

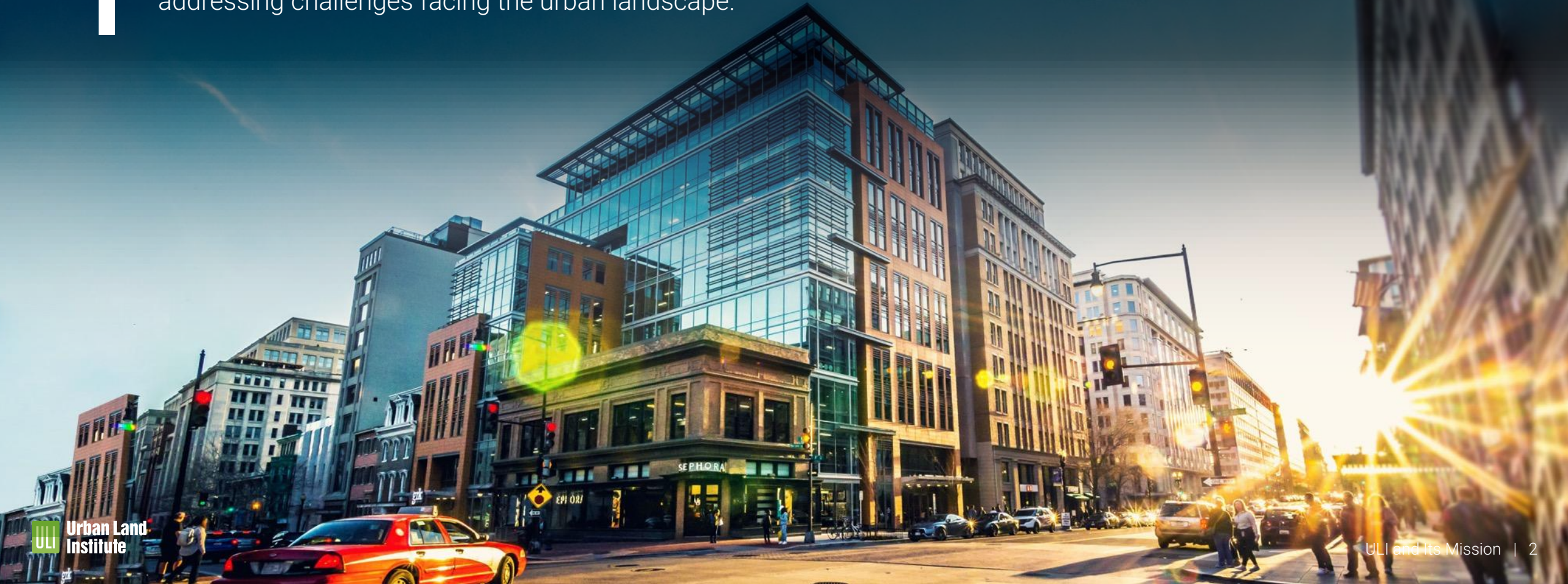
Water Wise Development Coalition

Marianne Eppig, Sr. Director of Resilience, ULI

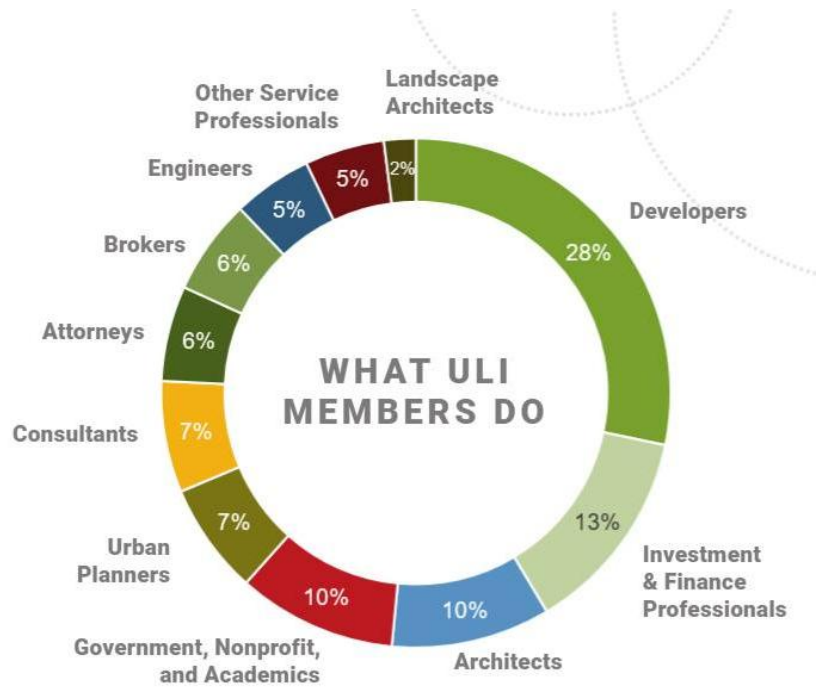
February 12, 2025

Headquartered in Washington, D.C., ULI is an independent and nonpartisan organization singularly focused on impact.

From its establishment in 1936, ULI's fundamental purpose has been to **connect** industry leaders, **inspire** best practices for equitable and sustainable land use, and **lead** in anticipating and addressing challenges facing the urban landscape.



LOCAL IMPACT



70+ District and National Councils worldwide

ULI AMERICAS

58 District Councils

ULI EUROPE

13 National Councils

ULI ASIA PACIFIC

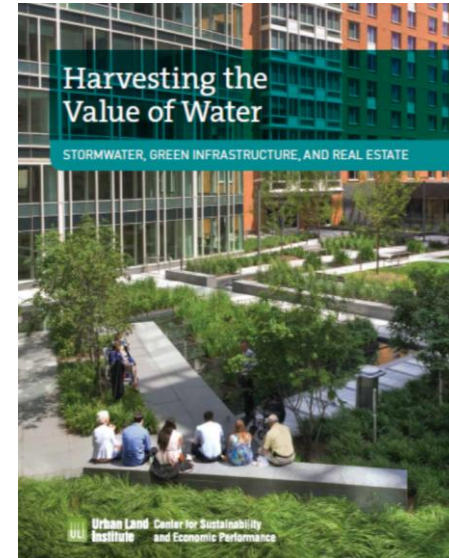
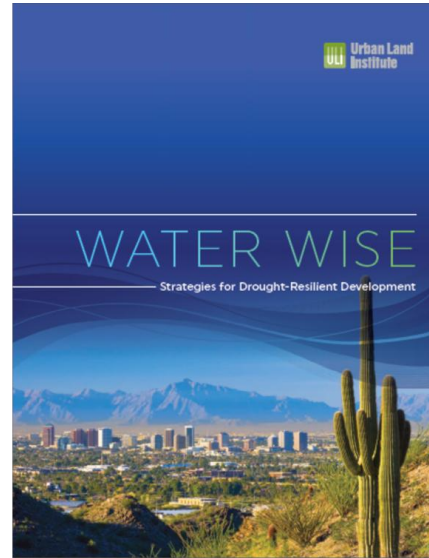
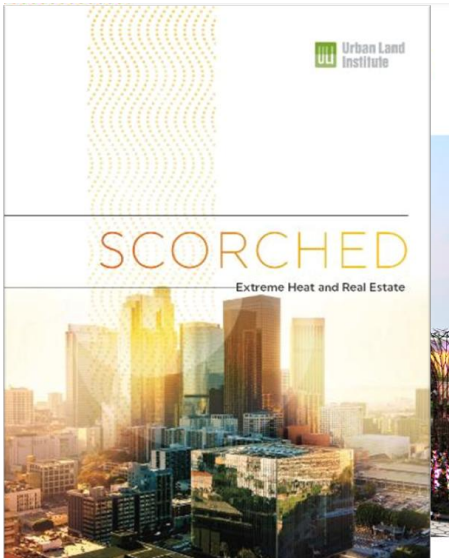
7 National Councils

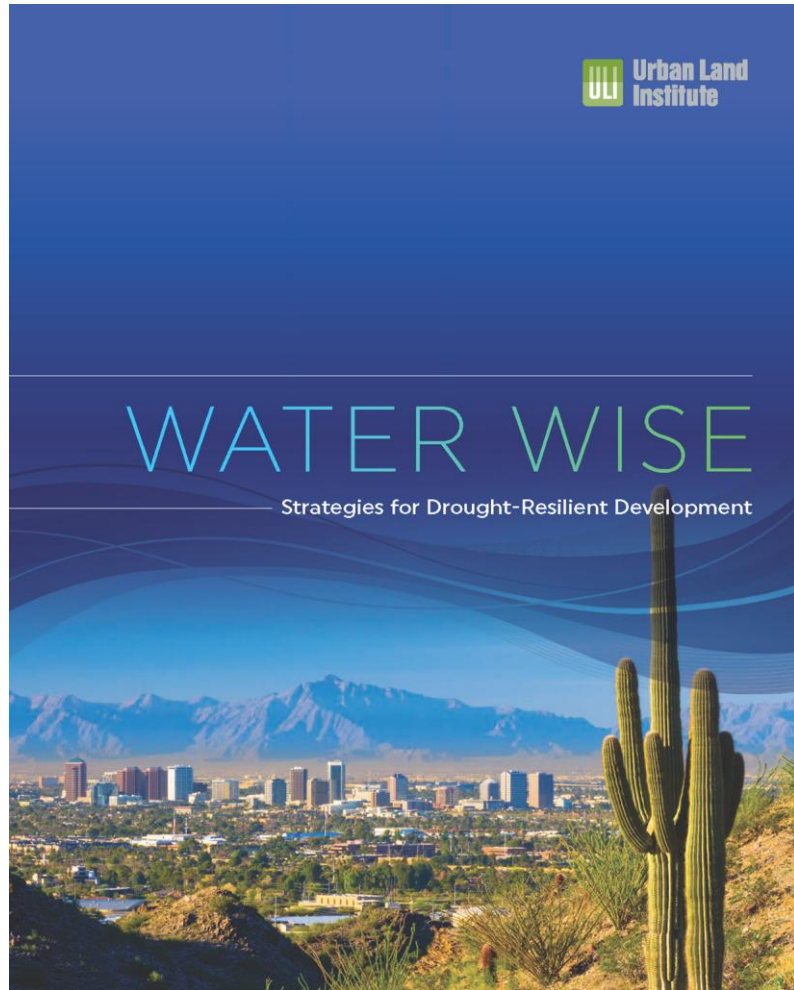


ULI's Urban Resilience Program

ULI's Urban Resilience program is focused on how buildings, cities, and communities can be more resilient to the impacts of climate change and other environmental vulnerabilities. We do this by:

- Advancing industry understanding of resilience
- Cultivating champions for resilience and catalyzing resilience partnerships
- Supporting communities in becoming more climate resilient





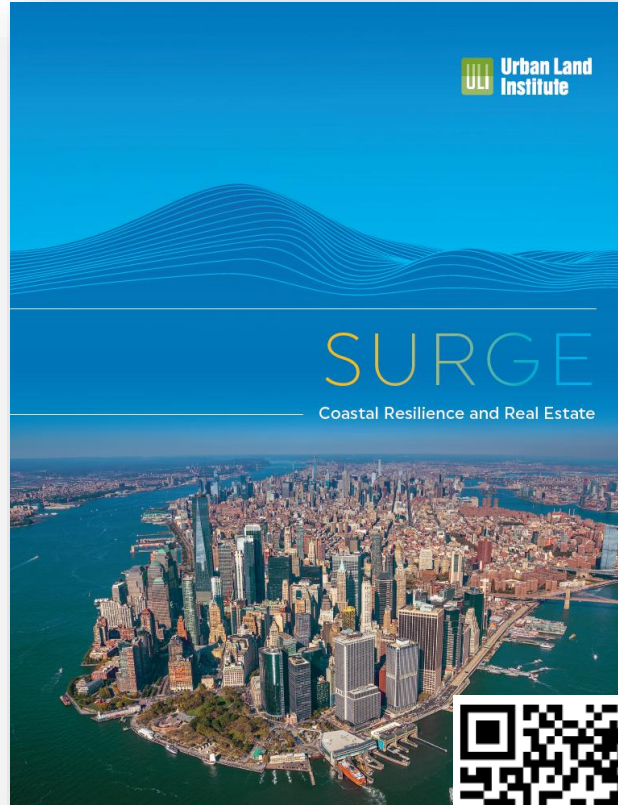
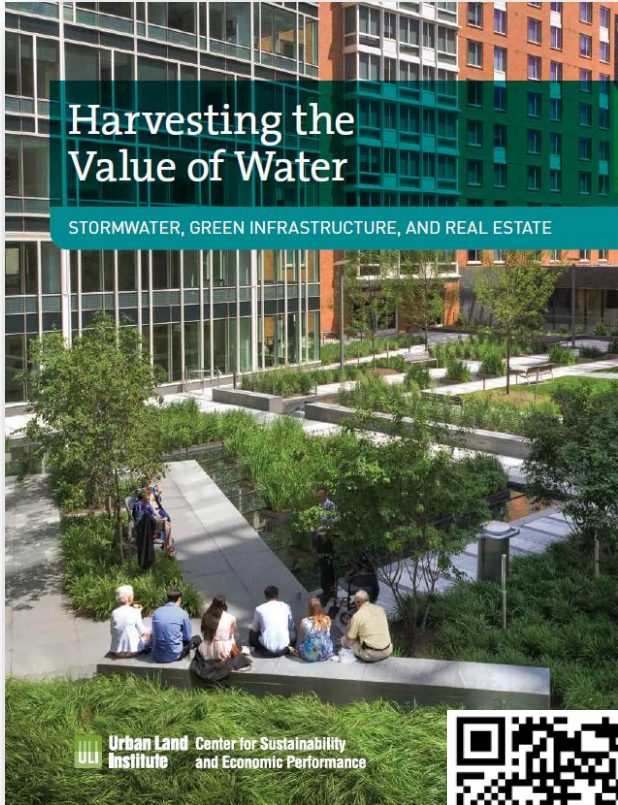
Water Wise Report

From ULI's Urban Resilience Program

Water Wise: Strategies for Drought-Resilient Development introduces the challenges associated with drought and limited freshwater availability and provides best practices for real estate and land use professionals to address them.



ULI Reports & Resources on Flooding



More ULI resources
on flood
preparedness:



Water Wise Development Coalition

Intro for newbies!

- **Who:** ULI, in partnership with the Alliance for Water Efficiency, the Sonoran Institute, and the WaterNow Alliance, is convening land use and real estate professionals with policymakers and decision-makers. This coalition is supported by the Colorado Water Conservation Board.
- **What:** Advancing water-smart real estate development and supportive policies.
- **When & Where:** Quarterly virtual meetings.
- **How:** Participants will have a say in meeting topics, speakers, and efforts.



Agenda

- ULI welcome and introductions (5 minutes)
- Speakers (20 minutes each, including individual Q&A):
 - **Meryl Corbin** from the Sonoran Institute and **Abbye Neel** from Brendle Group on Sonoran Institute's Metrics Project.
 - **Faith Sternlieb and Emily Wiggans** from the Center for Geospatial Solutions at Lincoln Institute of Land Policy on water data availability and resources.
 - **Mazdak Arabi** from the One Water Solutions Institute at Colorado State University on water forecasting for land use decision making with the POLARIS tool and lessons learned from communities in Colorado.
- Group discussion and resource sharing (20 minutes)
- ULI wrap up (5 minutes)



Growing Water Smart Metrics Technical Assistance Program



SONORANINSTITUTE.ORG



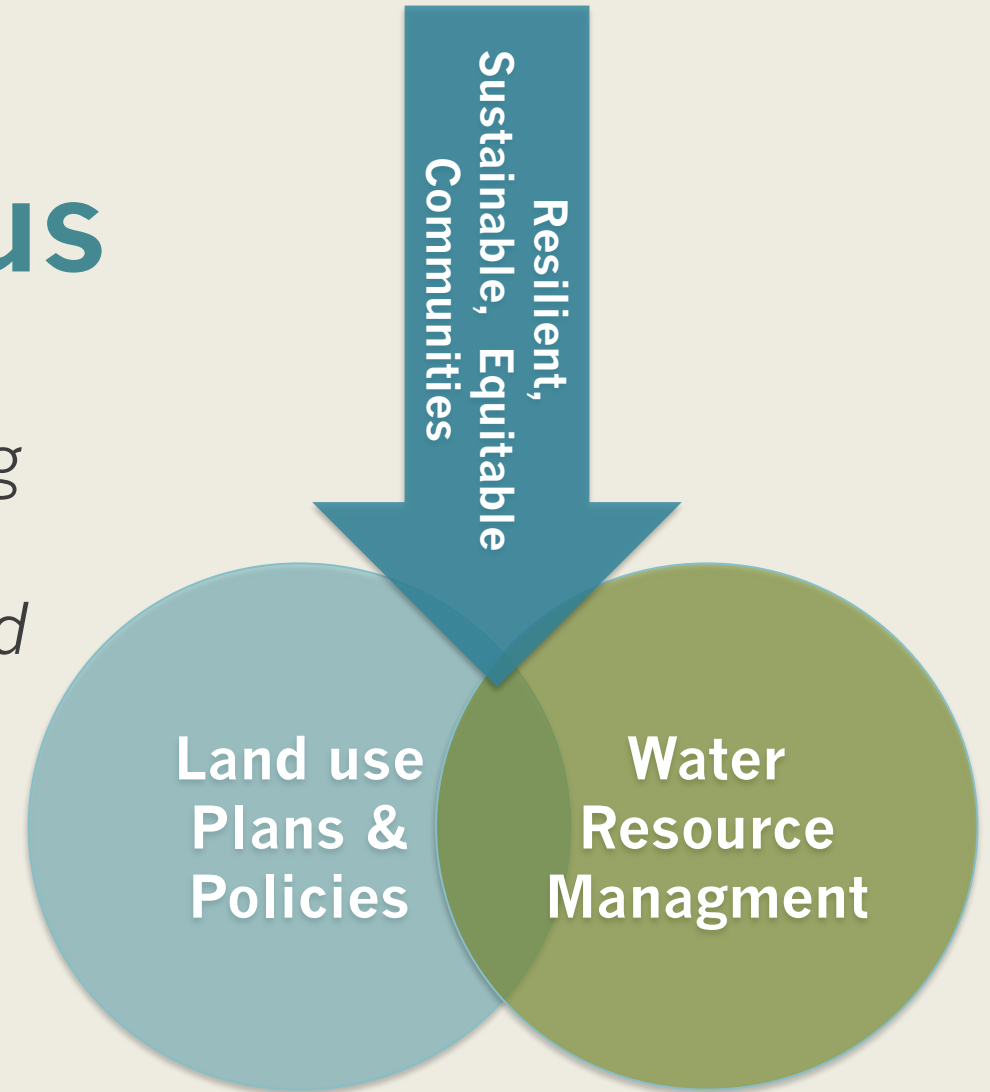
Growing Water Smart Program

- **Growing Water Smart** is a training & assistance program that empowers local leaders to implement plans and policies that support community and regional water resilience.
- Developed in 2017 by **Sonoran Institute** and **Babbitt Center for Land and Water Policy**, a **Center of the Lincoln Institute of Land Policy**.
- Key component of advancing plans and policies is technical assistance to help communities make **data-driven decisions**.
- The Metrics Program was developed in 2020 to provide technical assistance to track the **quantity, quality, and impact of integrated water and land use planning**.
- **City of Fort Lupton, CO** Growing Water Smart and Metrics Program Case Study



Land Use Water Nexus

Coordination between land use planners and water providers using their overlapping plans and policies can result in reduced demand and more resilient, sustainable, and equitable communities.



GWS Strategies



**Water Smart
Planning**



**Water Smart
Land Use Policy**



**Efficient
Water Demand
Programs**



**Adequate and
Sustainable Water
Supply Standards**



Healthy and Resilient Watersheds

GWS Trends and Data



Water Smart Planning

Trend: Understanding municipal water to serve demand

Data: Volume of water in with population

Outcome: Long-range plans that integrate water efficiency



Water Smart Land Use Policy

Trend: Amount of water serving outdoor uses

Data: Total water distributed and billing/meter information

Outcome: Landscape codes that require low-water material with quantifiable savings



Adequate and Sustainable Water Supply Standards

Trend: Assessing if a community can reliably meet future municipal demand with planned supplies

Data: Hydrologic and water allocation models

Outcome: Adopting adequate water supply rules

GWS Trends and Data



Healthy and Resilient Watersheds

Trend: Right water quality for to the right use

Data: Total water distributed and reuse supplies (reclaimed water and gray water)

Outcome: water reuse for irrigation, cooling, toilets, ect



Efficient Water Demand Programs

Trend: incentivize water conservation through conservation-oriented pricing structures

Data: Total water distributed and per capita water demands

Outcome: Pricing that incentivizes efficiency and conservation through steeply differing price signals



Fort Lupton, CO

- Diverse Experience on Roster: City Administrator, land use planners, engineer, GIS experts, utility billing managers, economic development and communication and marketing.
- Round 1 GWS: Big picture review of current planning efforts to find alignment.
- Metrics TA Project
- Round 2 GWS: Utilize data to have deeper conversations to integrate water conservation into multiple plans

Attend a GWS Workshop

- Currently accepting applications for our upcoming workshop with the **Colorado River District, Southwestern Water Conservation District, and the Colorado Water Conservation Board.**
- April 28-30 in Montrose, CO
- Due February 28, 2025
- Free for accepted communities
- For more information and the application, visit growingwatersmart.org
- Or email Meryl Corbin at mcorbin@sonoraninstitute.org.



Montrose Riverbottom and Water Sports Park

2020



GROWING WATER SMART METRICS

Tracking the Integration of Water
and Land Use Planning



Growing Water Smart Metrics Guidebook

Progress Metric

Measures a policy or action taken to integrate water and land use planning

Impact Metric

Measures an action or outcome that results in water savings (or another desired outcome)



PROGRESS METRICS



METRIC #	COMMUNITY SCALE	REGIONAL/STATE SCALES	
Development of long-range plans			
# 1		The community's long-range land use plan integrates water efficiency	Percent of population living in communities with a long-range land use plan that integrates water efficiency
# 2		The community's long-range water plan integrates land use strategies	Percent of population living in communities with a long-range water plan that integrates land use strategies
Implementation of conservation and efficiency programs			
# 3		The community is served by provider(s) using conservation-oriented system development charges	Percent of population served by provider(s) with conservation-oriented system development charges
# 4		The community is served by provider(s) using conservation-oriented pricing structures	Percent of population served by provider(s) with conservation-oriented pricing structures
Adoption of landscaping and building codes			
#5		The community has adopted the most recent International Code Council version and/or the International Green Construction Code	Percent of population living in communities that have adopted the most recent International Code Council version and/or the International Green Construction Code
#6		The community has adopted reuse water into local code	Percent of population living in communities adopting reuse water into local code
#7		The community has adopted outdoor efficiency standards that exceed State standards	Percent of population living in communities with outdoor efficiency standards that exceed State standards
Implementation of adequate water supply rules			
#8		The community has adopted water supply adequacy requirements that exceed State minimum standards	Percent of population living in communities with water supply adequacy requirements that exceed State minimum standards
Extent of regionalization/collaboration			
#9		Community planners and provider(s) have regular coordination meetings	Percent of population living in communities where planners and provider(s) have regular coordination meetings
#10		The community routes development proposals to provider(s) for review and comment	Percent of population living in communities that route development proposals to provider(s) for review and comment

IMPACT METRICS



METRIC #	DESCRIPTION	PRECURSOR METRIC
Trends in water demand and use		
#11	Total water distributed by providers	--
#12	Total potable water distributed by providers	11
#13	Percent of municipal demands served by potable water supplies	11, 12
#14	Total water reused/reclaimed	11
#15	Total non-potable water use	11
#16	Per capita water demands	11
#17	Percent of distributed water serving outdoor uses	11
#18	Average irrigation rate	17, 23
#19	Percent of irrigation demands supplied by non-potable or reuse supplies	17
#20	Water demands by land use type	11
#21	Forecasted water demands based on future land use plan	20
#22	Gap between annual water supplies and demands	21
Trends in development patterns and land use		
#23	Total irrigated area within provider service areas	--
#24	Population density	--

Metrics Program Summary

- **What:** Technical assistance opportunity to support entities in calculating integrated water and land use metrics from the [guidebook](#) via 6 – 8 months of assistance
- **Who:** water providers, water utilities, or communities in Colorado
- **Why:** Funded by Colorado Water Conservation Board, the program supports State goals to integrate water and land use planning for all Colorado Communities

Program Participant Benefits



Support **data-driven decision-making, transparency, and accountability**



Improved **data management**, quality control, and analysis workflows



Show **progress over time** through established baseline, metrics, and target values



Ability to **invest resources** where they have a significant impact



Use as a **communication tool** to demonstrate trends and progress

Example of Technical Assistance



Custom water analysis
tool to track metrics over
time



Estimate of water
demands by zoning
district and future land
use category

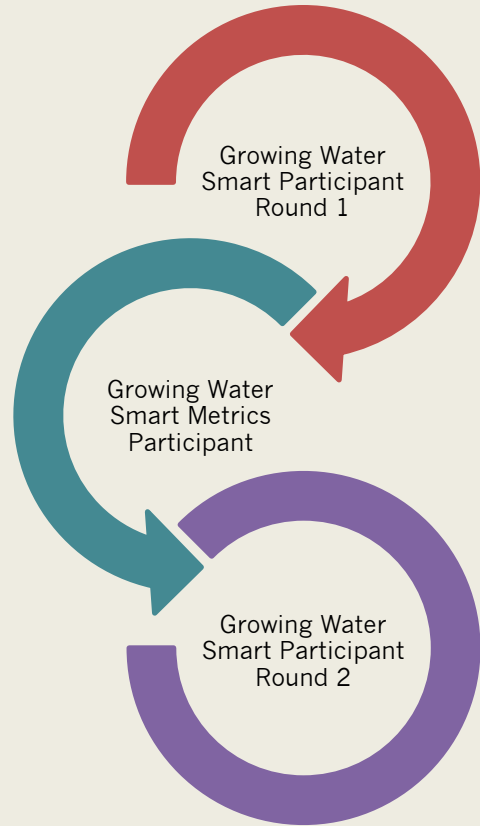


Tool to estimate water
demands associated with
incoming development



Policy research and
community engagement
resources to inform Water
Efficiency Plan strategies

Fort Lupton, CO



- **Details**

- City provides water service
- Representatives from Planning, Public Works, and Billing on metrics team
- Selected metrics to inform comprehensive plan and development review process

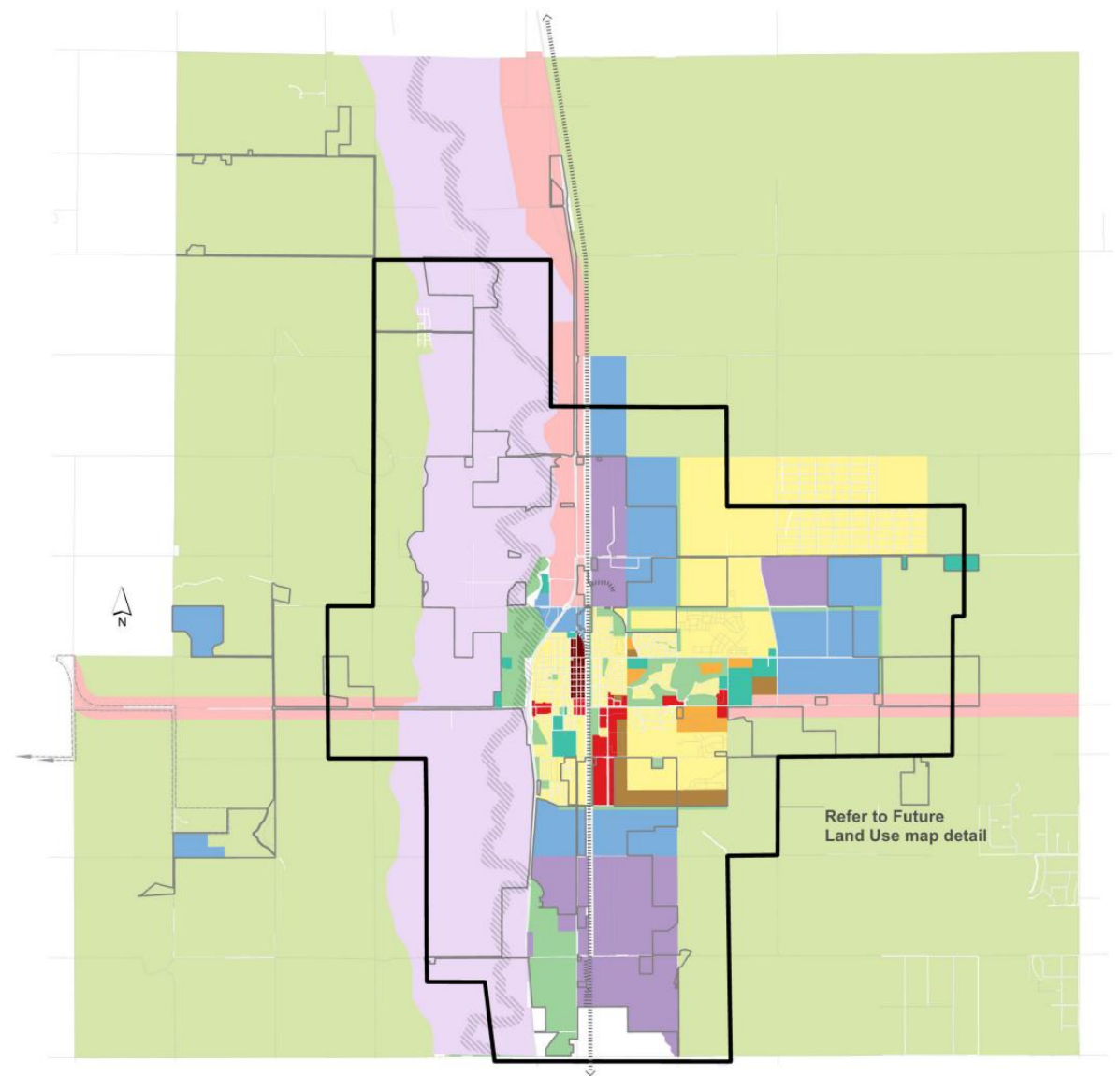
- **Metrics Selected**

- Water Demands by Land Use Type
- Forecasted Water Demands by Land Use Type

Fort Lupton

- Close to Interstate Highways
- Large Cities
- Mountains
- International Airport
- Rivers
- UP Railway through the city

***We have it all.
Come Paint Your Future
With Us.***

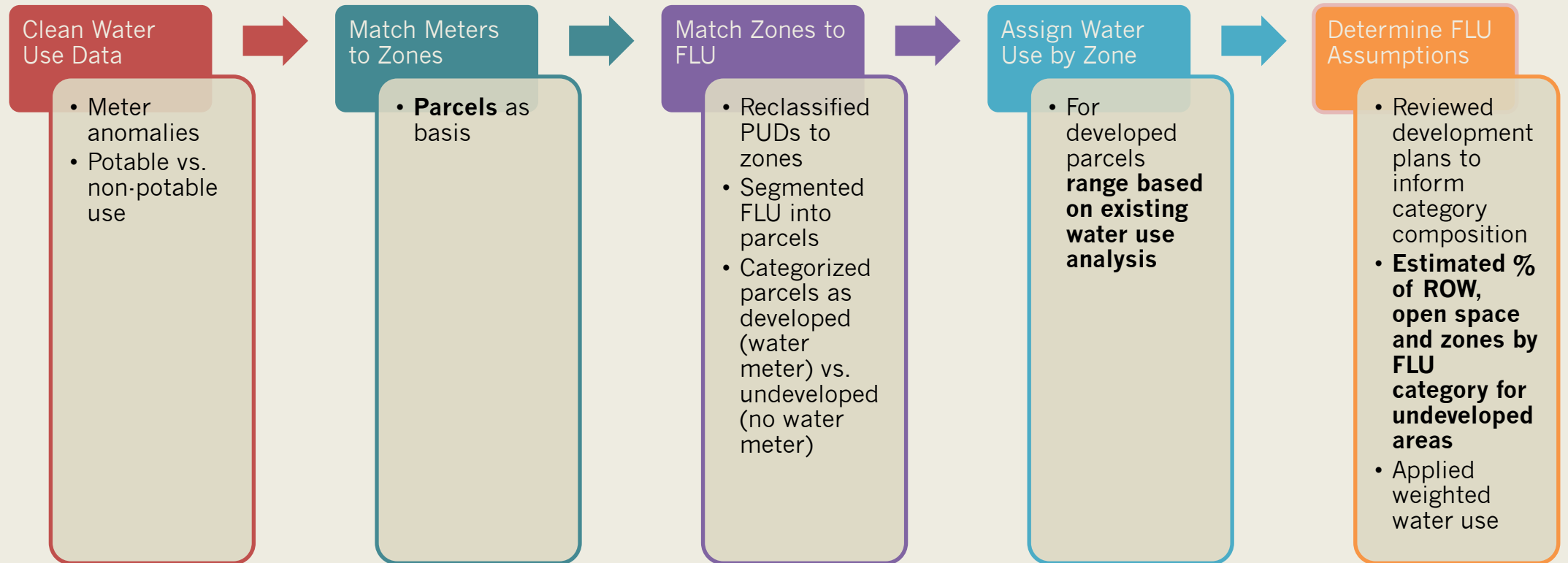


Future Land Use Planning Area

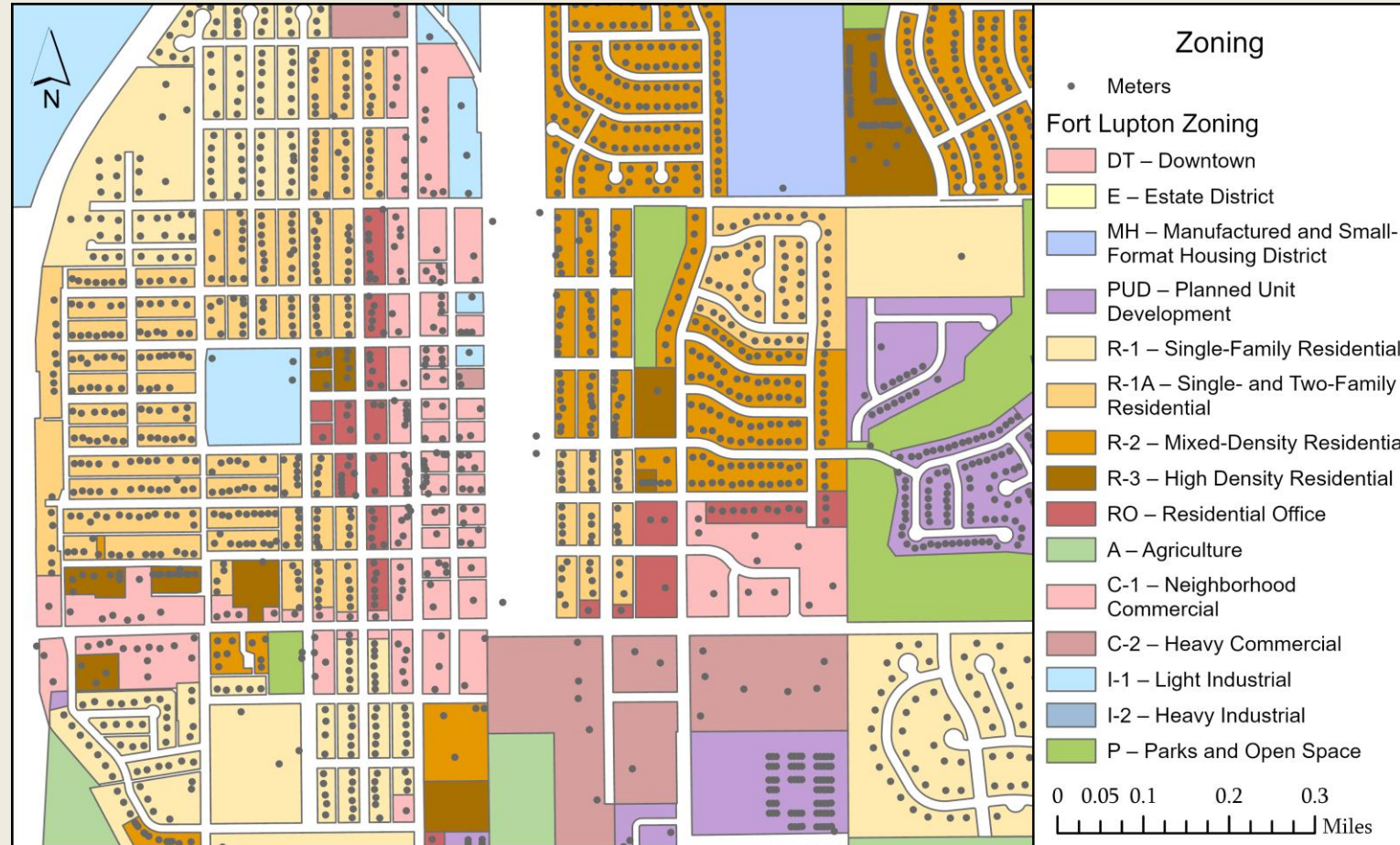
Updated August 1, 2024

- | | | | |
|--------------------|----------------------------------|-----------------------|---------------------------|
| Riparian | Agricultural & Rural Residential | Commercial General | Light Industrial & Office |
| Dacono City | Single-Family Detached | Commercial Transition | Mineral Zone |
| Existing Corporate | Single-Family Attached | Downtown Mixed-Use | Parks & Open Space |
| | Multifamily | Industrial | Public / Semi-Public |

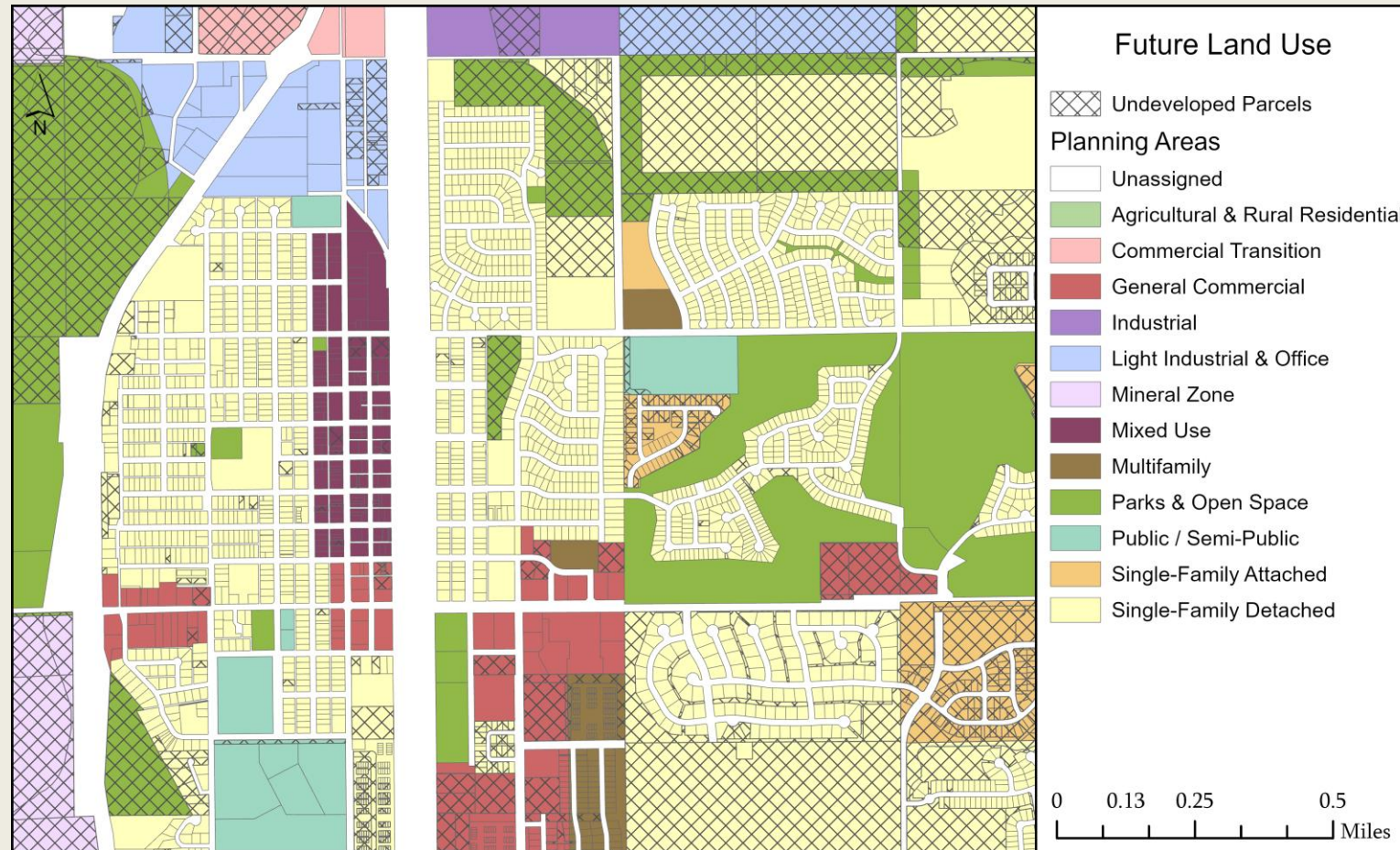
Process Summary



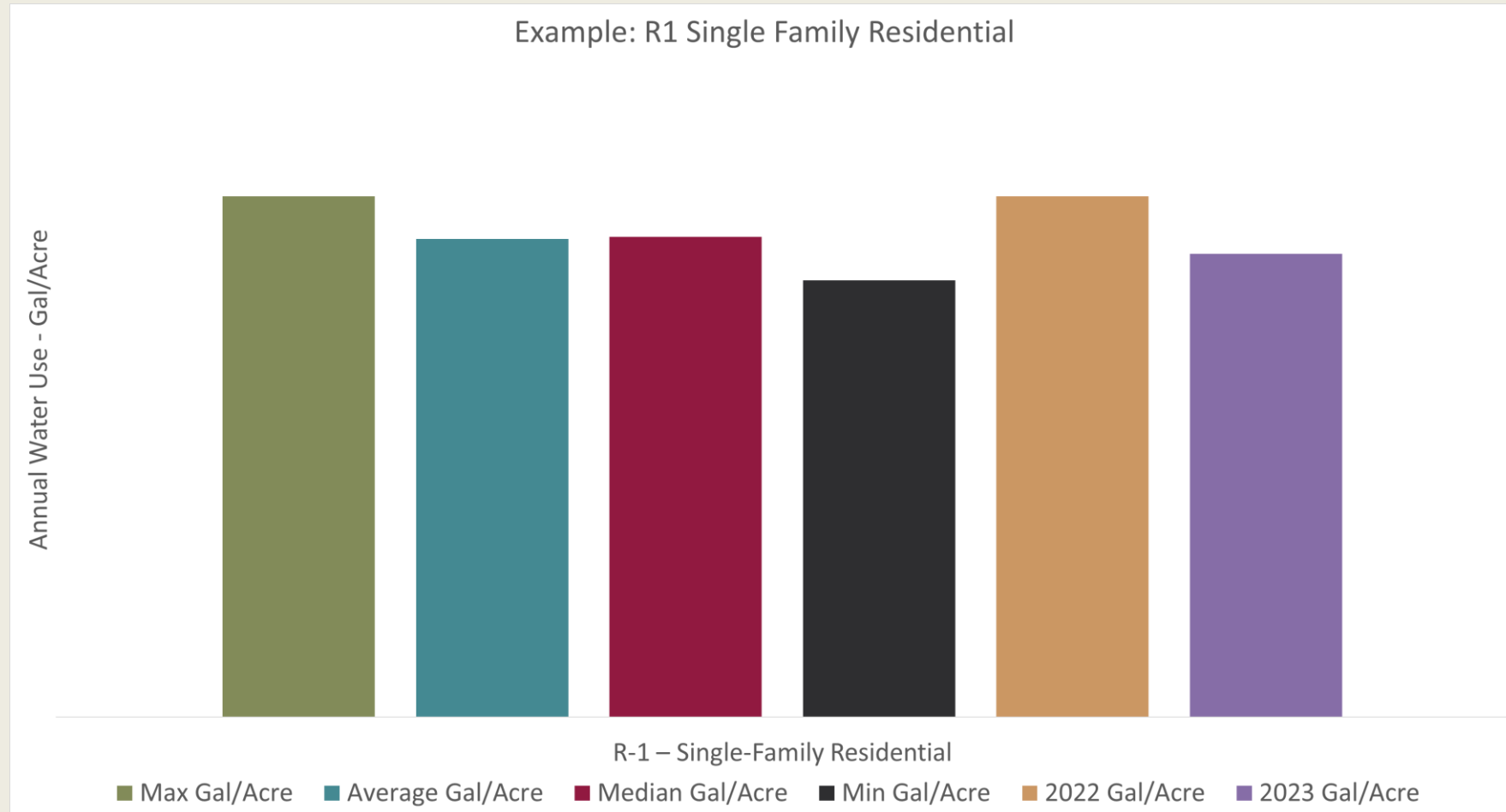
Matching Meters to Zones



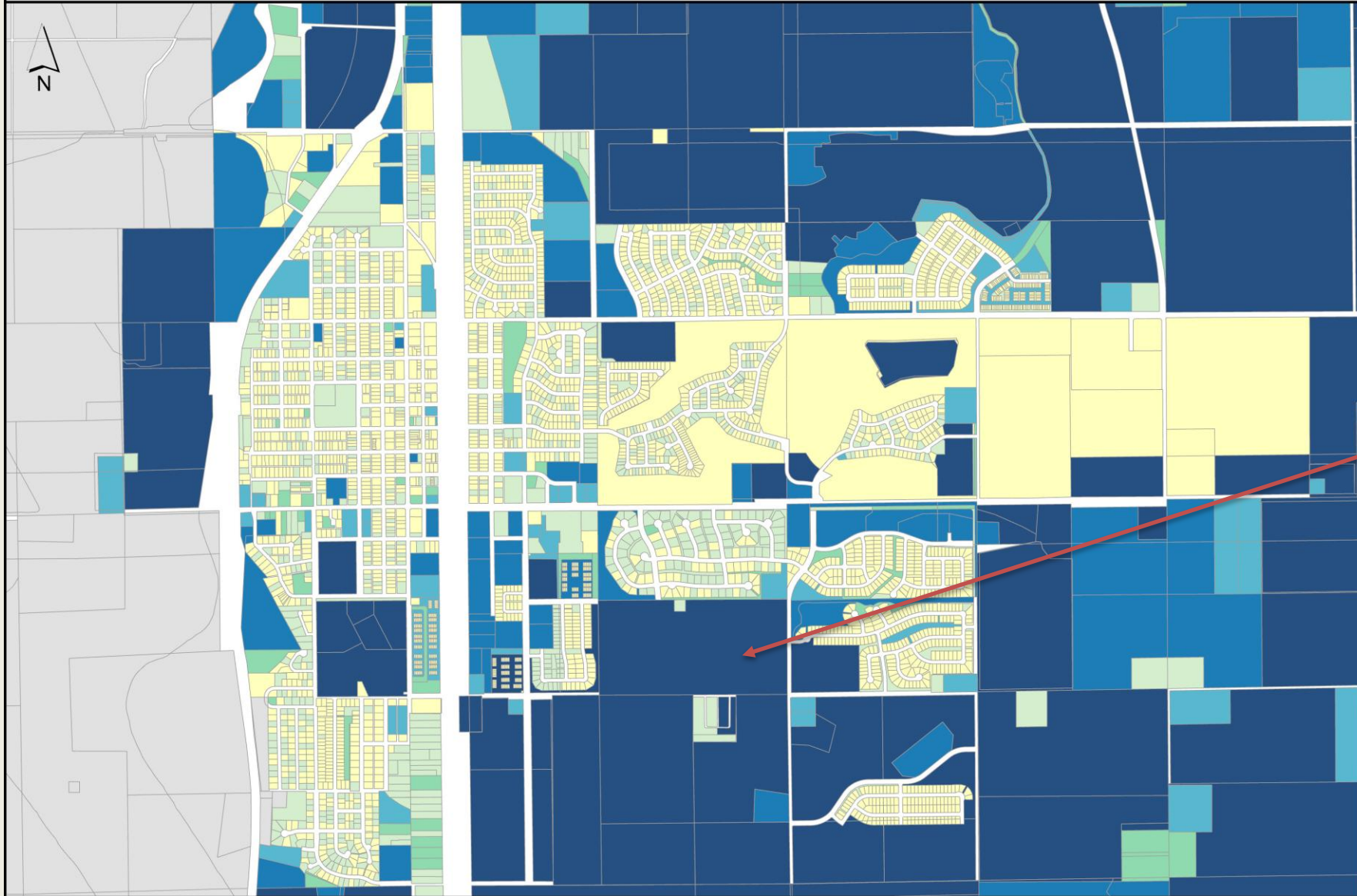
Matching Zones to FLU



Assign Water Use by Zone



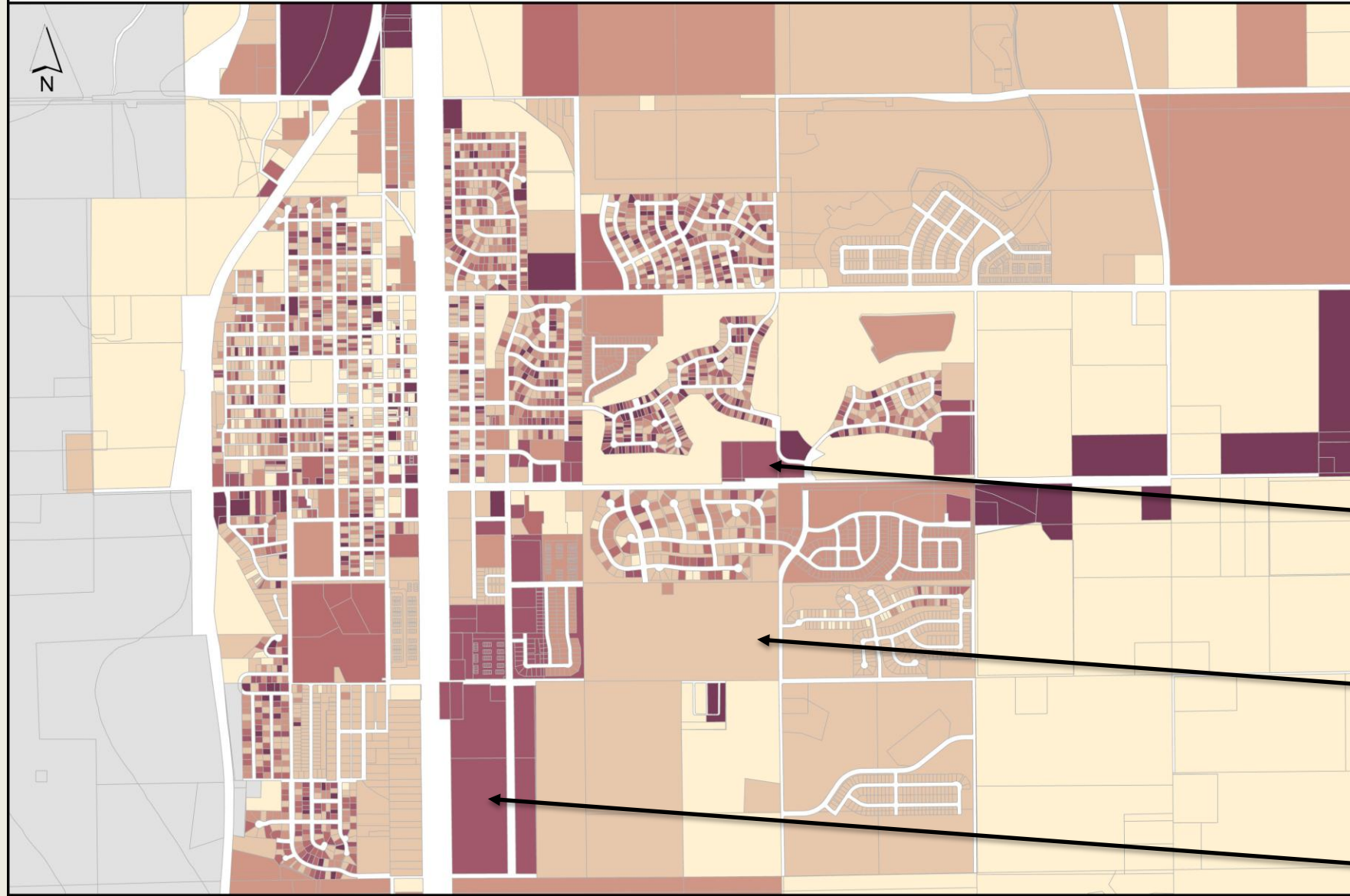
Fort Lupton Water Use by Future Land Use (leveraging 2021 data)



Dark blue =
more estimated
water use (gal)

Single Family
FLU: High
water use b/c
parcel is large

Fort Lupton Water Use by Future Land Use (leveraging 2021 data)



Red= more
estimated water
use (gal/acre)

Multi-family
FLU

Single family
FLU

Commercial
FLU

learn more:
sonoraninstitute.org



Modernizing Arizona Water Company's Data and Workflows

Water Wise Development Coalition Meeting - February 12, 2024

Faith Sternlieb, Associate Director of Engagement

Emily Wiggans, Senior Analyst



CENTER FOR
**GEOSPATIAL
SOLUTIONS**



Internet
of Water
COALITION

Helping organizations on the frontlines of our most complex land, water, and social challenges leverage **data** and **technology** to meet the **pace of change**.

2020

Founded at the Lincoln Institute
of Land Policy

20+

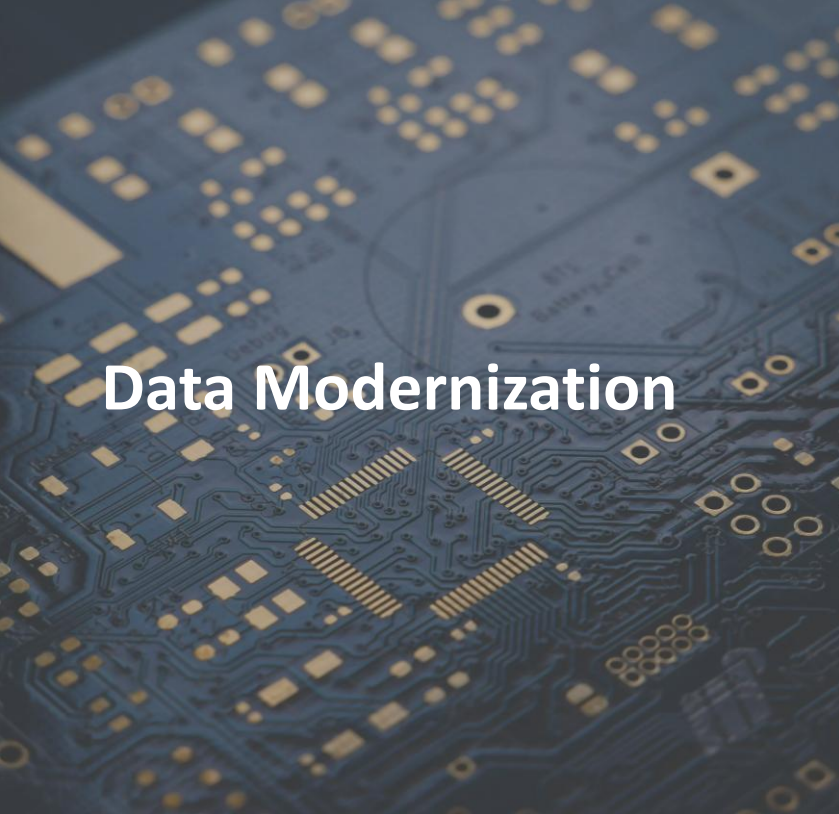
Employees across the
United States

20+

Public and private
collaborations to date



We transform complex, fractured data landscapes into actionable intelligence.



Data Modernization



Data Fusion



Data Storytelling



Solving Challenges

A Brief Arizona Groundwater History

- 1967 – AZ Republic reporter uncovers land swindle scandal
- 1980 – Gov Bruce Babbitt signs Groundwater Management Code to control groundwater depletion
- 1995 – New **Assured Water Supply (AWS)** rules require developers to demonstrate renewable water supplies for 100 years
- 2019 – Revised Pinal groundwater model shows **unmet demand** of 8.1 million AF, 2 million associated with AWS program

Los Angeles Times

CLIMATE & ENVIRONMENT

Water concerns prompt new limits on growth in Arizona



azcentral.

ENVIRONMENT

In Pinal, groundwater insufficient to meet long-term projected demands, officials say

 **Ian James**
Arizona Republic

Published 10:44 a.m. MT Oct. 12, 2019 | Updated 1:56 p.m. MT April 30, 2020



LAW

Building in Arizona with no water

NOVEMBER 9, 2023 · 4:50 PM ET

HEARD ON ALL THINGS CONSIDERED

 **Lauren Sommer**



Casa Grande Mayor Craig McFarland holds a map showing land with and without a water supply. "Casa Grande will continue to grow," he says. "We have to be frugal with the water we have."
Lauren Sommer/NPR

WATER

Rapid growth in Arizona's suburbs bets against an uncertain water supply

'The alternative is something they don't want to think about.'

Sarah Tory
Image credit: Roberto (Bear) Guerra/High Country News
June 1, 2021 | From the *print edition*

High
Country
News

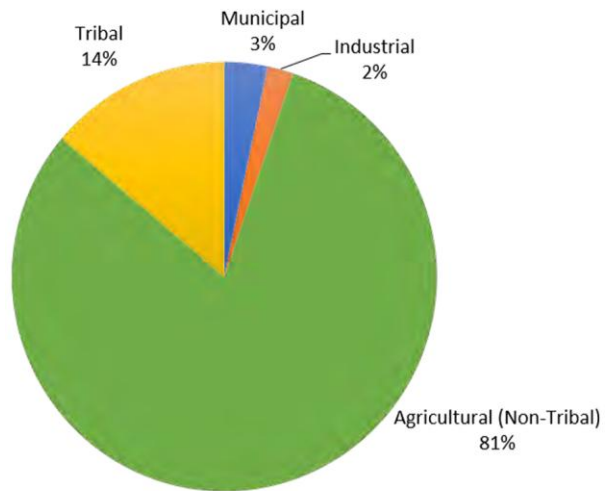


Severe drought and mandatory water cuts are pitting communities against each other in Arizona

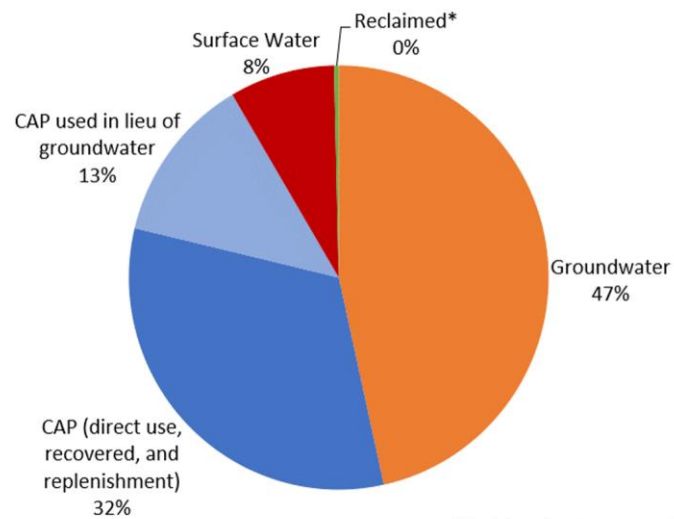
By René Marsh, CNN
⌚ 4 minute read · Published 7:01 AM EDT, Wed March 30, 2022

Pinal County, Arizona

PINAL AMA WATER DEMANDS

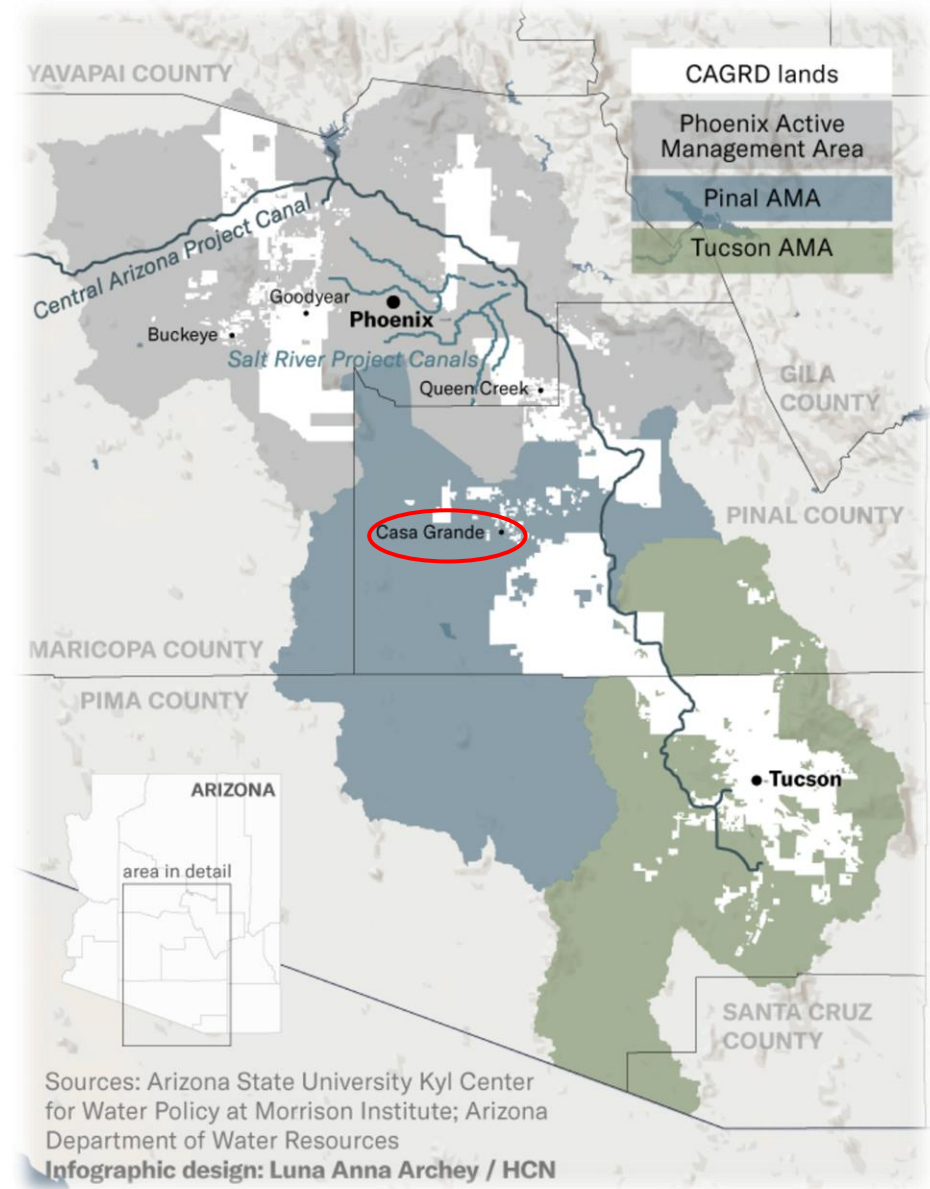


PINAL AMA WATER SUPPLIES



*Reclaimed water accounts for 0.35% of total supplies

Figure 2. Pinal AMA Average Water Demands and Supplies, 2008-2018 (ADWR 2020a)



Key Requirements & Features



**Parcel level data as
smallest unit**



**Common collaboration &
data sharing workspace**



**Permission and data access
configured for each partner**



**Metadata
documentation and
versioning**



**Repeatable,
transparent data
analysis workflows**



**Link land use with
water data**

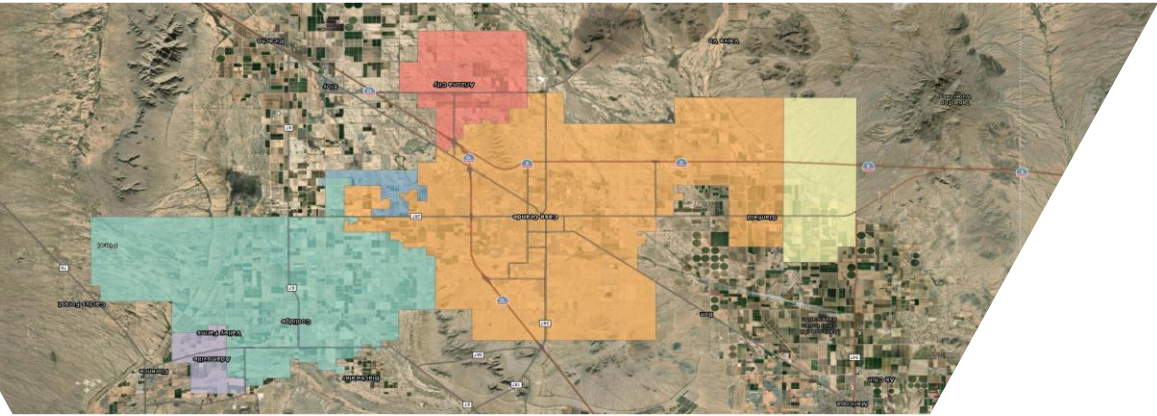


Data visualization



**Informs legal and
policy decisions**

**Utility Sub-regions
(county)**



**Certificate of Assured Water
Supply areas (neighborhoods)**



Parcels and water meters





Outcomes and Use in Policy

Planning for Growth



- Water usage and meter locations
- Sub regions



PINAL COUNTY

- Parcel data
- Permit data



- CAWS certificate information



**CITY OF
CASA GRANDE**
STRONGER UNITED

- Permit data



**MARICOPA
ASSOCIATION of
GOVERNMENTS**

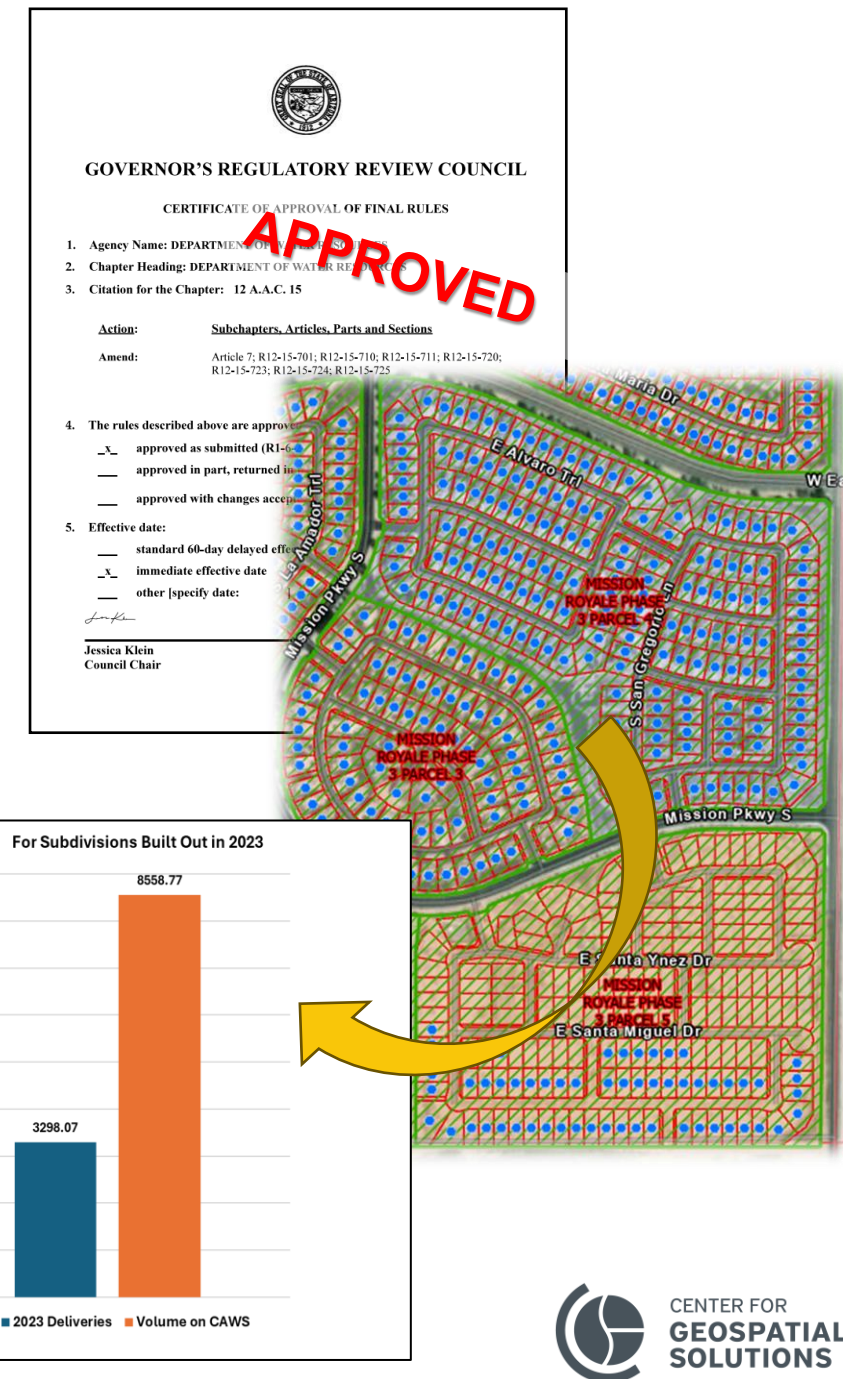
- Population/DU projections

Gives current:

- Total water use in certificate of assured water supply (CAWS) geometries
 - When housing units were built, current count of housing units

An Informed Future

- AWC is seeking an Alternate Designation of Assured Water Supply, ADAWS, based on new policy passed by the state legislature
- Our analysis shows across the region, CAWS water usage is ~1/3rd of what was originally granted
- Proof there is less need for water, with real, on-the-ground metrics and spatial data, allowing for responsible development into the future (through 2040)



Thank You!

Get in touch:
fsternlieb@lincolnst.edu
ewiggans@lincolnst.edu

POLARIS: A Web-Based Software for Integrated Water Supply and Land Use Planning

Mazdak Arabi, PhD

Professor and Borland Chair of Water Resources
Director, One Water Solutions Institute Civil and
Environmental Engineering Colorado State University



COLORADO
Colorado Water
Conservation Board
Department of Natural Resources



Water Wise Development Coalition
Meeting Feb 12, 2025

Polaris Purpose

1. Characterize the relationship between land use activities and water consumption
2. Analyze water consumption by land use and zoning districts, sector (e.g., residential, commercial, industrial), and indoor/outdoor uses





Polaris Purpose

- Forecast water demand for current and future land use, climate scenarios, and conservation scenarios

Colorado's Water Plan – Planning Scenarios

Drivers	A Business as Usual	B Weak Economy	C Cooperative Growth	D Adaptive Innovation	E Hot Growth
A. Economy/Population					
B. Urban Land use	 No change in density	 No change in density	 Higher density	 Higher density	 Lower density
C. Climate Status/Water Supply	 Same as 20th century observed	 Same as 20th century observed	 Between hot and dry and 20th century observed	 Hot and dry	 Hot and dry



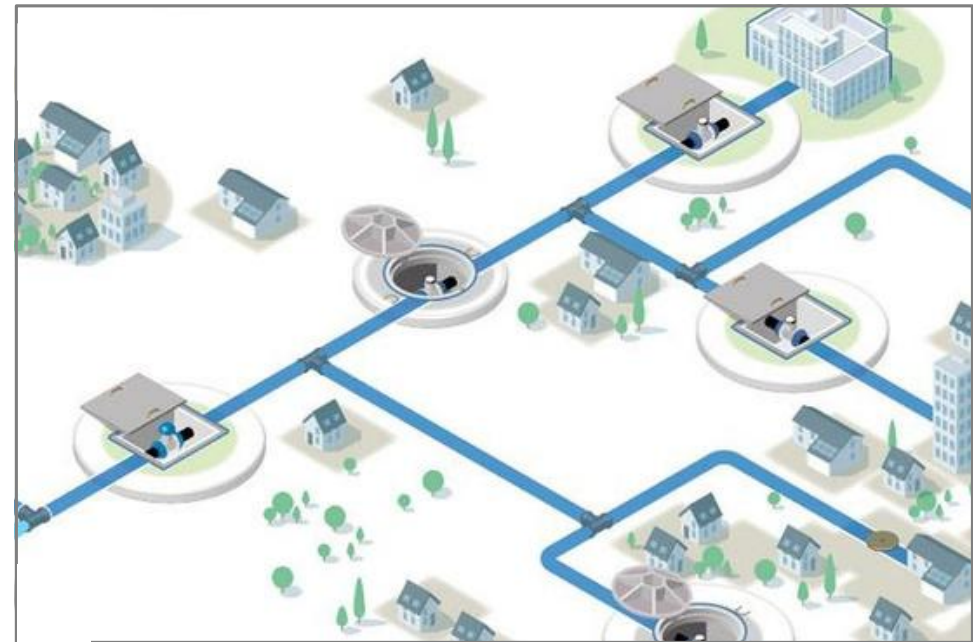
Polaris Purpose

4. Over a range of current and future scenarios, assess the reliability and resilience of:

water supply systems



water distributions networks





Water Consumption & Land Use Metrics



- Gallons per capita-day (GPCD)
- Gallons per household per day (GPHD)
- Million gallons per acre
- Million gallons per meter



- Population Density
- Housing Density
- Household Occupancy
- Open, Green, and Irrigated Space
- GDP, Employment



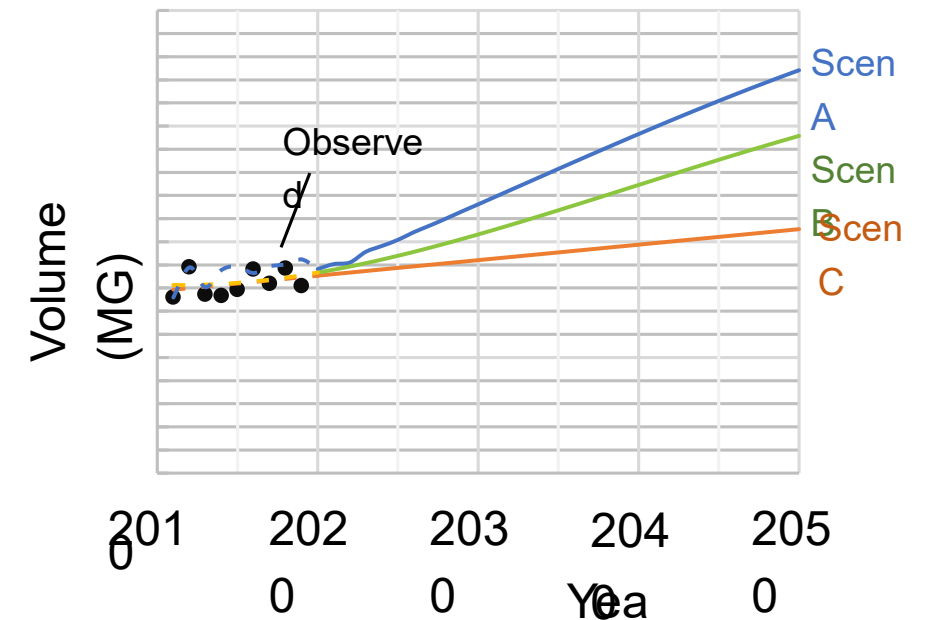
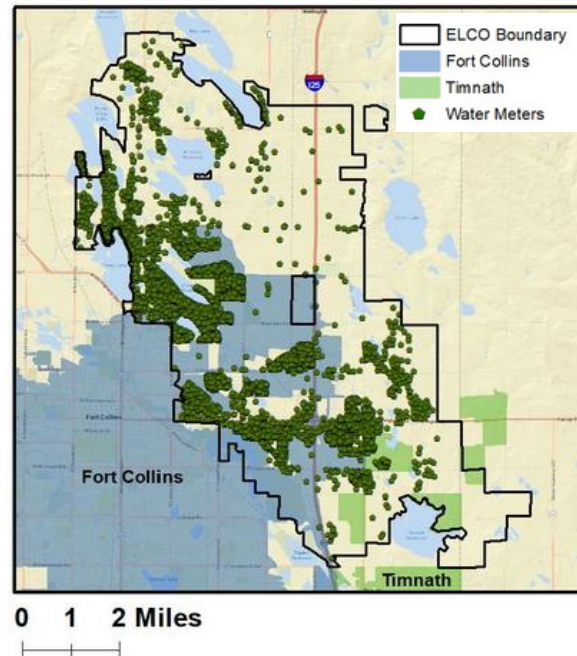
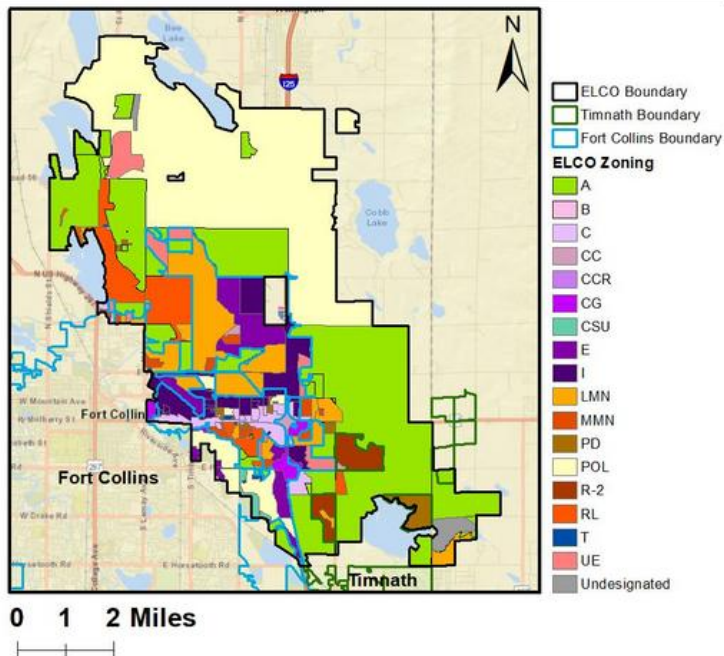


Polaris WORKFLOW

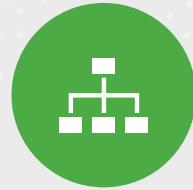
STEP 1:
Setup the
project

STEP 2:
Analyze historical
water use

STEP 3:
Evaluate
scenarios



POLARIS : SCENARIO PLANNING



**Comprehensive
plans**



**Water
efficiency
plans**



**Sub-
area
plans**



**Transit
oriented plans**



**Growth
area plans**



**Water
supply
master
plans**

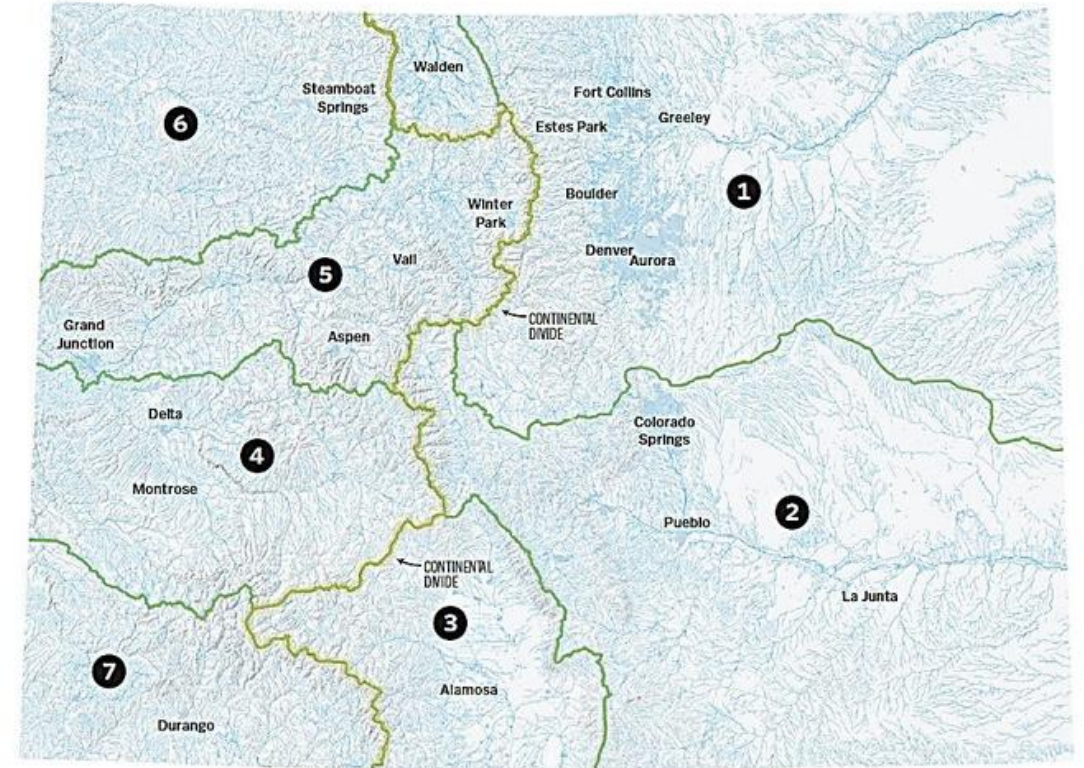


Community Partners in Colorado

Water Division Division 3 Division 4 Division 2
Division 7 Division 4 Division 1 Division 1 Division
1 Division 5 **San Juan Water Conservancy**
District Division 7 Division 6 Division 1

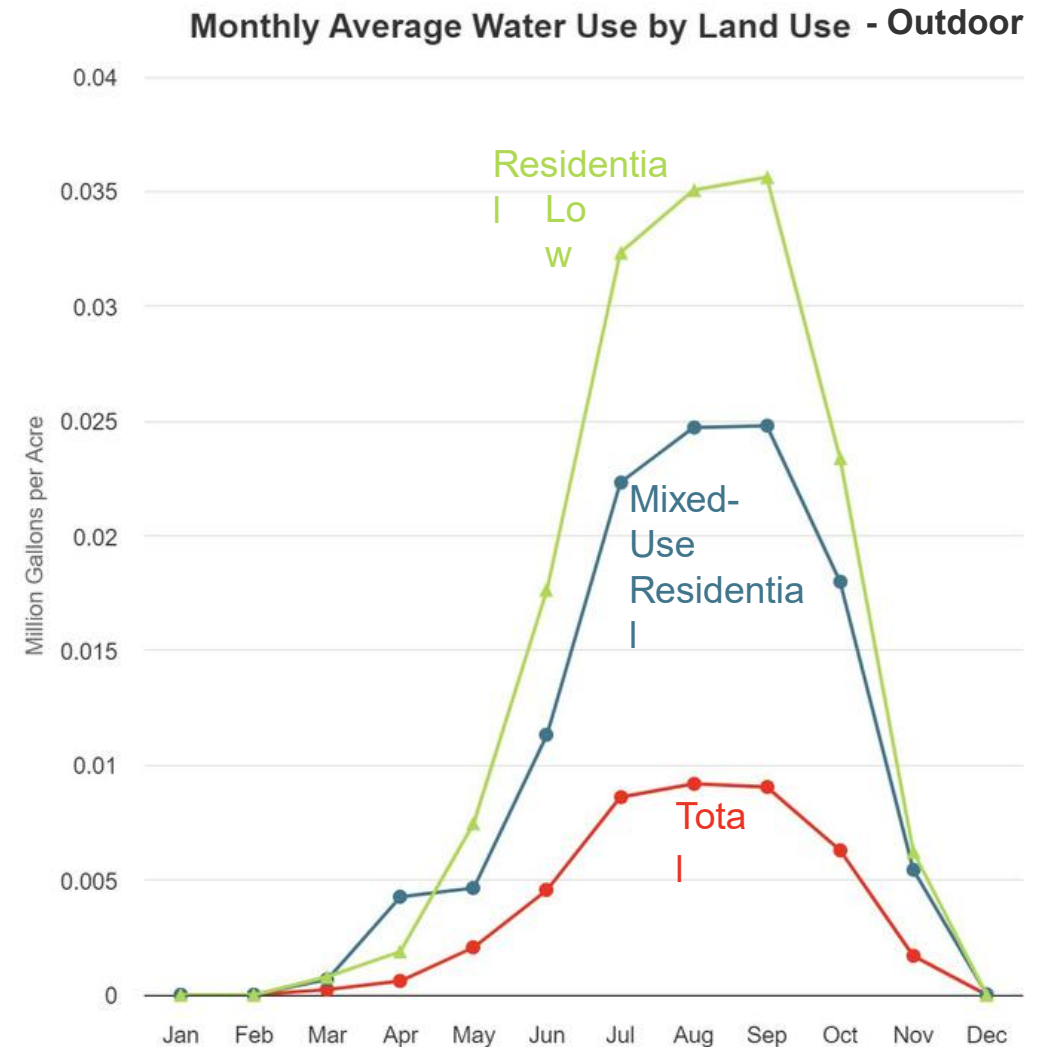
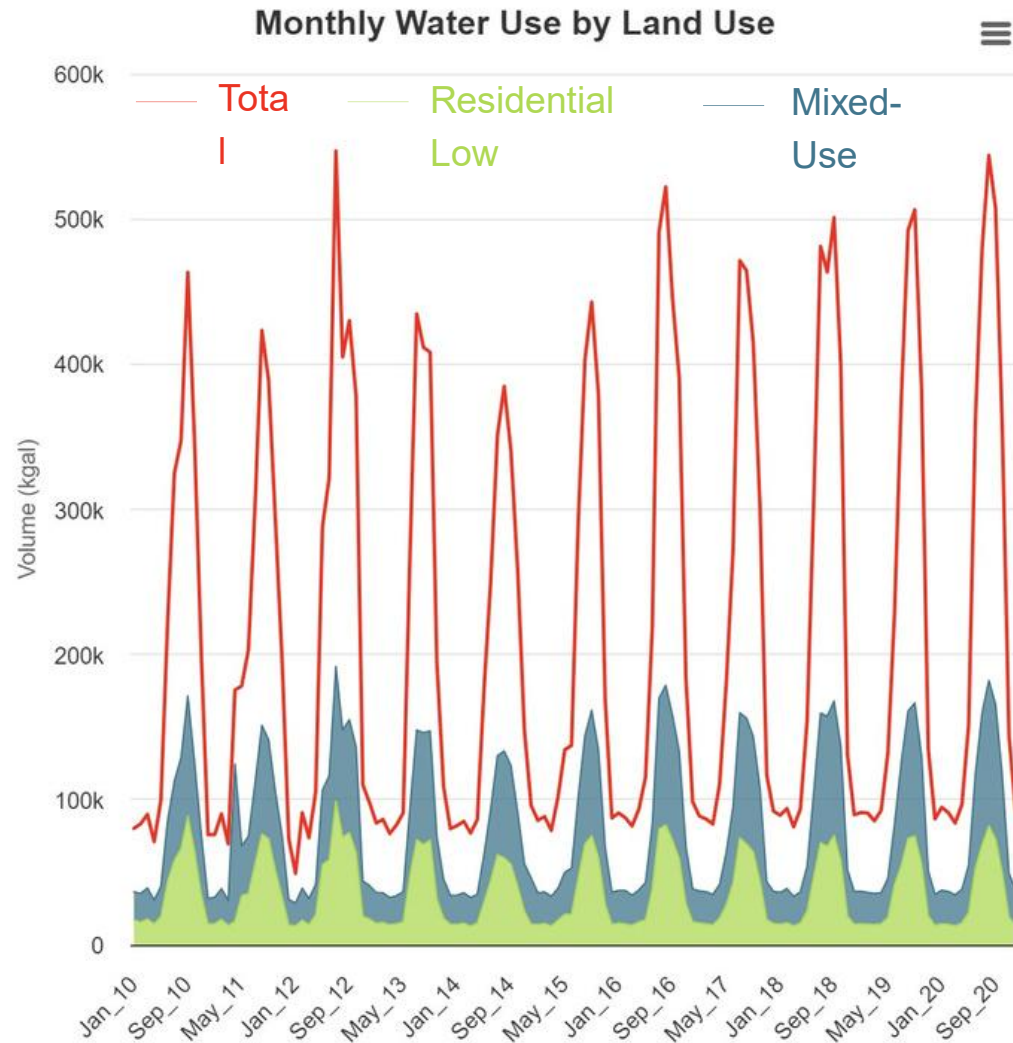
Community/ Organization Alamosa Collbran
Colorado Springs Cortez Crawford Denver Water East
Larimer County Water District Ft Collins Loveland
Water District Grand Junction

Steamboat
Springs
Westminster





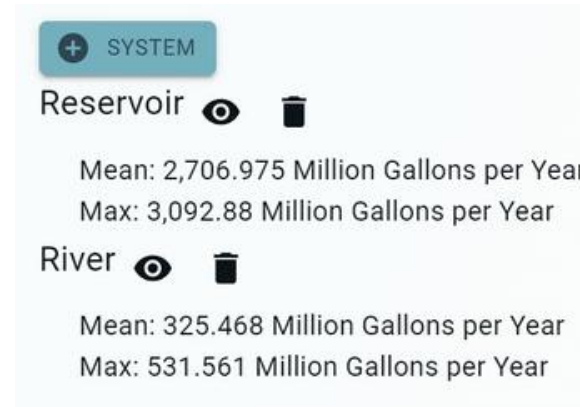
Historical Water Consumption Module





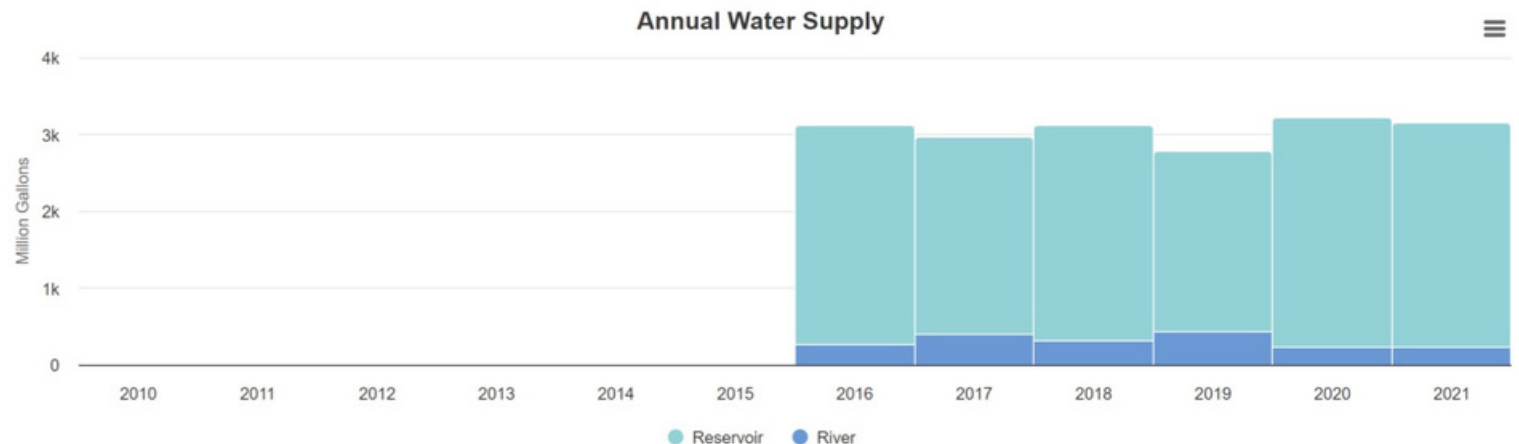
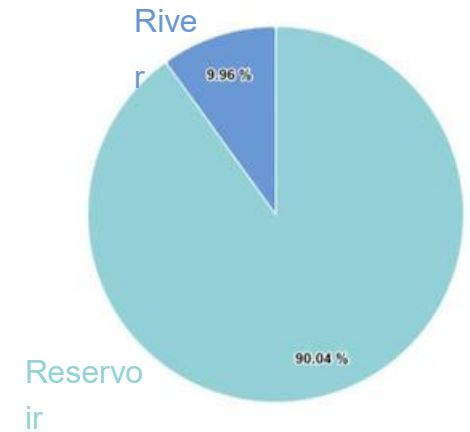
Historical Water Withdrawals Module

- Supply system
- Monthly or annual withdrawals
- Water supply diversity index



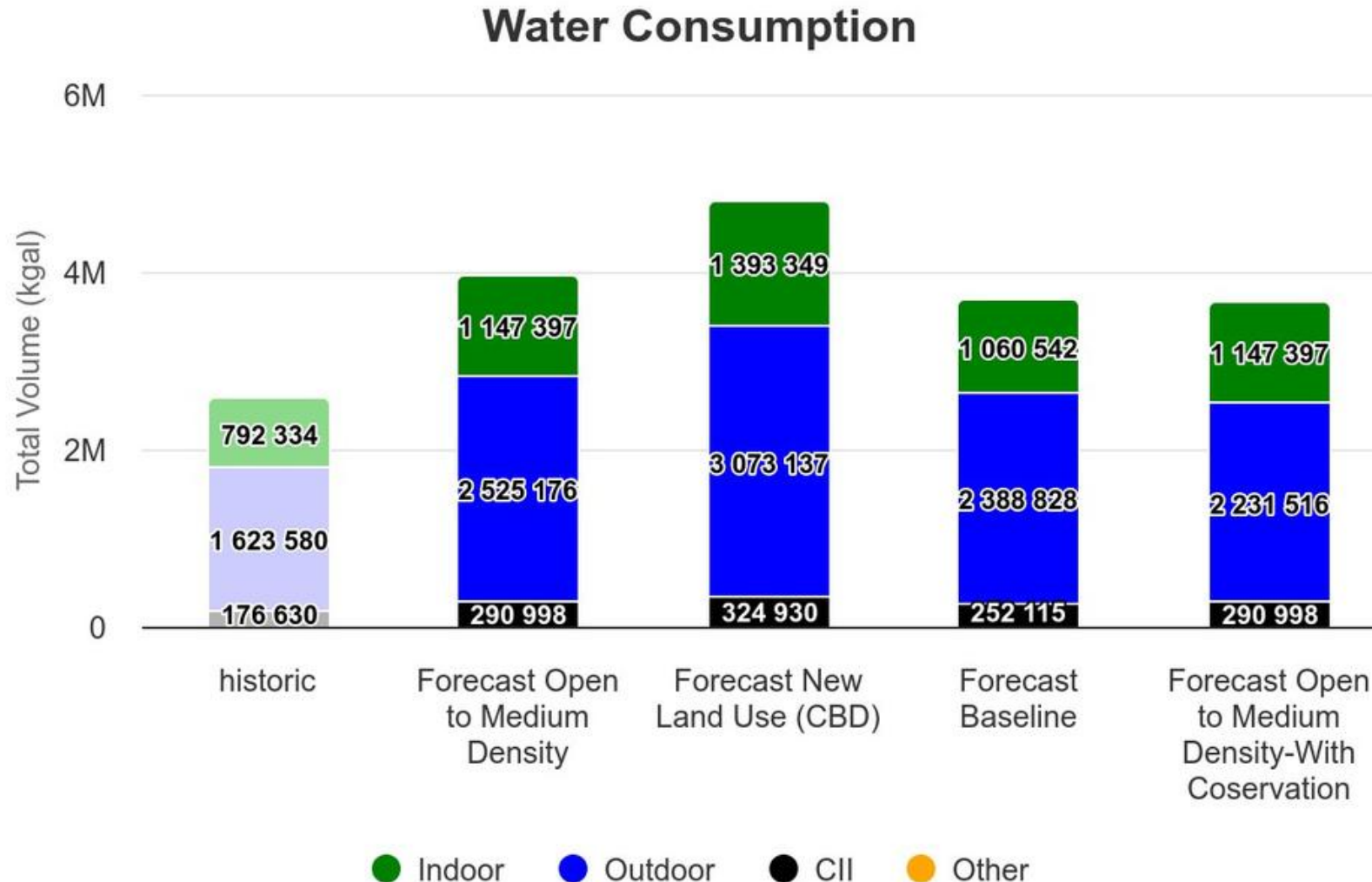
Water Supply Diversity Index = 0.325

Average Annual Water Supply (3058.76 Million Gallons)



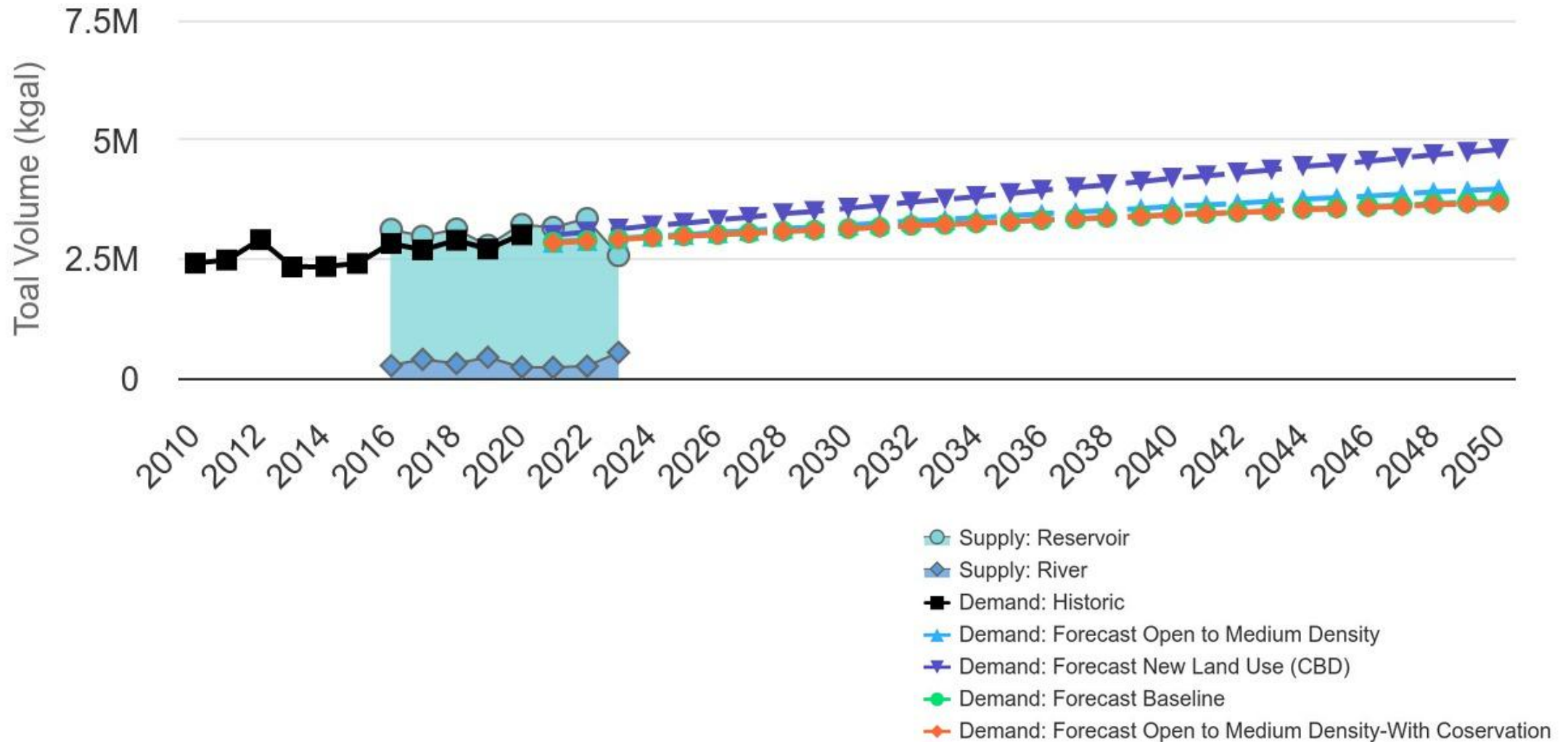


Scenario Assessment and Comparison Module

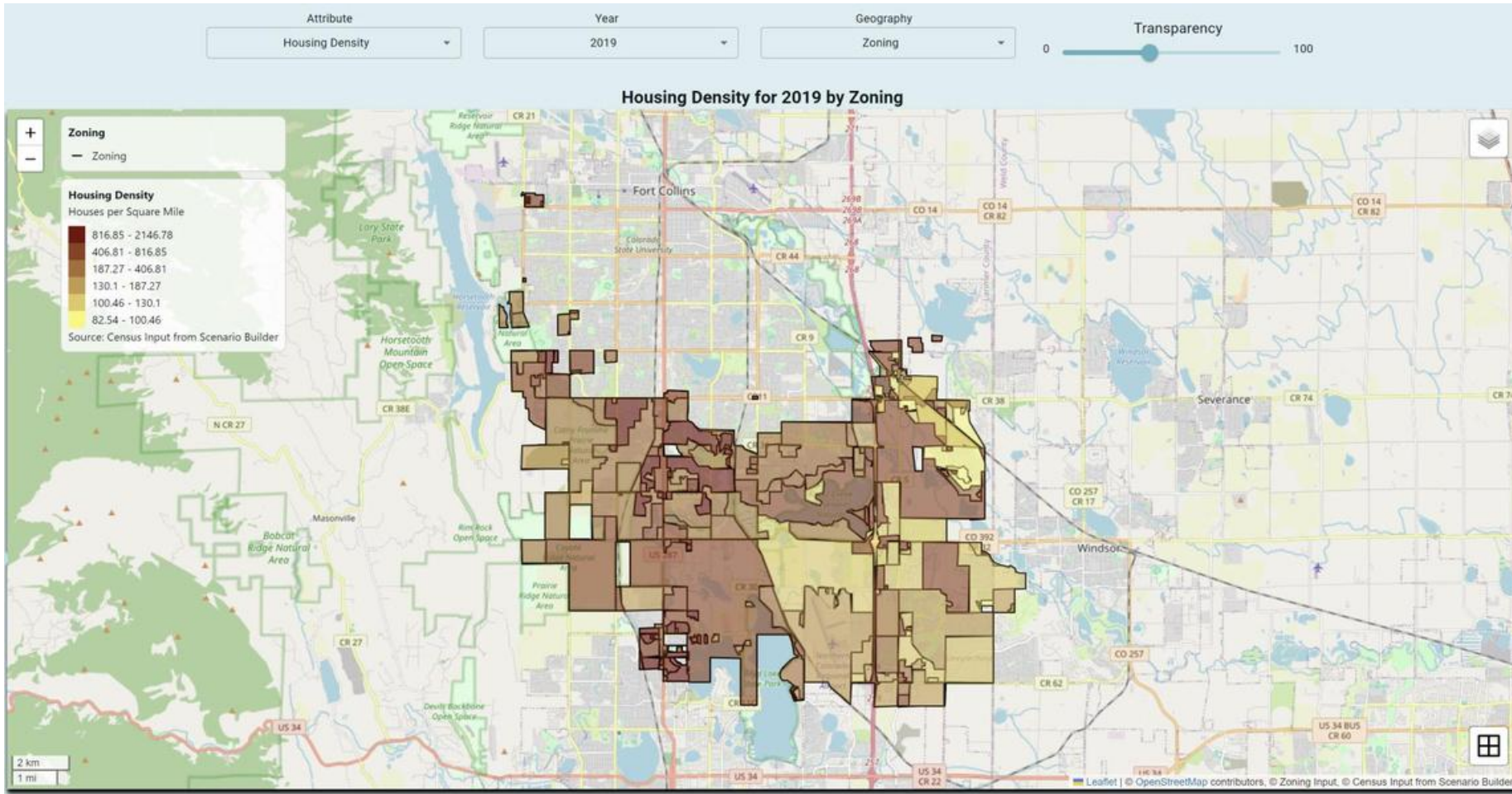




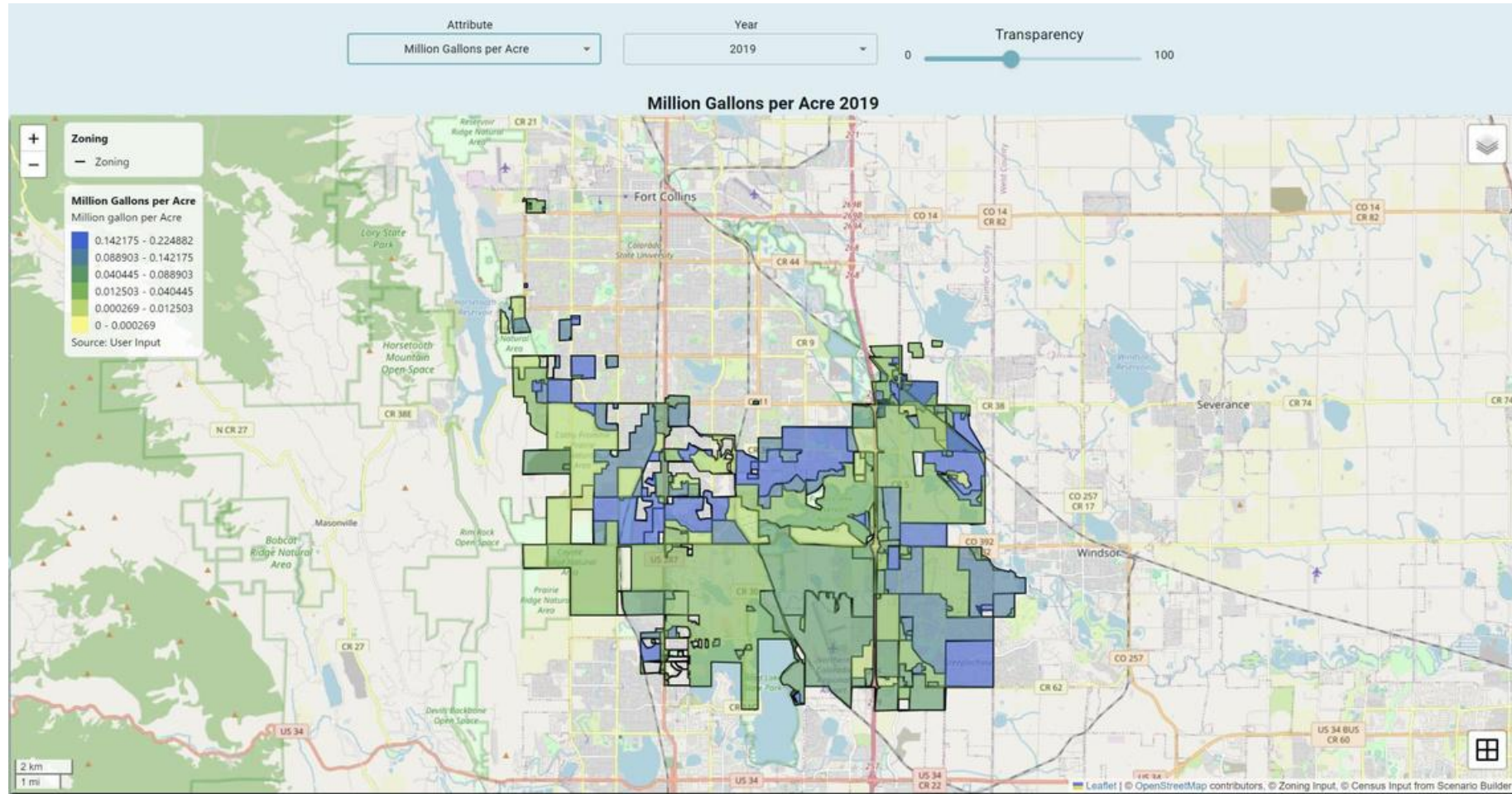
Scenario Assessment and Comparison Module



Mapping Components

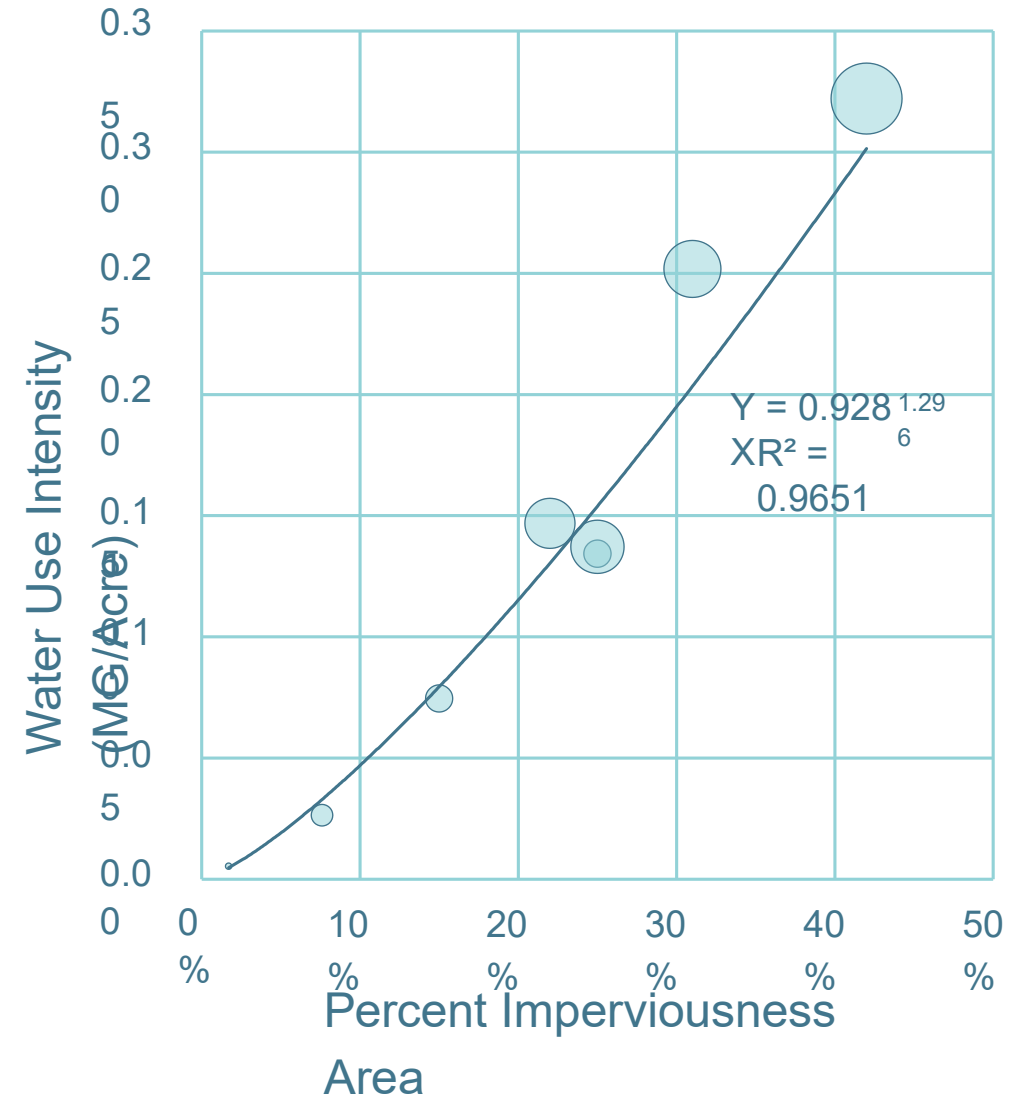


Mapping Components



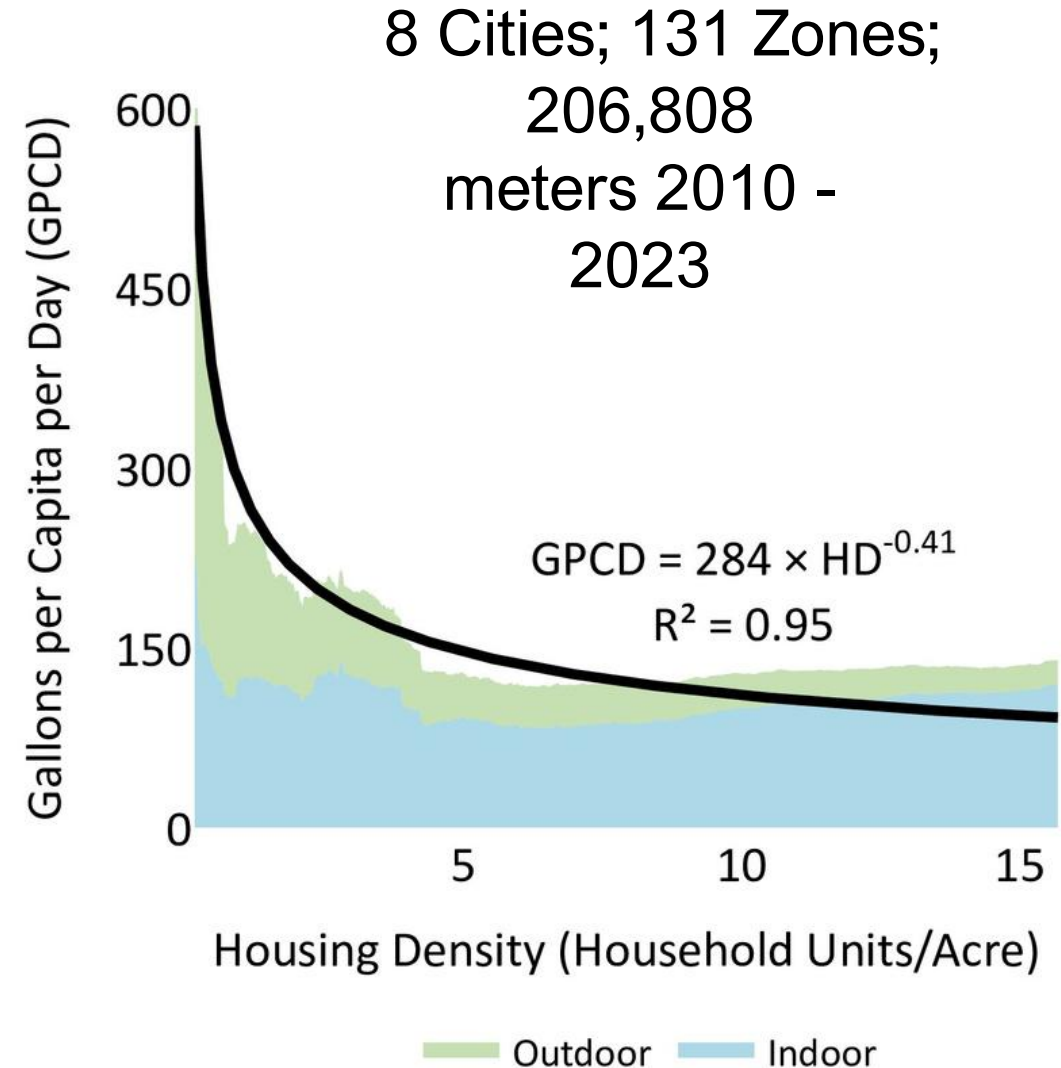
Regional Water Consumption Analysis

- City level analysis Assessments
- by generalized land use Scenario
- analysis for regional and statewide housing policy and zoning regulations



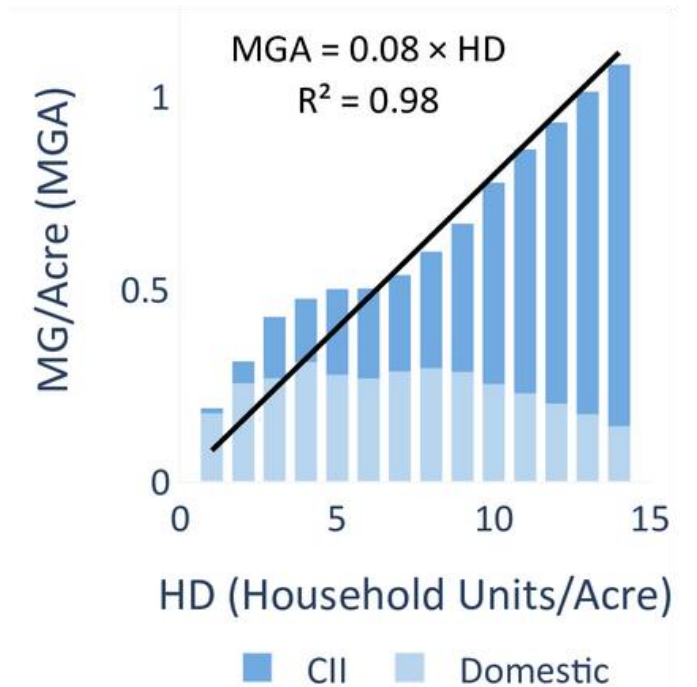
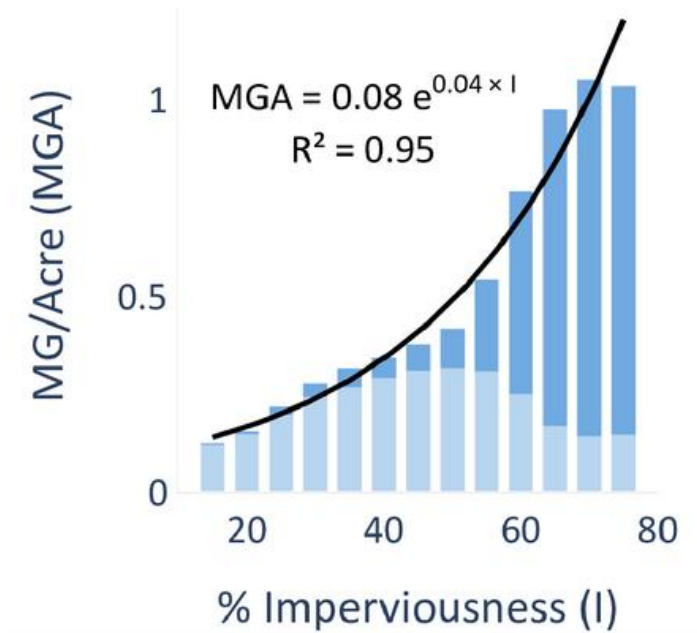
Residential Water Consumption

- Outdoor water consumption intensity in GPCD decreases from 65% to 15% of the total use as housing density increases.
- Water consumption intensity in GPCD decreases in zones with higher housing density, mainly, due to reduction in outdoor water use.

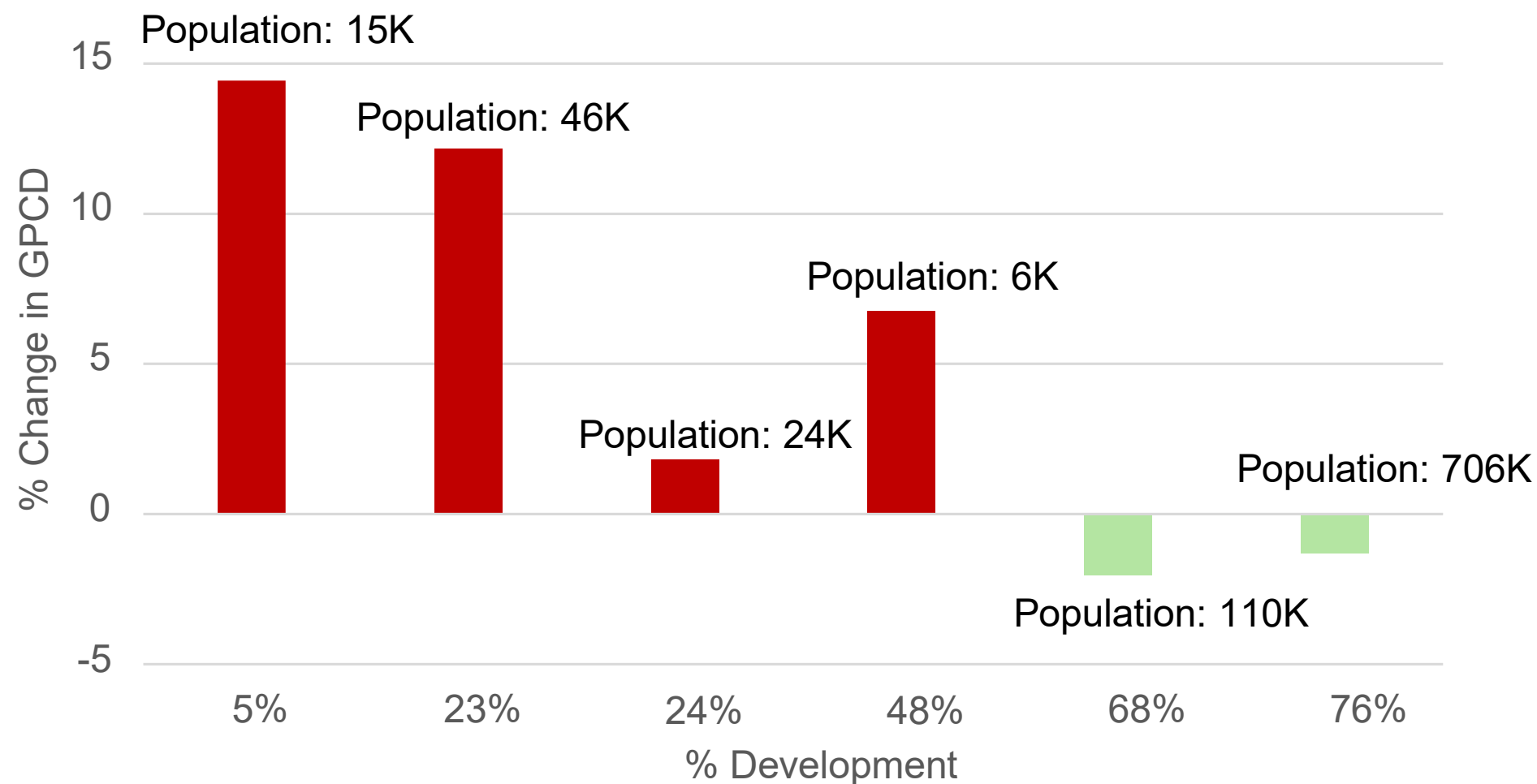


Effects of Urban Development Patterns on Water Consumption

- Total water consumption per unit of area (MG/Acre) in residential zones increases exponentially with urban development.
- Total water consumption (MG/Acre) increases linearly with housing density.
- The exponential increase is primarily driven by CII uses.



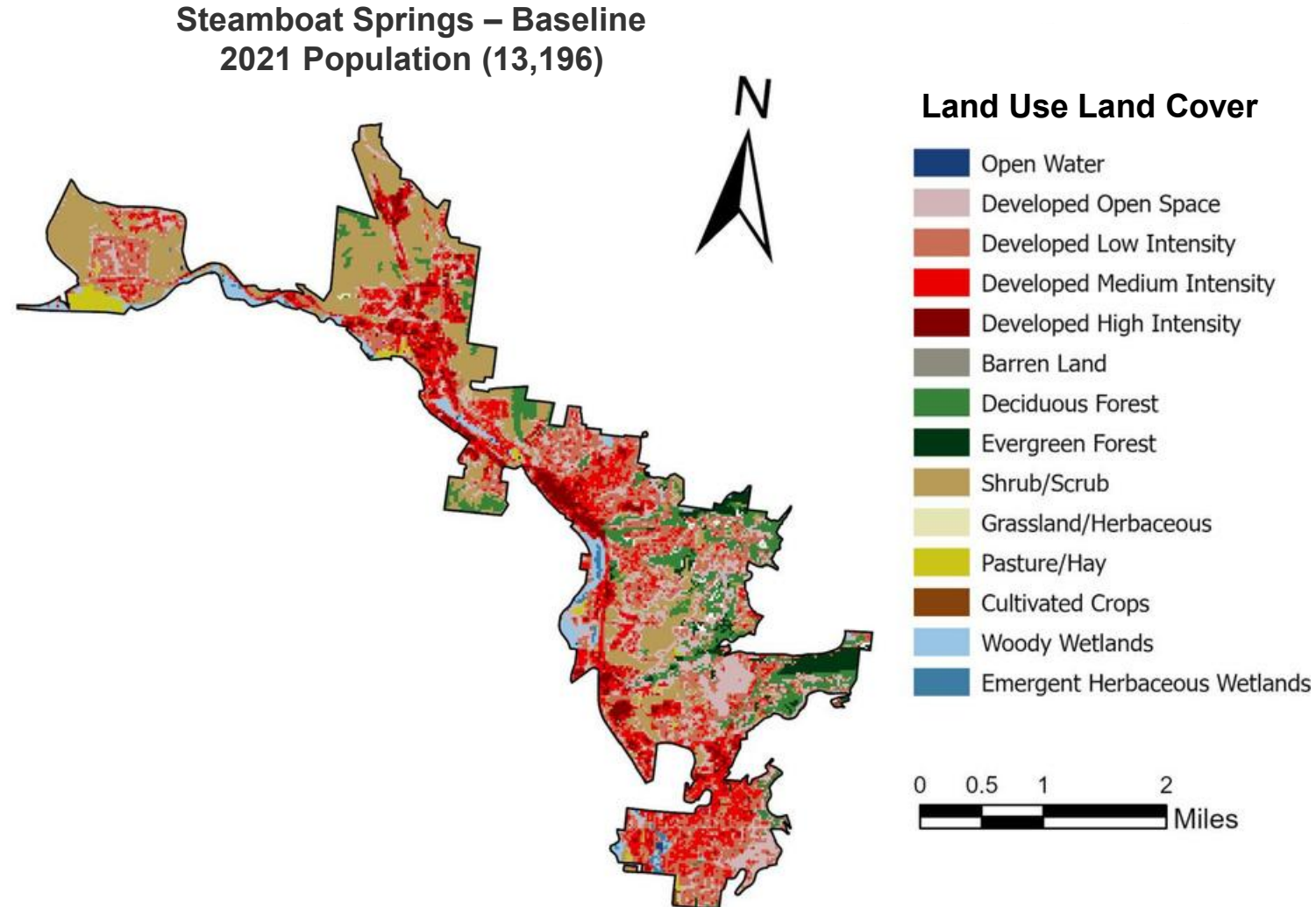
Over the past decade, more developed cities have achieved reductions in water conservation, while water use intensity (in GPCD) in developing areas continues to increase.





Land Use Evolution

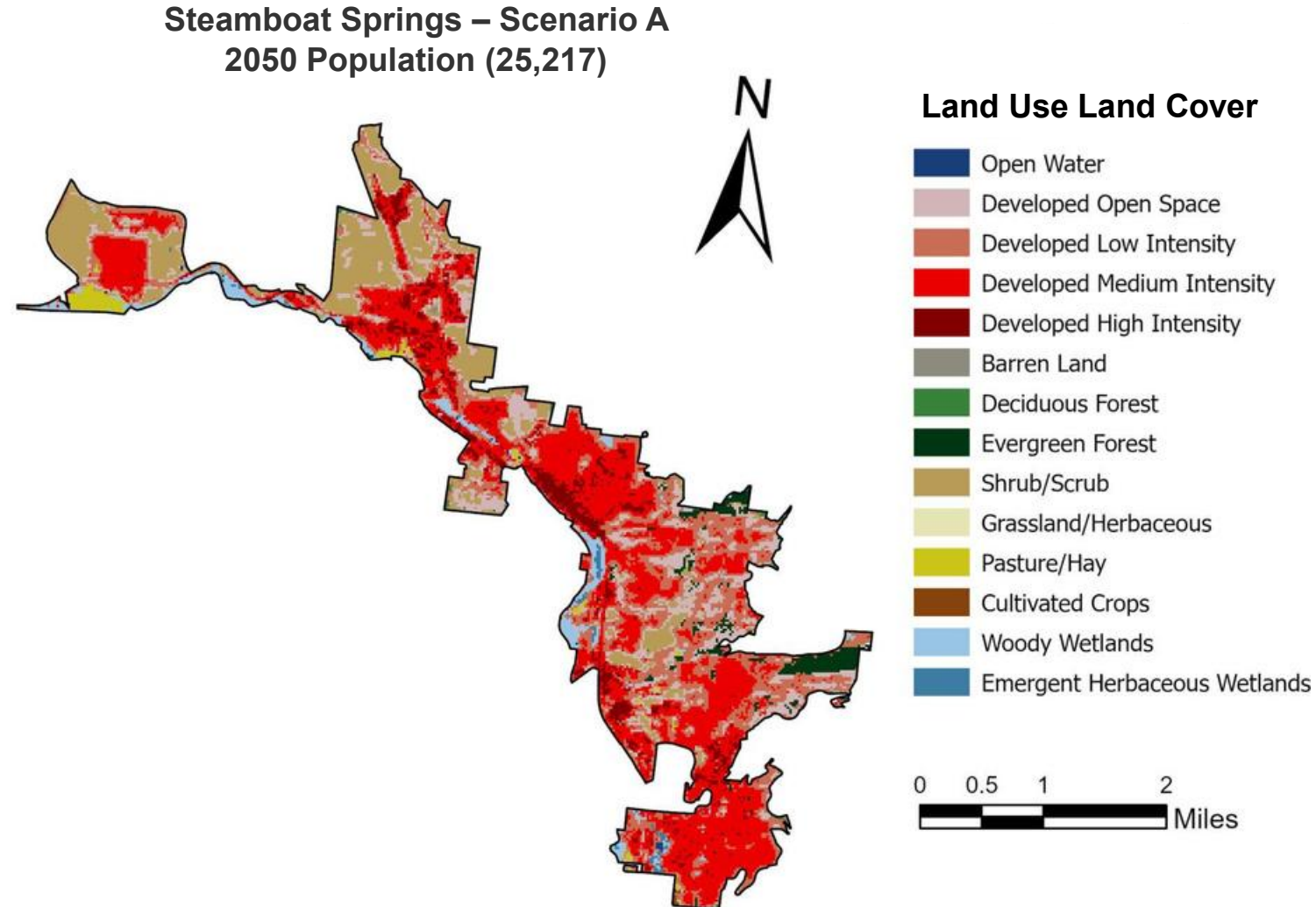
Using advanced machine learning, a land use evolution model is used to identify likely future land use land cover in the assessment area.





Land Use Evolution

Using advanced machine learning, a land use evolution model is used to identify likely future land use land cover in the assessment area.





Water Wise Development Software at OWSI

POLARIS

Integrated land use and water supply planning from neighborhood to regional scales

Net Zero Water

Conservation, end-use efficiency, and reuse strategies from building to regional scales

CLASIC

Stormwater infrastructure decisions on extent of green, gray, and hybrid green-gray practices from neighborhood to regional scales

Thank you.

- **Mazdak Arabi**

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biological integrity
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Resources & Updates

- We started resource lists for water wise landscapes, policies, and affordability
- Land use decision making post *Sackett v. EPA*?
- Alliance for Water Efficiency opportunities
- Growing Water Smart opportunities
- ULI Resilience Summit in Denver





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RESILIENCE SUMMIT



2025 RESILIENCE SUMMIT

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CALL FOR ABSTRACTS FOR AWE'S 2025 SYMPOSIUM

AWE is seeking actionable research, practical resources, and hands-on learning.

Core topics include:

- Advanced Metering & Data
- Affordability & Efficiency
- Outdoor Water Use
- Energy-Water Nexus
- Commercial & Industrial Water Use
- Climate Change & Water
- Water Loss Prevention
- Education & Outreach
- ...and more!



**OPEN CALL
FOR ABSTRACTS**

Deadline: Friday,
March 7, 2025

JOIN US IN CHICAGO, AUGUST 6-8, 2025
FOR THE 3RD ANNUAL SYMPOSIUM

[Submit your abstract here.](#)

TAKE AWE'S SURVEY ON PEAK WATER DEMAND MANAGEMENT STRATEGIES

- **WRF #5265:** Evaluating Changes in Peak Water Demand and How That May Affect the Choice, Design, Management, and Evaluation of Demand Management Strategies
- About the survey:
 - Seeking responses from water utilities to provide broader qualitative context to our quantitative case studies
 - Complete in 12-15 minutes
 - Only aggregated or anonymized data will be published
- **Complete by March 7th!**



[Take the survey here.](#)

WATERSENSE SUPPORT LETTER

- The letter is in response to an Executive Order signed by President Trump titled [*Unleashing American Energy*](#). Among many things, the Executive Order directs agency heads to identify strategies to change policies, within 30 days, that limit the “freedom to choose from a variety of goods and appliances.”
- AWE has drafted this support letter to facilitate our discussions with EPA, and we are asking you to join us signing it.
- **If you are interested in signing on and supporting WaterSense, please email AWE's Director of Policy, Andrew Morris (andrew@a4we.org)**

[Sign On Letter to Support WaterSense - Alliance for Water Efficiency](#)

WaterNow Updates

Project Accelerator Deadline: Friday, February 14, 2025

<https://waternow.org/our-work/our-work-projects/project-accelerator/>

Colorado State Revolving Fund Technical Assistance Dashboard is Live!

<https://tapin.waternow.org/colorado-state-revolving-fund-technical-assistance/>

Mark Your Calendars! Emerging Leaders Award Ceremony: June 11, 2025, Denver

<https://waternow.org/emerging-leader-awards/>

Questions? Email Victoria Arling at va@waternow.org

WATERNOW ALLIANCE

Programming Brainstorm

Let us know what you want for coalition meetings!

Cohort Programming Agenda	Subject Brainstorm
Jan/Feb/March 2025	Water reuse (Water Reuse Foundation, Pacific Institute)
April/May/June 2025	One Water Approach + land use (US Water Alliance, Denver One Water, Tucson)
July/Aug/Sept 2025	Colorado Water Wise guidebook on best practices (Colorado WaterWise, Brendle Group, Peter Mayer, Victoria, Lindsay)



THANK YOU FOR JOINING US!

You can reach me at Marianne.Eppig@uli.org