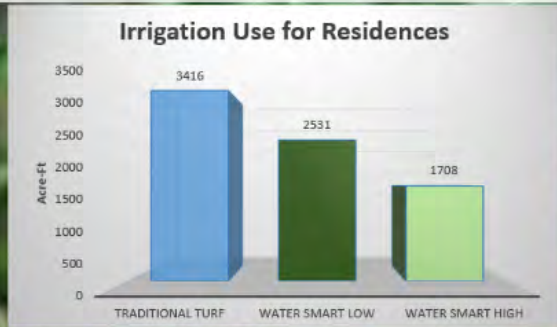


Benefits of Water Smart Landscapes

Irrigation Water Use Comparison

Assumptions

- Lawn size 3,500 ft²
- Watering 3x week for 1 month at 0.5" = 13,000 gallons/month
- Irrigation season is 5 months
- 17,177 residents (19,382-2,205 crispy lawns)
- Water Smart landscape design (1/4 low water use plants, 1/4 moderate water use, 1/2 traditional turf) reduces water consumption by 18-50%

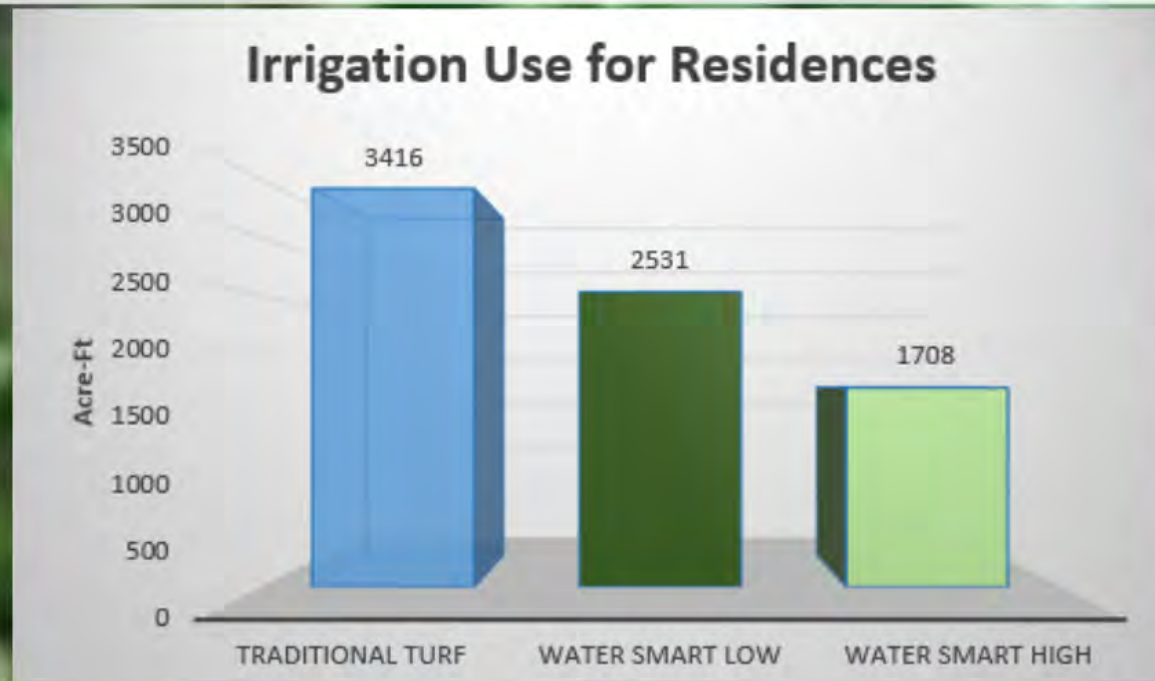


12 gallon/ft²

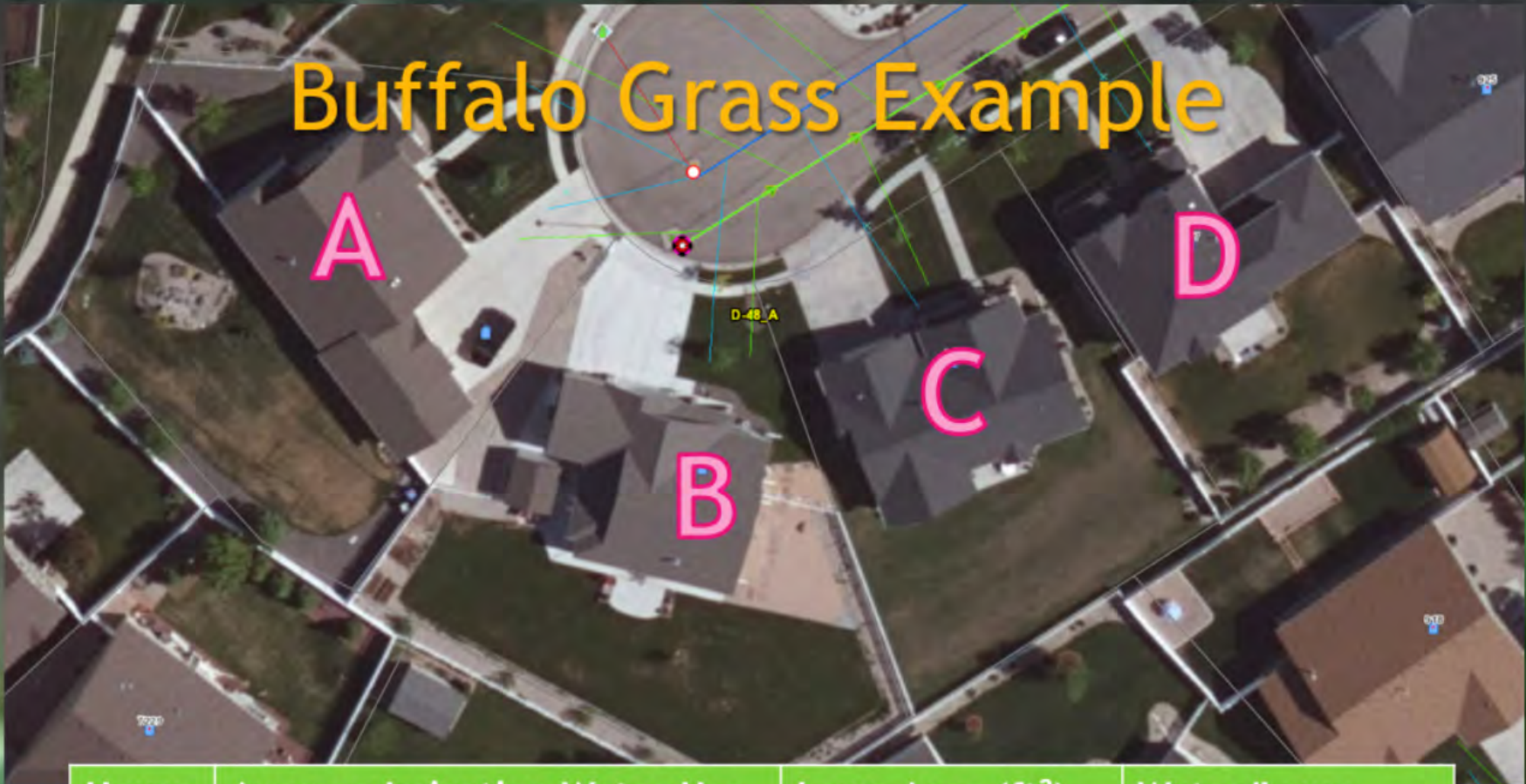
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Buffalo Grass Example

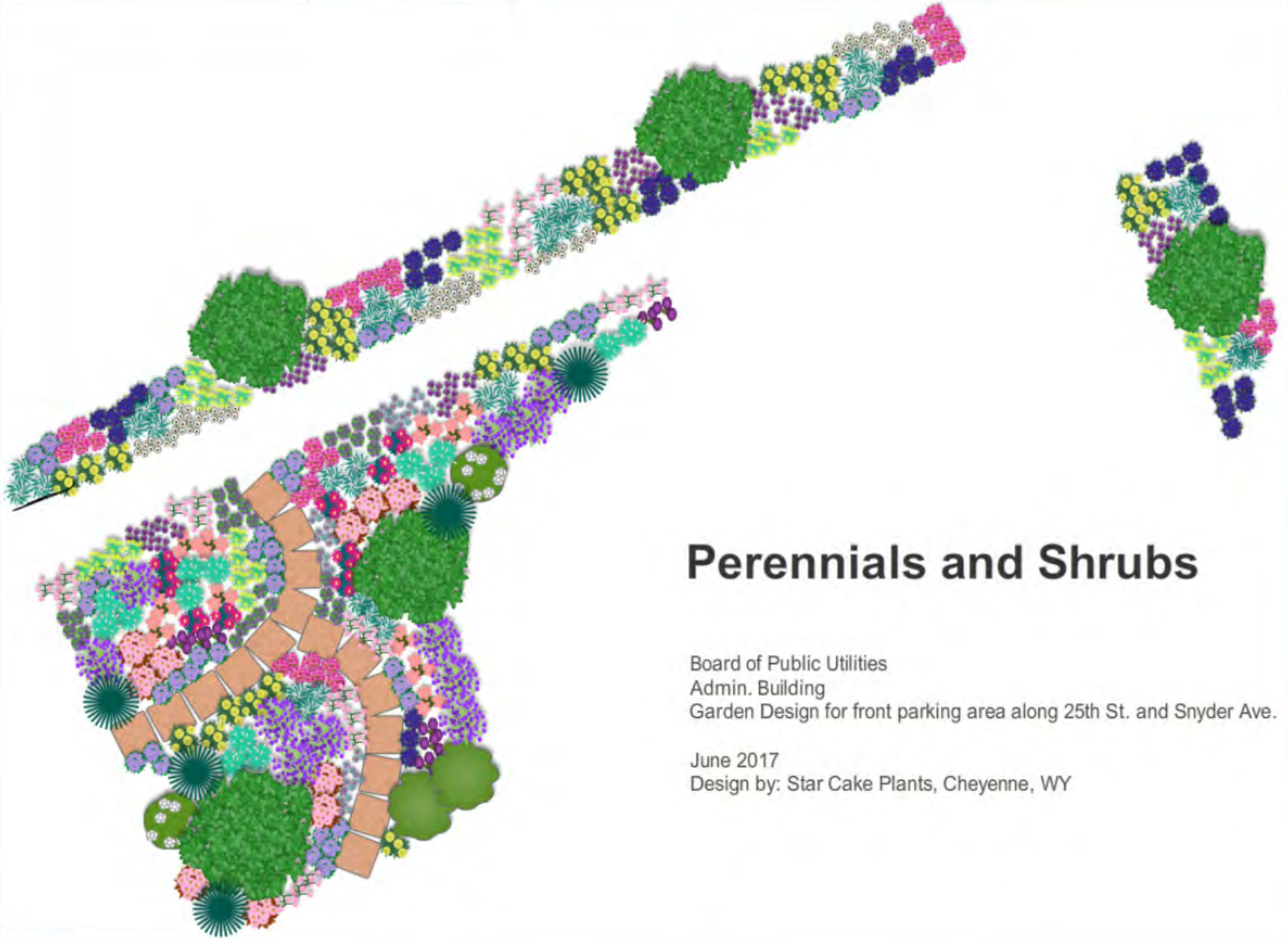


House	Average Irrigation Water Use (gallons)	Lawn Area (ft ²)	Water/Lawn (gallons/ft ²)
A	70,066	6,363	11.10
B	90,333	5,344	16.90
C	46,047	6,212	7.41
D	71,690	5,198	13.79

12 gallon/ft²



Remove ~1,500 square feet of turf



Perennials and Shrubs

Board of Public Utilities
Admin. Building
Garden Design for front parking area along 25th St. and Snyder Ave.

June 2017
Design by: Star Cake Plants, Cheyenne, WY

"Prairie Sky" Switchgrass



"Princess Victoria Louise"
Oriental Poppy

"Magnus Superior"
Coneflower



"Blue Chip Jr." Butterfly
Bush

"Lady in Black"
Calico Aster



www.alamy.com - B9D2FF



"Sunlight" Agastache

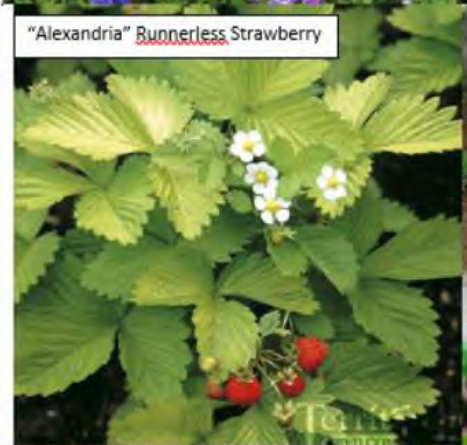
Woolly Thyme



Missouri Evening Primrose



"Alexandria" Runnerless Strawberry



Blue Avena Grass



"Goliath" Alpine Aster




"Winterglut"
Pissouak



2. Water Smart Landscape Rebate Program


Objectives

- *Reduce costs to Board and customer by deferring infrastructure costs*
- *Decrease the cascading outdoor effect of "crispy lawns"*
- *Develop a more drought tolerant community*




MATT ROLLINS' PROJECT
Lafayette, CO
Removed: **307 sq. ft.**
Potential water savings: **3,200** gallons per year

BEFORE



AFTER



Garden in a Box Kits

- **Water smart starter plants**
- **Plant and care guide**
- **Educational resources on water conservation practices**
- **Rebate Program**

Launch Program 2019

How long to water by sprinkler type?

Recommended Minutes to Water Per Zone



**Fixed
Spray
Heads**

**Rotor
Heads**

**Rotary
Nozzles**

**Manual
Sprinklers**

May	10	19	21	16
June	14	25	27	20
July	18	33	36	26
August	16	29	32	24
September	12	23	25	18
October	6	11	12	9

- Avoid watering when it's windy or raining.
- Use fertilizer sparingly
- Water in bursts. Cheyenne's soil can handle 1/3" of water per hour.
- Mow higher when grass is 2.5-3" tall

Irrigation Efficiency

Protocol

- Delineated turf areas
- Metered Water Consumption
- Calculate Daily Evapotranspiration
- Determine irrigation need
- Provide efficiency index
- Discussion to a solution

Determined using:

$$ET_{(Perman-Monteith)} = \frac{0.408\Delta(R_n - G) + \gamma \frac{900}{T + 273} U_2 (e_s - e_a)}{\Delta + \gamma(1 + 0.34U_2)}$$

Where

ET	evapotranspiration
Rn	net radiation at the crop surface
G	soil heat flux = 0 when calculating at a daily interval
T	mean air temperature (deg C)
u2	mean windspeed (m/s)
e _s	saturation vapor pressure
e _a	actual vapor pressure
Δ	slope of saturation vapor pressure-temperature curve
γ	psychrometric constant

Color Scale

	Under Irrigating (less than 70% of Irrigation Need)
	Efficient Irrigating (70% to 185% of Irrigation Need)
	Over Irrigating (185% to 300% of Irrigation Need)
	Check (300% plus of Irrigation Need)

Efficiency

	4	5	6	7	8	9	10
	0.01	0.35	0.34	0.47	0.56	0.29	0.37
		0.1	0.25	0.51	0.77	0.4	0.14
		0.6	2	1.7	4.57	1.63	1
			2.63	2.25	2	2.36	1.83
		0.6	3.14	1.4	1	0.75	1
		0.36	1.67	1.46	2.53	2.11	0.6
		0.03	1.47	0.95	1.94	2.21	1.3
		0.7	2.69	2.19	1.93	2.59	1.33
		0.47	2.75	3.71	3.85	4.48	2.31
	0.11	1.4	0.98	1.63	1.31	1.4	1.02
			2.11	2.16	1.27	0.6	4.14
			1.93	2.1	2.19	0.02	3.57
	0.08		0.81	1.15	0.56	1.01	0.48
				0.33	0.27	0.23	0.79

Landforms

- Landscapes to capture and use water.
- Ease erosion and improve water quality.
- Refill groundwater tables.
- Conserve water and reduce bills.

Laramie Library Project



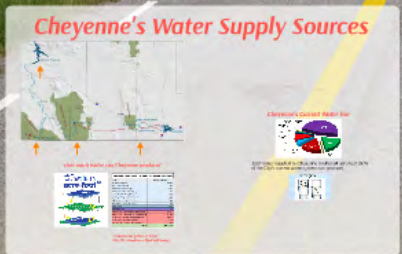
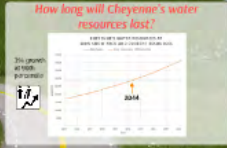
Quick Facts:

1. Outdoor water use ~ 968,750 gallons.
2. Remove turf=\$1,180/yr. in water bills.





Sustainability



A Landscape View of Water Sustainability through Conservation

Cheyenne Board of Public Utilities
Dena Egenhoff
Water Conservation