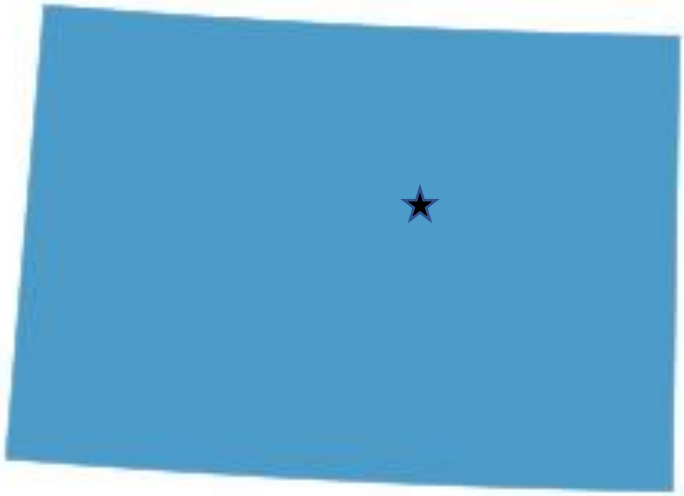


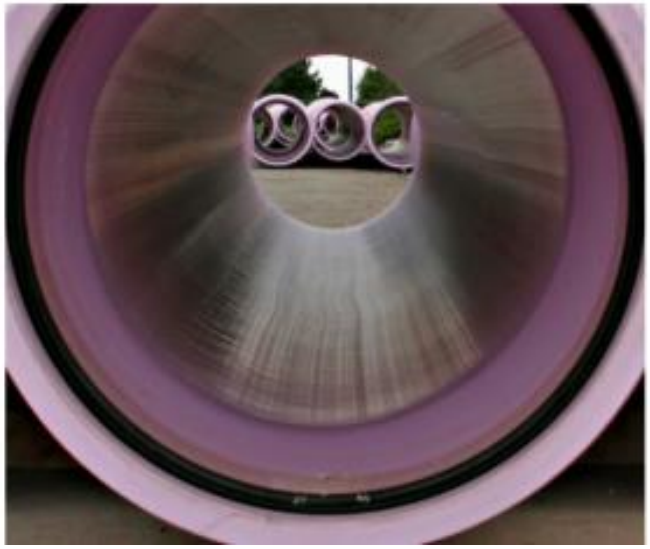
The Status of Reuse in Colorado

September 6, 2017

Brenley McKenna – President, WRCO
Laura Belanger – WRA
John Rehring – Carollo Engineers

Agenda - Water Reuse in Colorado

- WateReuse Colorado – Who We Are
- What is Water Reuse
- Increasing Reuse Opportunities
- Direct Potable Reuse
- Water Energy Nexus



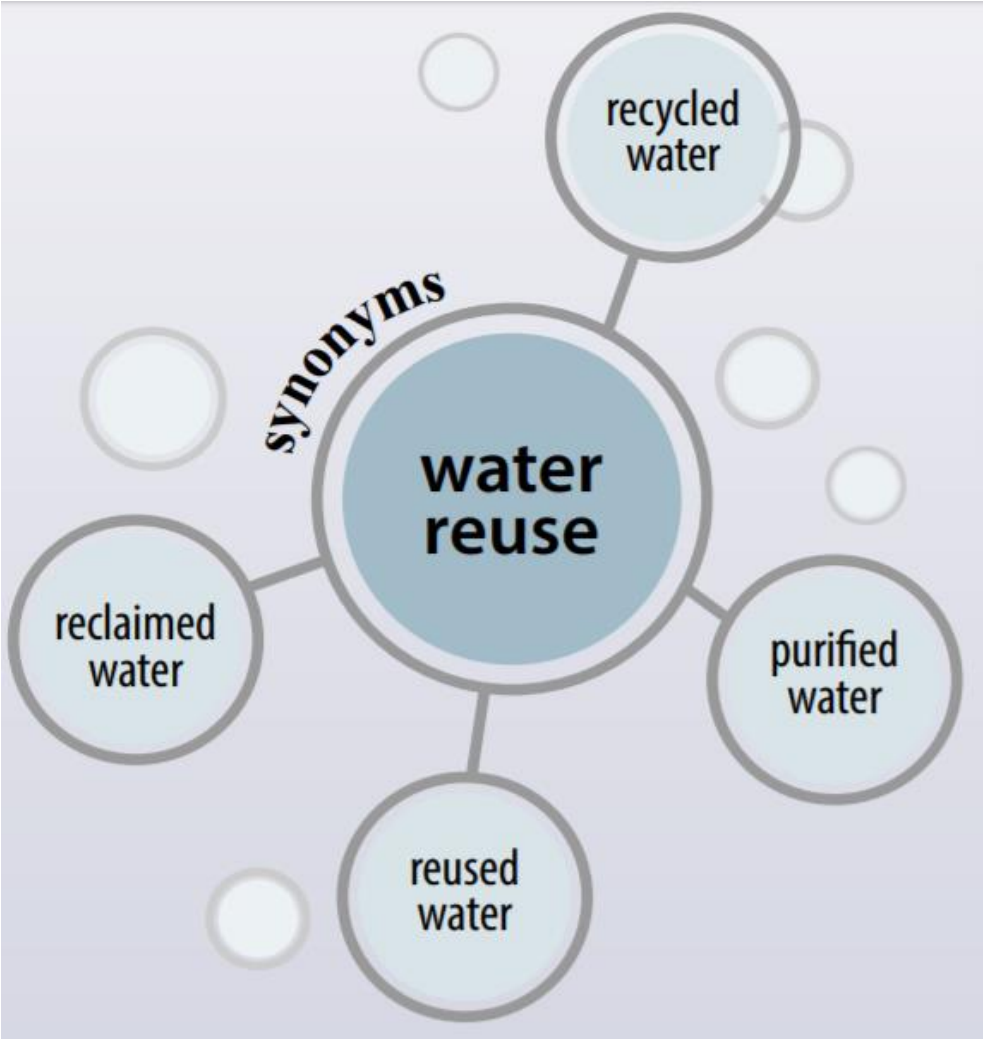
WATEREUSE COLORADO

Mission

The primary objectives of WateReuse Colorado include supporting the mission of the WateReuse Association, advocating for legislation and regulations which facilitate appropriate water reuse, promoting safe and effective reuse throughout the state, and improving public understanding of water reclamation.

What is Water Reuse?

Recycled water is treated domestic wastewater that is used more than once before is passes back into the water cycle.



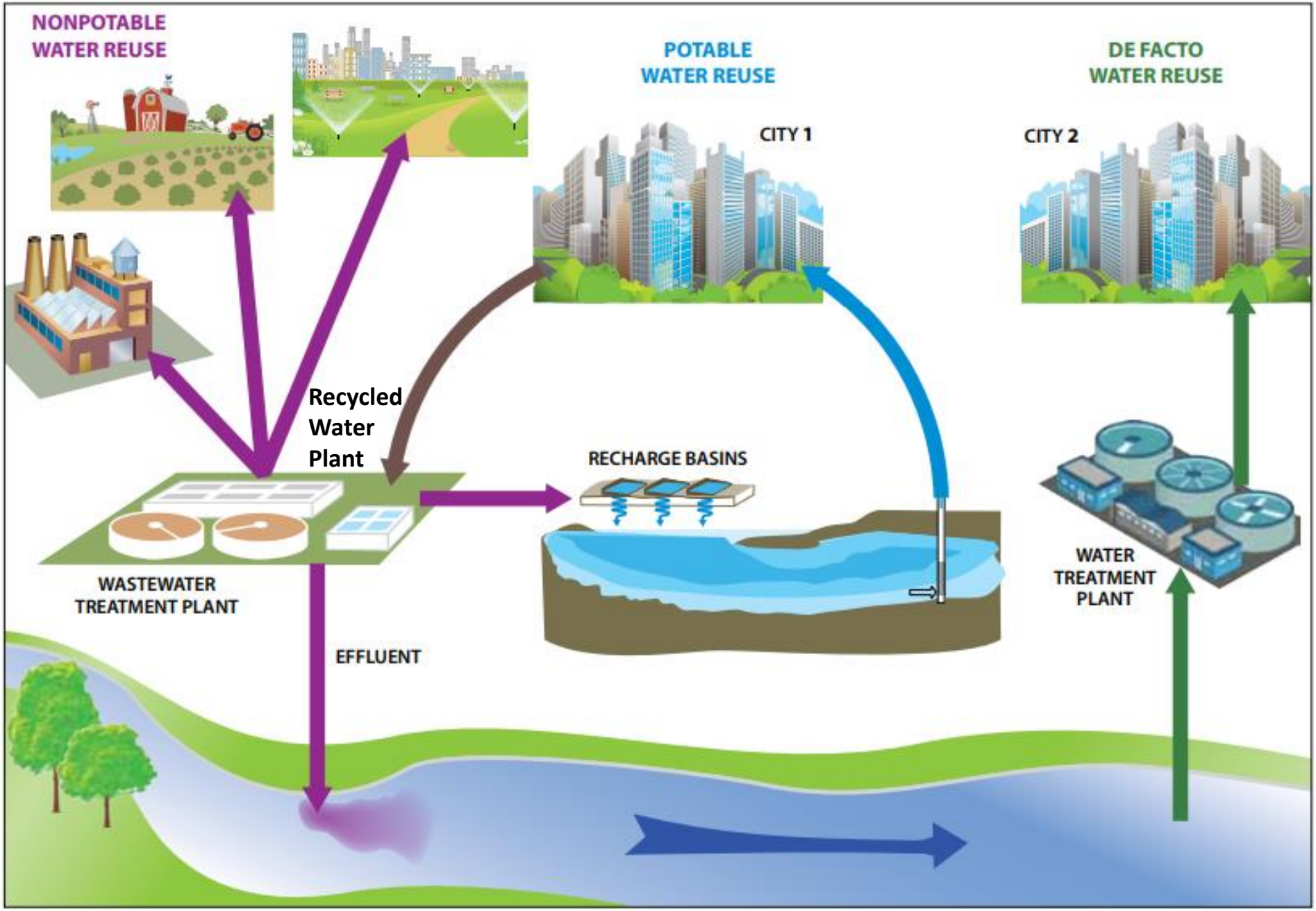
Types of Water Reuse

- **Nonpotable Reuse** – refers to reclaimed water that is not used for drinking, but is safe to use for irrigation, industrial uses, or other non-drinking water purposes.

- **Potable Reuse** – refers to recycled water that you can drink. The reclaimed water is purified sufficiently to meet or exceed federal and state drinking water standards and is safe for human consumption.

  - **Indirect Potable Reuse** – water is blended with other environmental systems such as a river, reservoir, or groundwater basin before the water is reused.
  - **Direct Potable Reuse** – water is distributed directly into a potable water supply distribution system

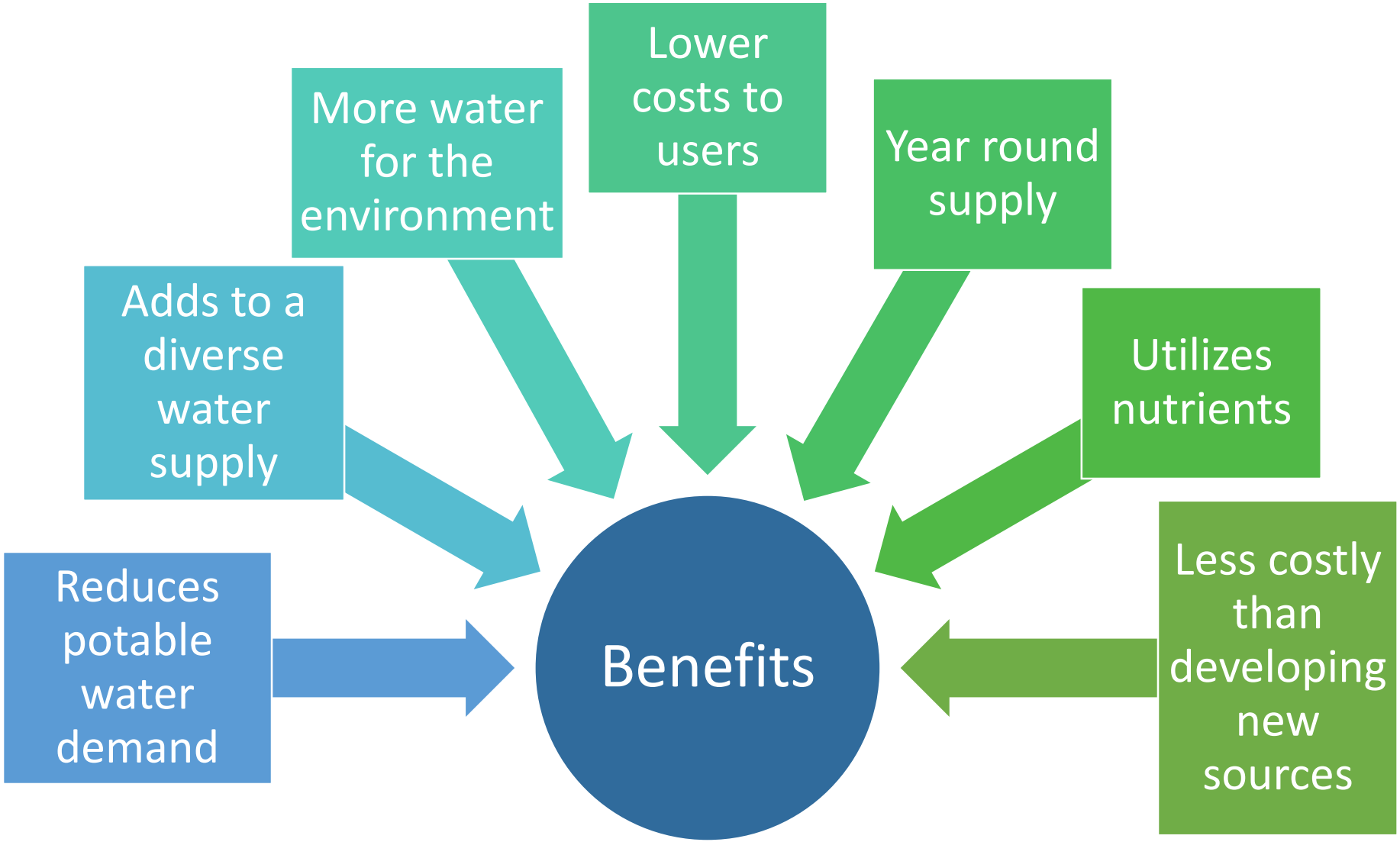
- **De-Facto Reuse** – occurs when water intakes draw raw water supplies downstream from discharges of clean water from wastewater treatment plants.

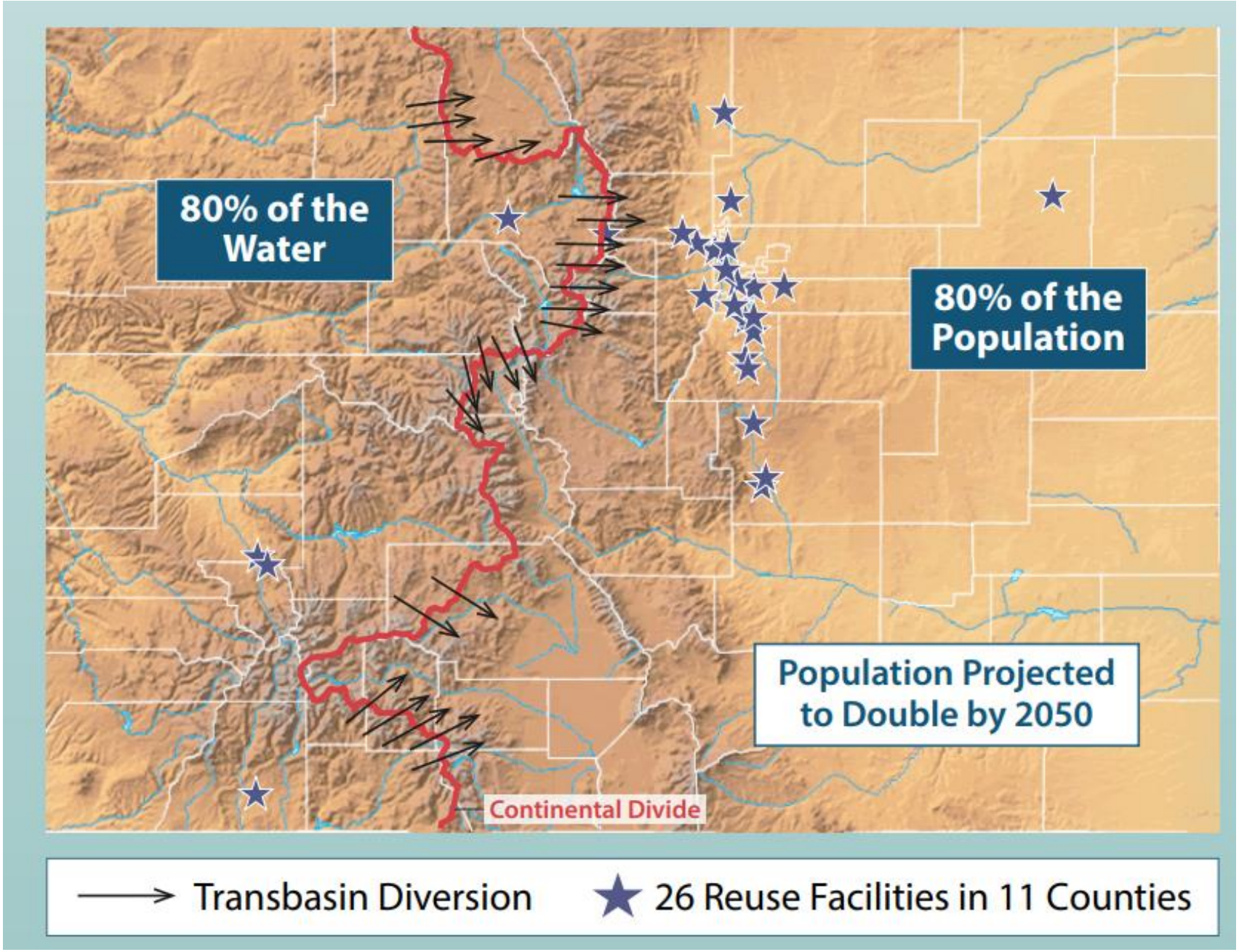

NONPOTABLE
WATER REUSE
POTABLE
WATER REUSE
DE FACTO
WATER REUSE
CITY 1
CITY 2
Recycled
Water
Plant
RECHARGE BASINS
WASTEWATER
TREATMENT PLANT
WATER
TREATMENT
PLANT
EFFLUENT

Reuse in Colorado

History	• Water reuse has been practiced for over 50 years in Colorado.
Places	• Denver, Aurora, and Colorado Springs are among the 26 cities reusing water.
Water Rights	• Only existing reusable water rights can be utilized in a reuse program.
Water Quality	• Treatment can be tailored to meet the water quality needs of the intended use.
Users	• Commercial, industrial, and municipal users range from power plants to irrigation.

Benefits of Reusing Water




80% of the Water
80% of the Population
Population Projected to Double by 2050
Continental Divide
Transbasin Diversion
26 Reuse Facilities in 11 Counties

Questions?

Brenley McKenna

bmckenna@waterrf.org

303.347.6188

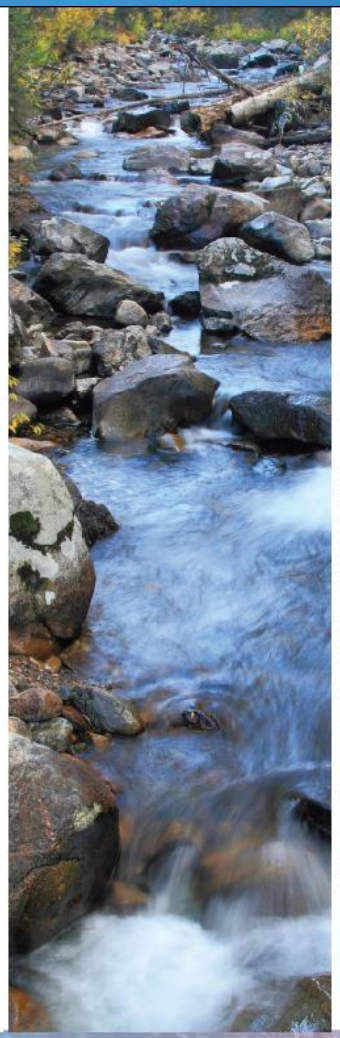
https://watereuse.org/sections/watereuse-colorado/

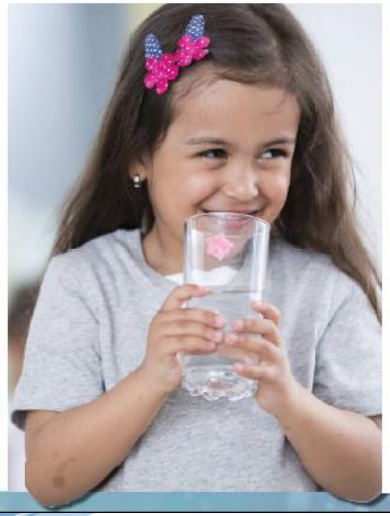
Reuse and Colorado's Future

- Increasing Opportunities

Laura Belanger, P.E.
Western Resource Advocates





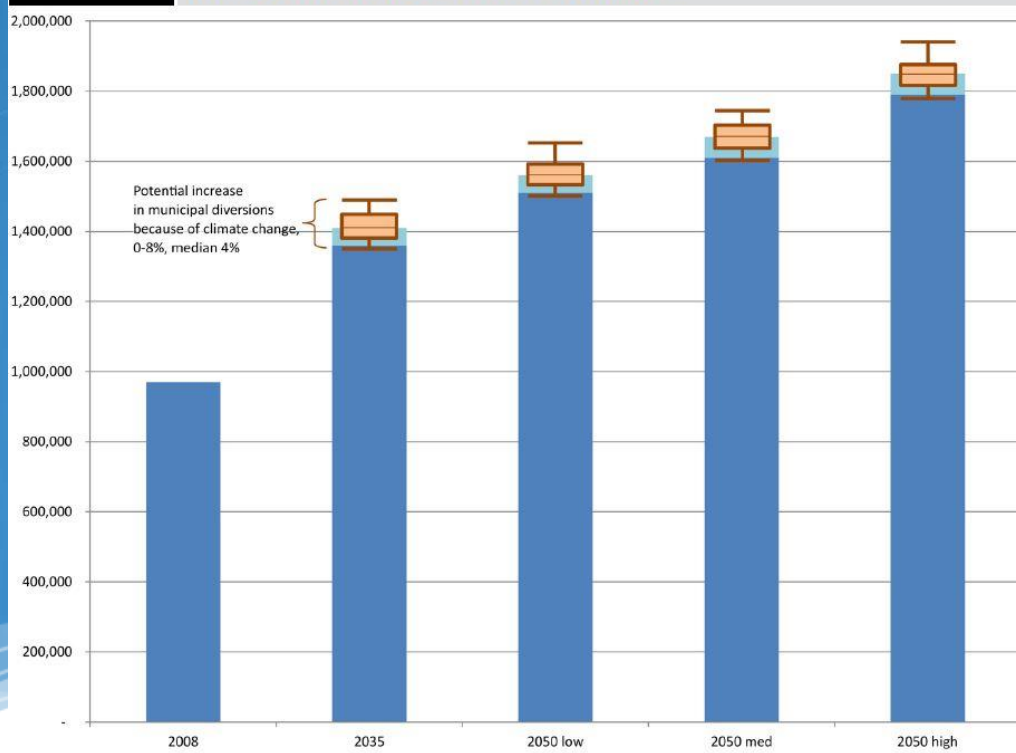




Important Role Reuse Will Play

Colorado's Water Plan:

- Colorado' s population projected to ~double by 2050
- 2050 annual M&I supply-demand gap that could be as high as 560,000 acre-feet

Need a diverse set of water supply & demand management strategies – <u>Including **reuse**</u>



Significant Statewide Support for Increasing Reuse

Colorado's Water Plan:

- "Water conservation activities and water **reuse** will play an important role in balancing the need for additional water supply with strategies to lessen that need."
- "Widespread development of **potable reuse** will be an important facet of closing the future water supply and demand gap."

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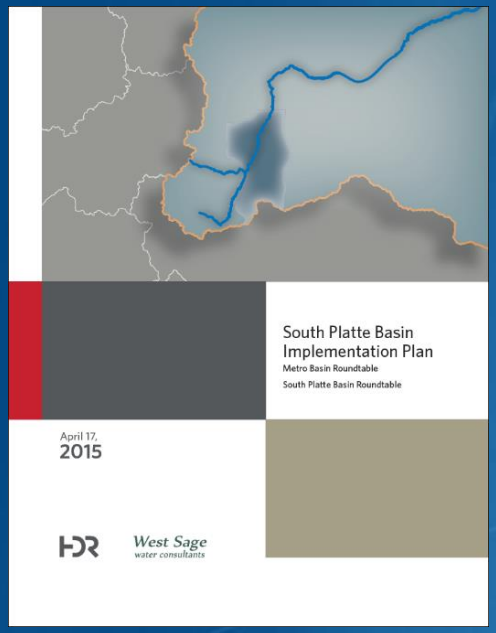
Basin Implementation Plans



South Platte:

- "Maintain leadership in conservation and **reuse** and implement additional measures to reduce water consumption rates"
- "…enhance current levels of municipal **reuse**."
- "Efficient use of the basin's resources, through water **reuse** and conservation, is a critical component of meeting future water needs:
- "Implement additional **reuse** where practicable.

WESTERN RESOURCE ADVOCATES

Basin Implementation Plans

- Arkansas: "…future demands will have to be met from better management of existing supplies including **reuse** of transbasin water supplies to the maximum potential…"
- Gunnison: "Entities must first **reuse** all legally available reusable water supplies to the maximum extent possible prior to further development of Colorado River System water"
- Southwest: "Municipalities receiving water from a new TMD will fully develop their existing water supplies within their basin (such as **reuse** strategies, storage, etc.)."

  "The Roundtable continues to firmly believe that conservation and **reuse** must be a major means to reduce demand and address future gaps…"

WESTERN RESOURCE ADVOCATES

Basin Implementation Plans

- Yampa-White-Green: "Water **re-use** should be an increasing part of meeting future water needs. Where water can legally be reused to extinction (transbasin water, already converted consumptive use water, non-tributary groundwater), it should be."
- Colorado: "TMDs should be the last "tool" considered as a water supply solution, once….and once everything that can be done to conserve and **reuse** water has been undertaken."

WESTERN RESOURCE ADVOCATES

Benefits of Reuse

West Slope:

- Decreases need for new transbasin diversions (TBD)
- Ensures TBD supplies are used effectively and efficiently

Environmental and Recreational:

- Takes pressure off streams and rivers for new diversions

Agricultural:

- Decreases need to look to agriculture for new municipal supplies (*does* impact return flows)
- Ensures any transferred agriculture CU is used effectively and efficiently

Municipal:

- New supply options are limited
- Often least costly option

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Water Plan: Strategies to Meet the Municipal (M&I) Gap

- Water Conservation and Reuse
- Alternative Agricultural Transfers (ATMs)
- Identified Projects and Processes (IPPs)
  - Agricultural water transfers (traditional & ATMs)
  - Reuse of existing fully consumable supplies
  - Growth into existing supplies
  - In-basin projects
  - New transbasin projects
- Water Storage

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South Platte BIP Reuse Identified Projects and Processes (IPPs)

From SPBIP Table 4-10

Basin	Providers	Project	Estimated Yield (AFY)
Metro	Aurora	Prairie Waters Project Expansion & Storage	TBD
Metro	Northglenn	Northglenn Reuse Plan	700
Metro	Thornton	Thornton Reuse	2,000
Metro	Denver Water	Denver Water Reuse	17,500
Metro	Westminster	Westminster Reclaimed Water	
Metro	Denver Water	Downstream Reservoir Exchanges	12,000
Metro	Castle Rock	Alternative water Supply Project	2,500
Metro	Castle Rock	Plum Creek Diversion & WPF Upgrades	4,100
Metro	ACWWA	Reuse of ACWWA Flow Program Deliveries	3,520
Metro	City of Brighton	South Platte and Beebe Draw Well	3,200
Metro	SMWSA, Denver Water, Aurora	WISE	7,225
South Platte	Erie	Erie Reclaimed Water	5,390
		TOTAL	**58,135**

Water Plan: Strategies to Meet the Municipal (M&I) Gap

- Water Conservation and Reuse
- Alternative Agricultural Transfers (ATMs)
- Identified Projects and Processes (IPPs)
  - Agricultural water transfers (traditional & ATMs)
  - Reuse of existing fully consumable supplies
  - Growth into existing supplies*
  - In-basin projects*
  - New transbasin projects
- Water Storage

*May be reusable - supply specific.

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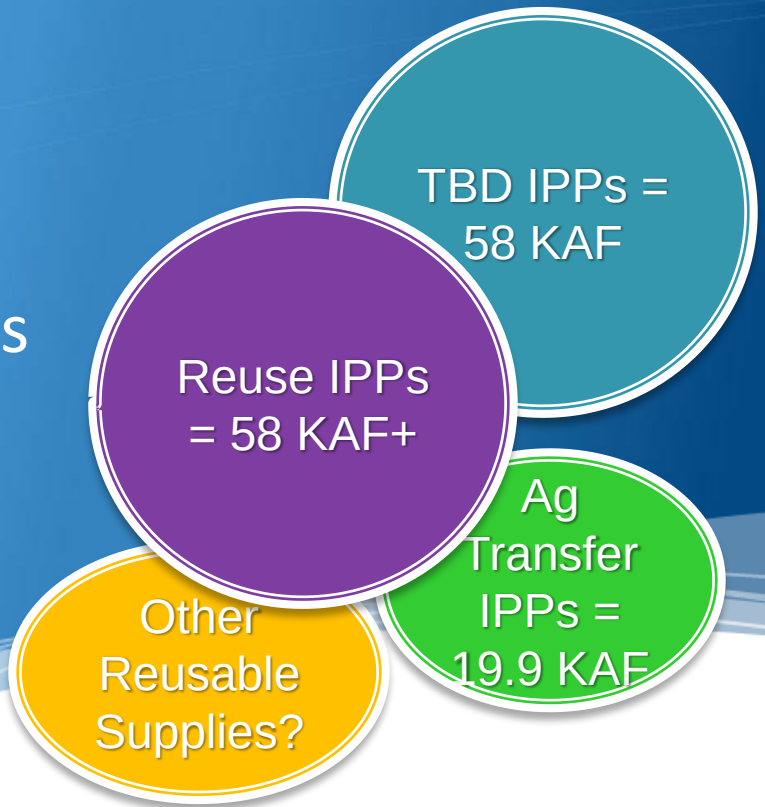
Reuse Potential

- Additional IPP Reuse Opportunities
  - Agricultural Transfers - **19,900 AF** identified in the SPBIP
  - Transbasin Projects - **58,000 AF** identified in the SPBIP
  - Unquantified overlap with Reuse IPPs
  - Additional reuse IPPs and opportunities in other basins
  - Higher yields as potable reuse is pursued through subsequent reuse of indoor return flows

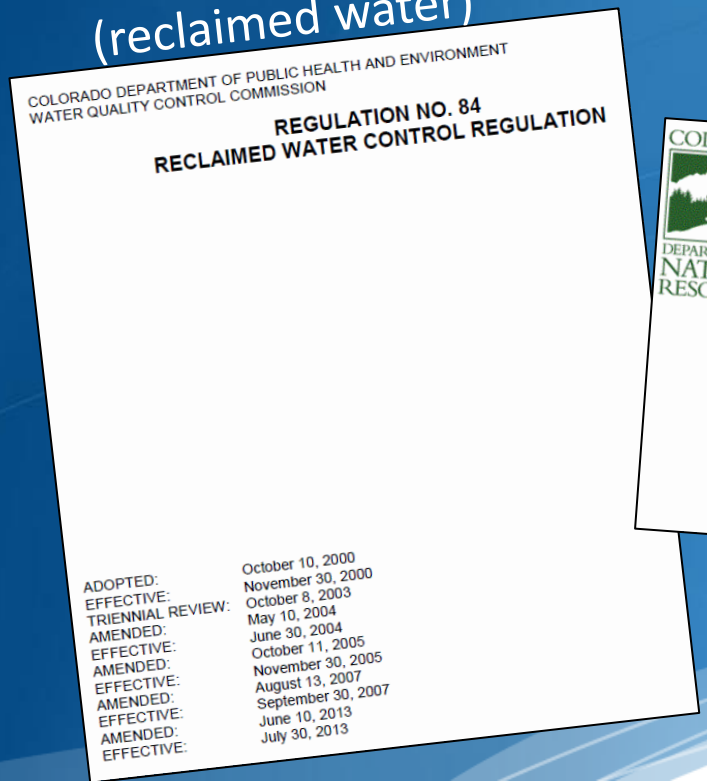


Increasing Reuse

- **Water Plan Critical Action** (Chpt 10): "Evaluate regulations to foster reuse of water supplies while protecting health and the environment."

Need to make progress on non-potable and potable regulations

Non-potable reuse (reclaimed water)

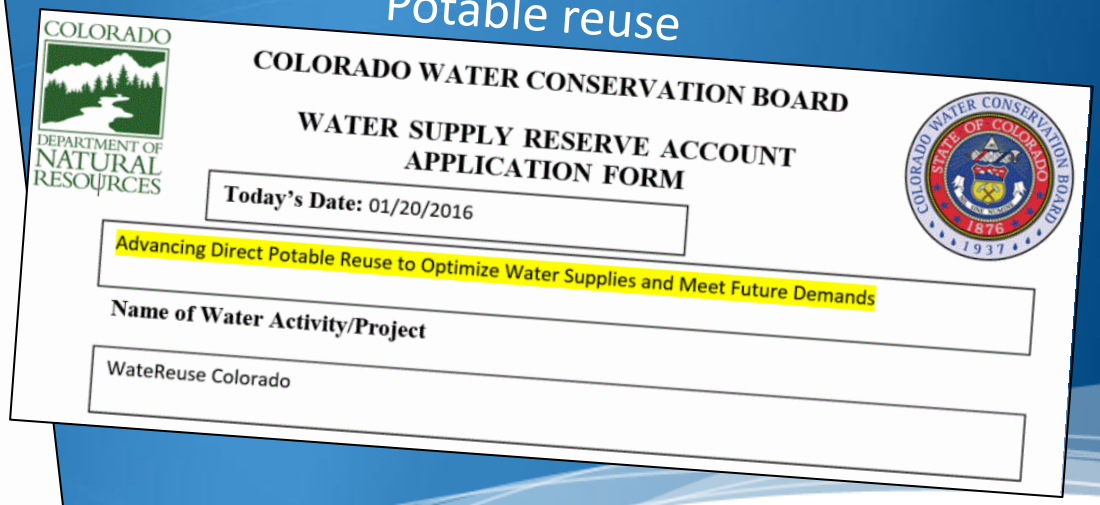


COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
WATER QUALITY CONTROL COMMISSION

REGULATION NO. 84
RECLAIMED WATER CONTROL REGULATION

ADOPTED:	October 10, 2000
EFFECTIVE:	November 30, 2000
TRIENNIAL REVIEW:	October 8, 2003
AMENDED:	May 10, 2004
EFFECTIVE:	June 30, 2004
AMENDED:	October 11, 2005
EFFECTIVE:	November 30, 2005
AMENDED:	August 13, 2007
EFFECTIVE:	September 30, 2007
AMENDED:	June 10, 2013
EFFECTIVE:	July 30, 2013

Potable reuse



COLORADO
DEPARTMENT OF NATURAL RESOURCES

COLORADO WATER CONSERVATION BOARD

WATER SUPPLY RESERVE ACCOUNT APPLICATION FORM

Today's Date: 01/20/2016

Advancing Direct Potable Reuse to Optimize Water Supplies and Meet Future Demands

Name of Water Activity/Project

WateReuse Colorado

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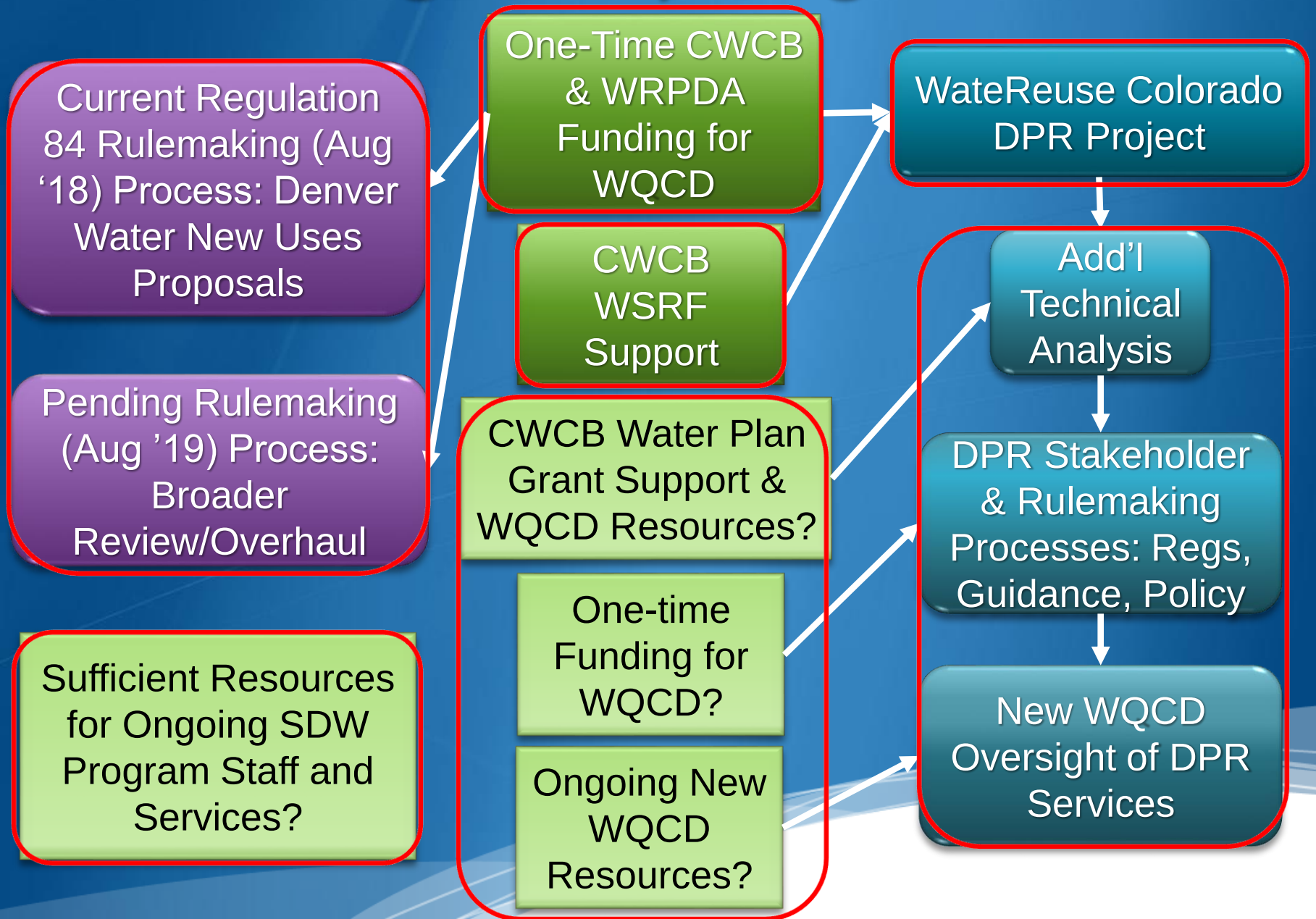
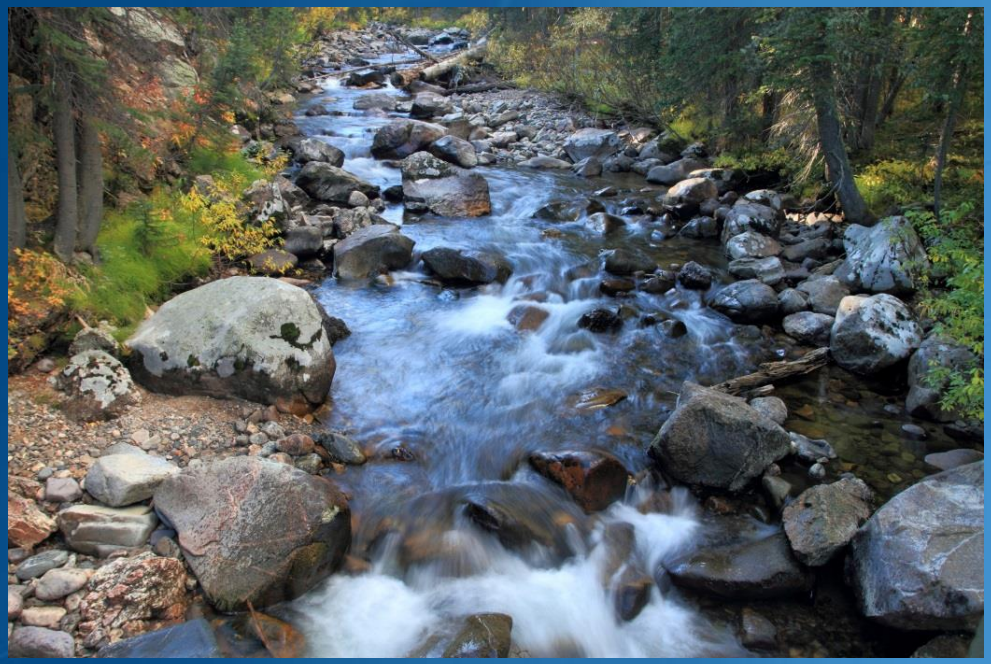
Regulatory Progress



Thank You



Laura Belanger, P.E.

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www.westernresources.org

WESTERN RESOURCE ADVOCATES

Direct Potable Reuse in Colorado

AN UPDATE ON THE WATEREUSE COLORADO DPR PROJECT

Water Resources Review Committee
September 6, 2017

John Rehring, P.E.
Carollo Engineers

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OUR PASSION

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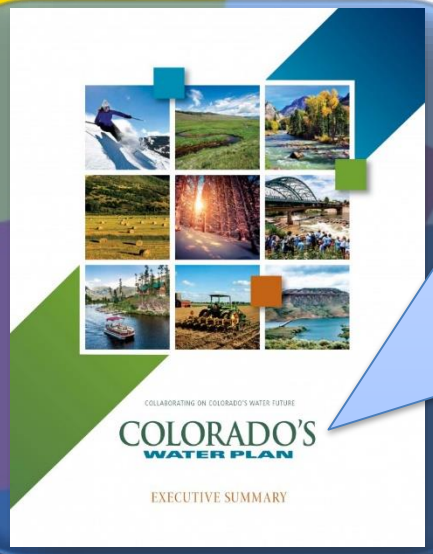
Engineers...Working Wonders With Water®

What's the role of reuse in Colorado?

Non-potable reuse

Some surface water IPR

No DPR projects in place or imminent



2050

POPULATION

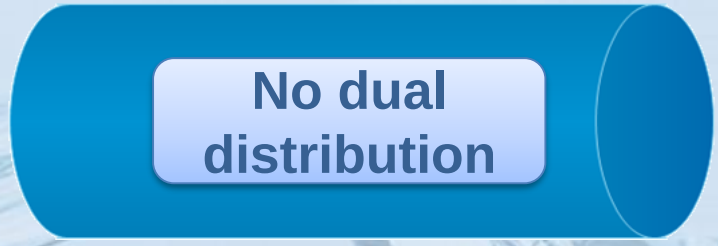
~2X

M&I SUPPLY GAP

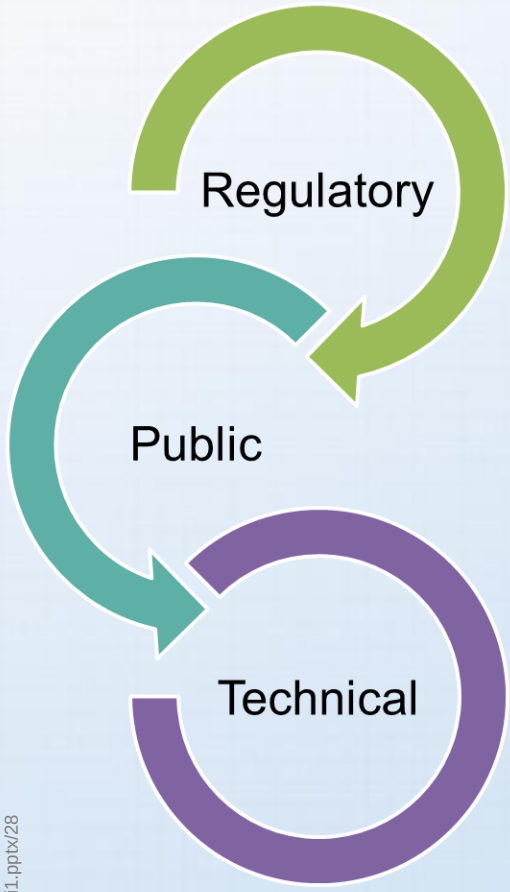
560K

AC-FT/ YEAR

Supply benefits of Potable Reuse



WateReuse Colorado Direct Potable Reuse Project goals



- Set a clear framework for DPR regulations: **Regulatory/Technical Workgroup**
- Increase public understanding and acceptance: **Outreach Workgroup**
- Adapt & use existing planning tools to help utilities assess potable reuse

A proactive approach to support DPR implementation in Colorado

WATEREUSE COLORADO

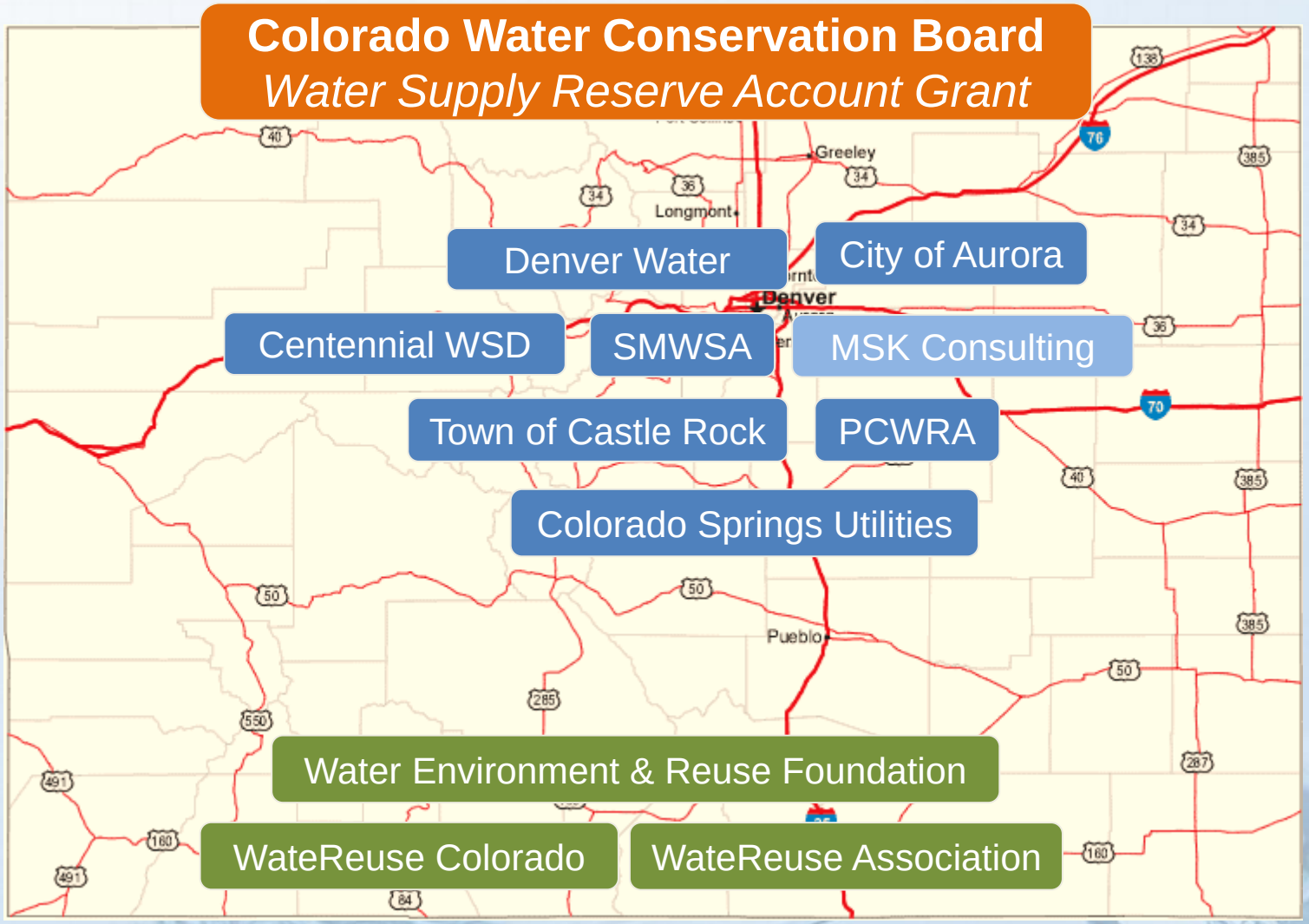
OUTCOMES

Regulatory framework

Outreach tools and products

Planning tools to assess DPR options

Workgroup comprises project supporters from utilities and organizations



Regulatory Development

Why develop DPR regulations?

DPR Regs

Confidence in public health protection

Certainty in planning for Utilities / Water Providers

Public **Acceptance**

ALIGNMENT

Water Providers
CDPHE WQCD
Stakeholders

State of the Union (from a DPR Perspective)

No national DPR regs – or plans to create them

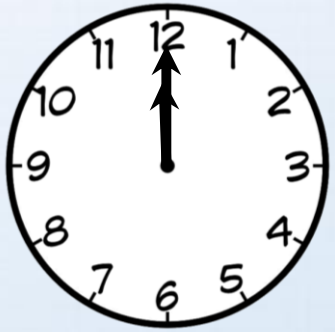
One operational DPR system /
More in the works

Some states have IPR regs

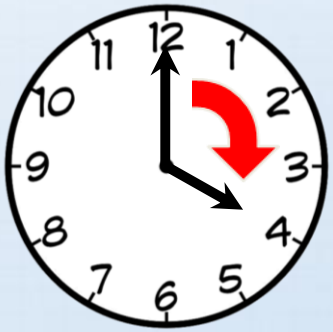
Several states working on DPR regs

When is the right time to develop DPR regulations?

Before a DPR project is proposed



Concurrent with a project's design



During or after startup of a project

Colorado's Regulatory Focus for Potable Reuse

INITIAL FOCUS

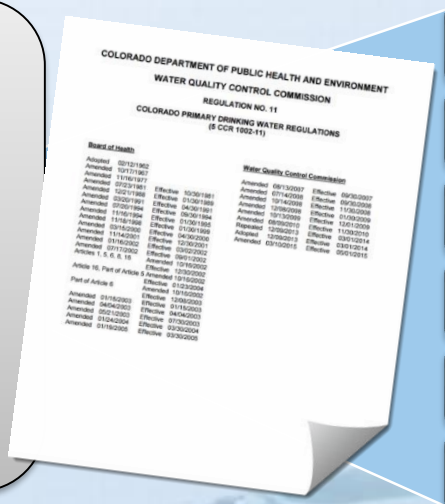
- DPR
- Structure for Regs, Policy, Guidance

FUTURE WORK

- IPR
- Adapt applicable provisions from DPR regs

CDPHE

Reg. 11 Colorado Primary Drinking Water Regulations


COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
WATER QUALITY CONTROL COMMISSION
REGULATION NO. 11
COLORADO PRIMARY DRINKING WATER REGULATIONS
(5 CCR 1002-11)

- Surface Water Treatment Rule
- Groundwater Rule
- NEW Potable Reuse Rule
- Total Coliform Rule
- Nitrate and Nitrite Rule
- …

Flexibility and adaptability through three levels of regulatory documents

Regulation

Non-compliance has consequences and requires public notification.

Commission hearing process to modify.

Policy

Interprets the Regulation, provides specifics.

Can be modified at CDPHE staff level, approved by Commission.

Guidance

Best practices and information on how utilities can best comply with the Regulation.

Non-enforceable.

Topic Areas for DPR Reg / Policy / Guidance

1. Definitions/Terminology
2. Source Control
3. Wastewater Treatment
4. Pathogen Disinfection/Removal
5. Chemical Pollutants
6. Advanced Treatment Processes
7. Monitoring Requirements
8. Reporting
9. Facility operations/ certification programs
10. Education and outreach
11. Technical, Managerial and Financial (TMF) capacity

An example of how the Reg / Policy / Guidance Matrix works

Topic Area	Regulation	Policy	Guidance
Source Control	✓ Require a source control program. ✓ Require review and updates of source control program. ✓ Require regulatory reviews of monitoring results.	✓ Required components of program. ✓ Specific requirements for all components of the program (i.e., monitoring frequency, location, reporting).	✓ Best practices for sampling and emergency response.

Workgroup “breakout” teams helped vet and enhance the Reg / Policy / Guidance matrix for each topic

What information is missing from the regulatory matrix?

Where do the components of each topic belong: regulation, policy, or guidance?

What resources are available for each topic?

What additional information or research is needed?

Path from framework to regulation

Early 2018:
WateReuse Colorado Reg / Policy / Guidance Framework

Develop Health-Based Standards

Develop Implementation Programs

Water Quality Control Commission Rulemaking

Reg / Policy / Guidance

Unresolved Issues:

Timeline

Resources

Outreach

Taking a proactive approach to DPR outreach and education to foster success in future project implementation

Outreach and Education

DPR project concept → **Project implementation** → **DPR in Colorado!**

Effective communications strategy for each target audience starts with a good plan

Example audiences
Local elected officials
Press/media
Community organizations
Local health department
Community leaders
Industry
Environmental groups
State legislators

Workgroup members evaluated best strategies to reach target audiences

Outcomes	• Advocate, not oppose • Promote with constituents
Motivations	• Economic growth • Getting re-elected
Hurdles to Overcome	• Cost • Perception
Messaging	• Safety • Has been proven before
Messengers	• Staff • Constituents
Delivery Mechanisms	• Board meetings • Concise and consistent bullets

Work plan and outreach needs extend beyond the WateReuse Colorado project

- Identify target audience(s)
- Craft an outreach message and strategy
- Develop new and leverage existing materials
- Assign a timeline for implement-tation
- Identify and utilize evaluation tools

Takeaways: Facilitating DPR in Colorado

Regulatory development can apply leading research & best practices from other states to result in flexible & adaptable requirements

Statewide outreach efforts start with knowing who to reach and how we can make the most impact

Resource limitations could constrain ability to develop regulations and prepare Colorado for this significant supply source

Direct Potable Reuse in Colorado

AN UPDATE ON THE WATEREUSE COLORADO DPR PROJECT

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WATEREUSE COLORADO

carollo
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Reuse and the Energy-Water Nexus

Laura Belanger, P.E.
Western Resource Advocates

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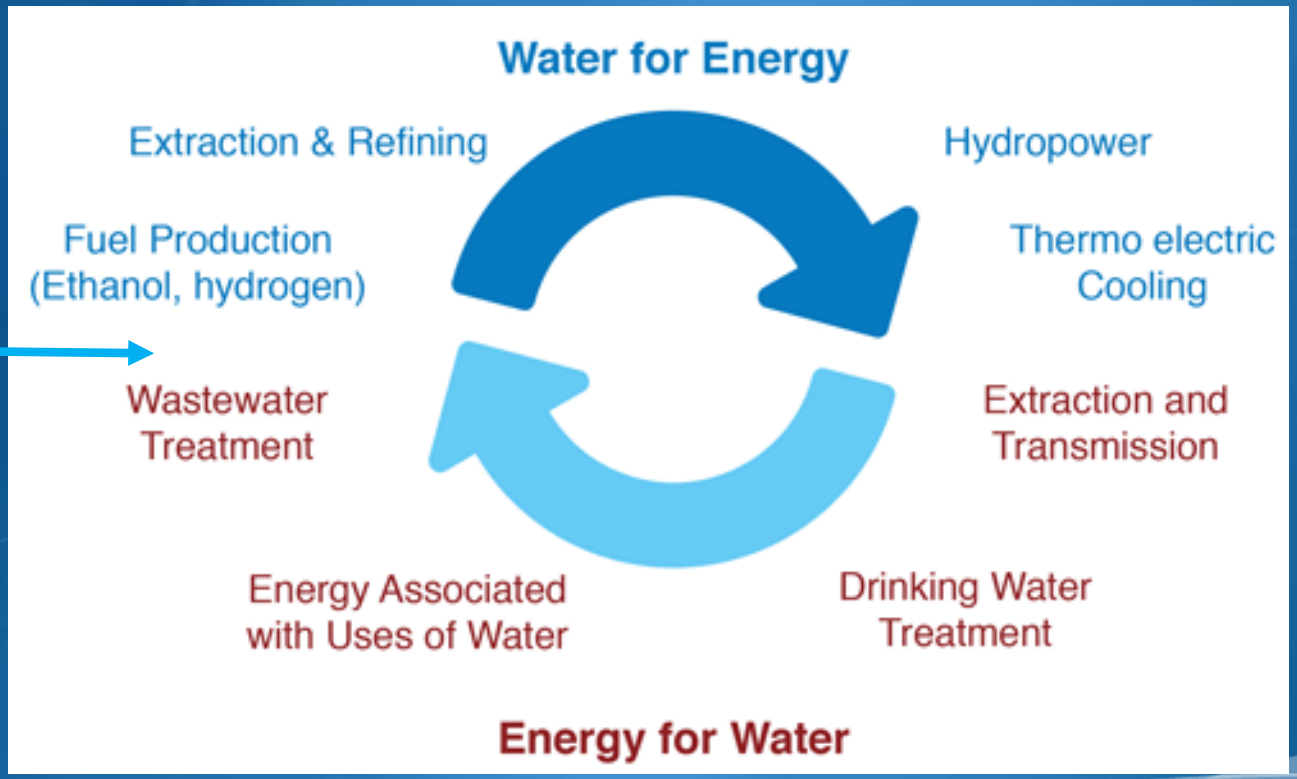
Water and Energy

Two of our most important resources
Inextricably linked



Water Reuse

Source: Water, Energy and Climate Change: A Contribution from the Business Community. World Business Council for Sustainable Development. 2009

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Water and Energy

Water for Energy

- 2010 thermoelectric power plants = ~0.7% (86,300 AF) of total Colorado freshwater withdrawals[1]
  - Mostly for cooling, recirculated until fully consumed.
  - 2010 Municipal withdrawals = 7.7% (950,000 AF) of total freshwater withdrawals[1]

Energy for Water

- ~13% of energy use nationwide is embedded in water use[2]
  - Energy is second biggest cost for many utilities, second to staff salaries[3]

[1] USGS Circular 1405. Estimated Use of Water in the US in 2010
[2] Sanders, K and M. Webber. 2012
[3] AWWA State of the Water Industry 2013

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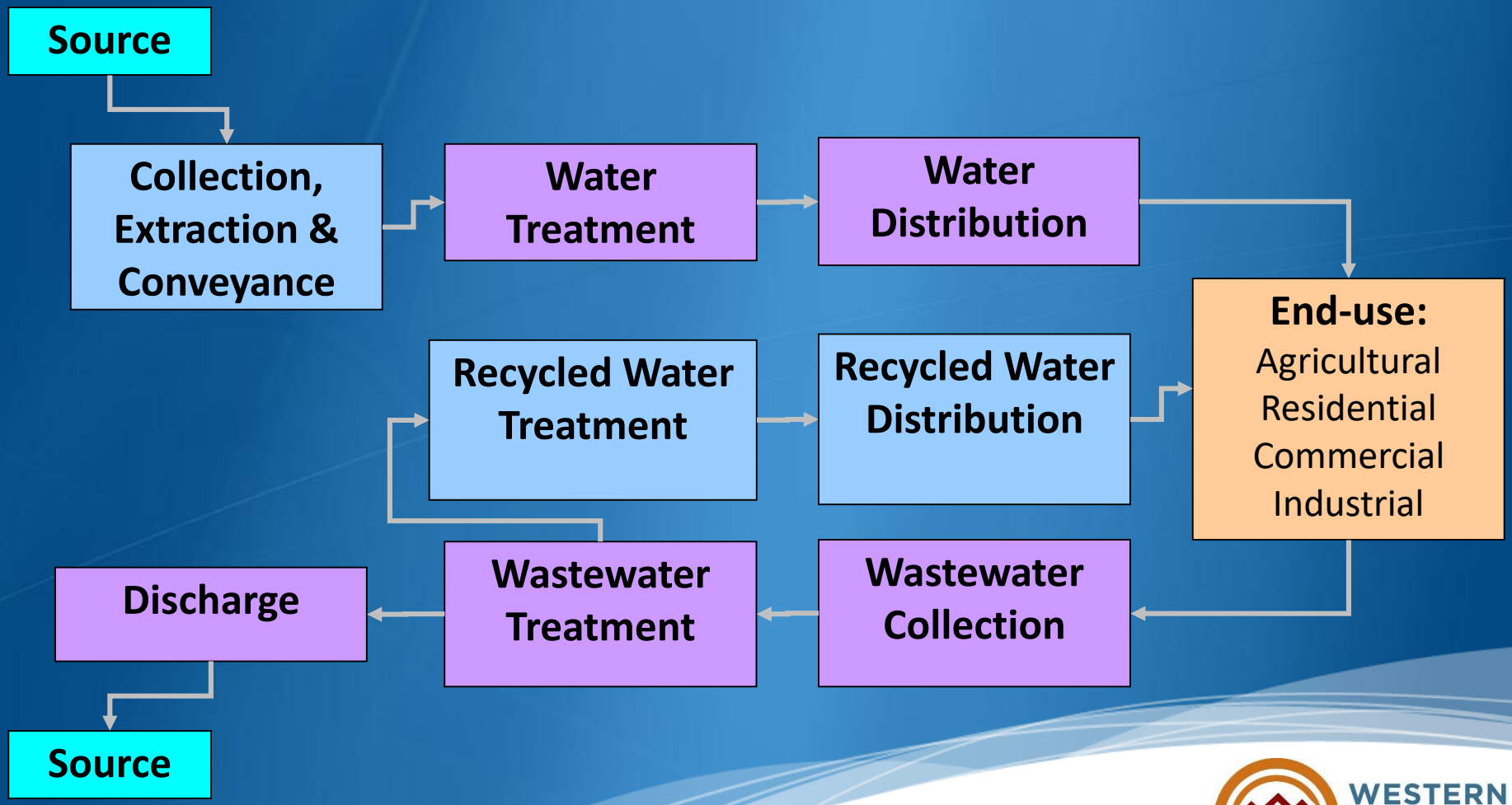
Providing Water

Energy is used to collect, pump, treat, distribute, heat, and use water; to treat and discharge wastewater; and/or to treat water for reuse.



Graphic: Bob Wilkinson, UCSB

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Energy Intensity of Water

Photo: Mark Conlin

Varies Greatly:

- Gravity Fed Surface Supplies
  - Minor amounts of energy to treat and distribute potable water to their customers
  - Ex: Denver Water, Fort Collins
    - Energy intensity of Denver Water, including supplying water and treating wastewater, averages 821 kWh/AF[1]
- Groundwater, Distant Sources
  - Significant energy needed to pump water
  - Ex: Parker Water and Sanitation to pump groundwater from aquifers.
    - Energy intensity of water in Parker, including supplying water and treating wastewater, averages 4,494 kWh/AF[1]

Photo: Chris Austin

[1] Water Conservation = Energy Conservation: A Report for the CWCB, Western Resource Advocates, 2009

WESTERN RESOURCE ADVOCATES

New Water Supplies

New water supplies will require more energy:

- Have tapped easiest, least energy-intensive supplies
- Groundwater pumped from greater depths
- Surface water conveyed long distances, transbasin diversions
- Lower quality water requiring more treatment

How does reuse compare?

- Locally available supply
- Likely less energy intensive than other alternatives
- Source water is treated wastewater
- Incremental additional treatment for reuse
- WWTP often at bottom of system so pumping needed to provide to users

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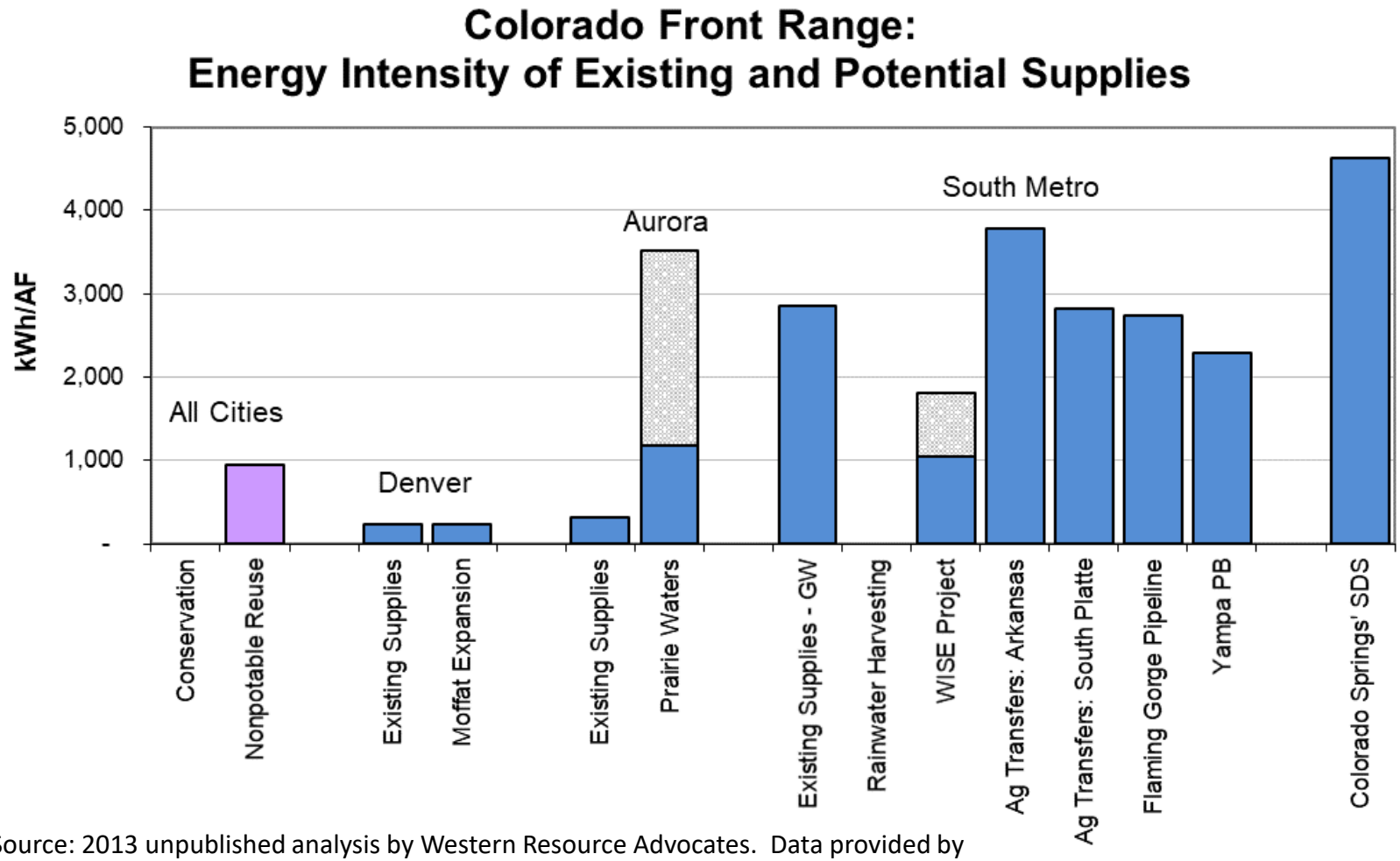
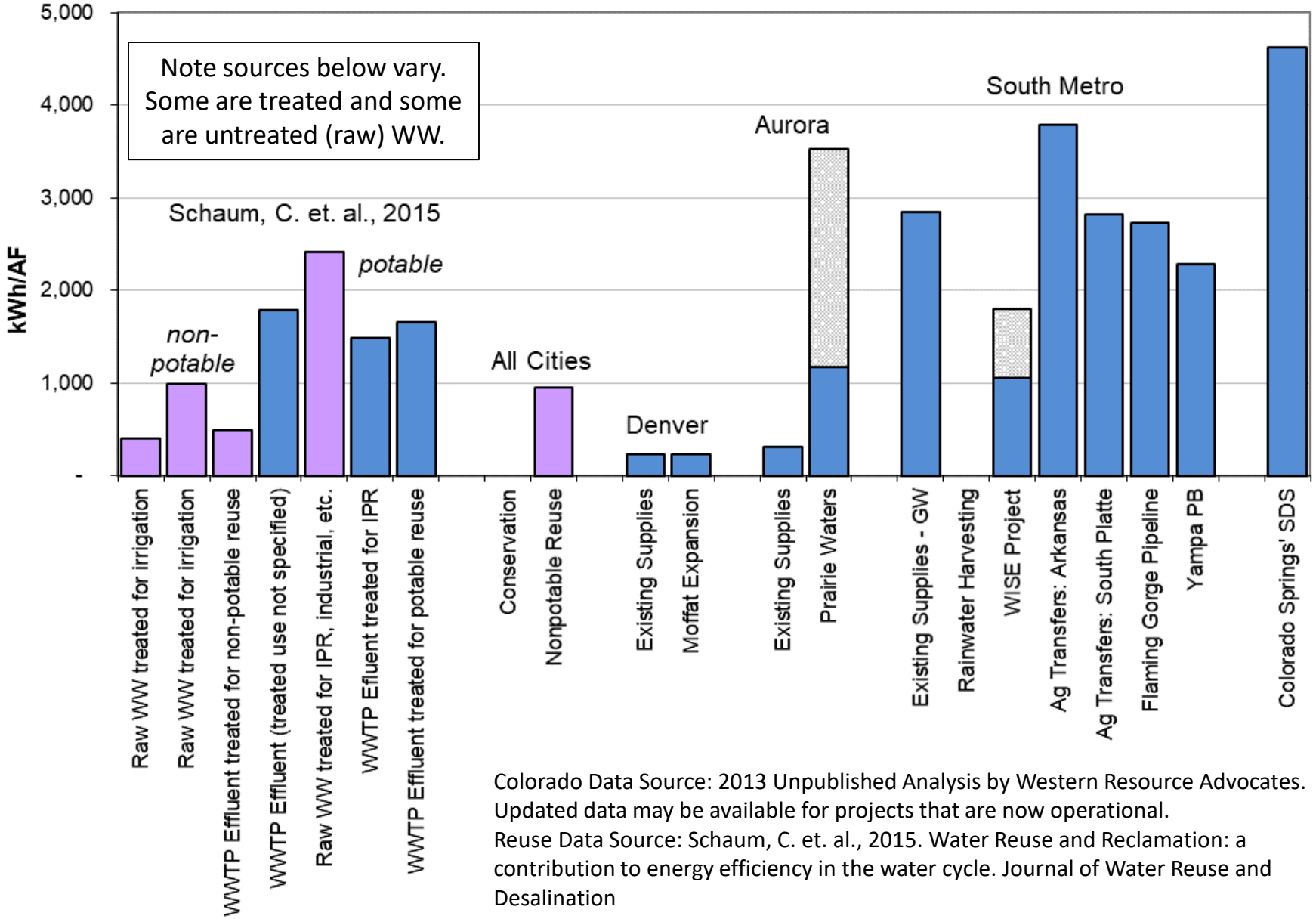
Includes conveyance from source, treatment and delivery. Does not include wastewater treatment.



Source: 2013 unpublished analysis by Western Resource Advocates. Data provided by cities. Updated data may be available for projects that are now operational.

WESTERN RESOURCE ADVOCATES

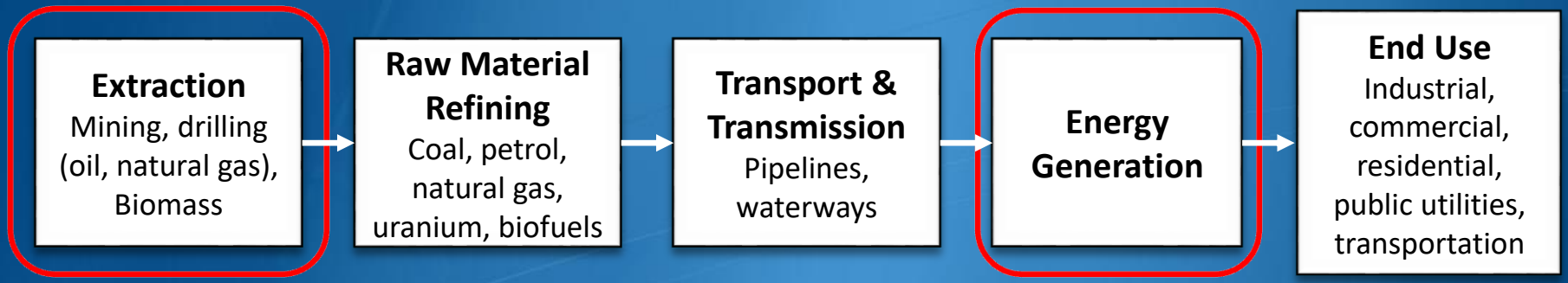
Reuse and Colorado Front Range: Energy Intensity of Existing and Potential Supplies



Colorado Data Source: 2013 Unpublished Analysis by Western Resource Advocates. Updated data may be available for projects that are now operational.

Reuse Data Source: Schaum, C. et. al., 2015. Water Reuse and Reclamation: a contribution to energy efficiency in the water cycle. Journal of Water Reuse and Desalination

Water for Energy



Source: Adapted from WitW 2013, Water in the West: Water and Energy Nexus: A Literature Review. Stanford Woods Institute

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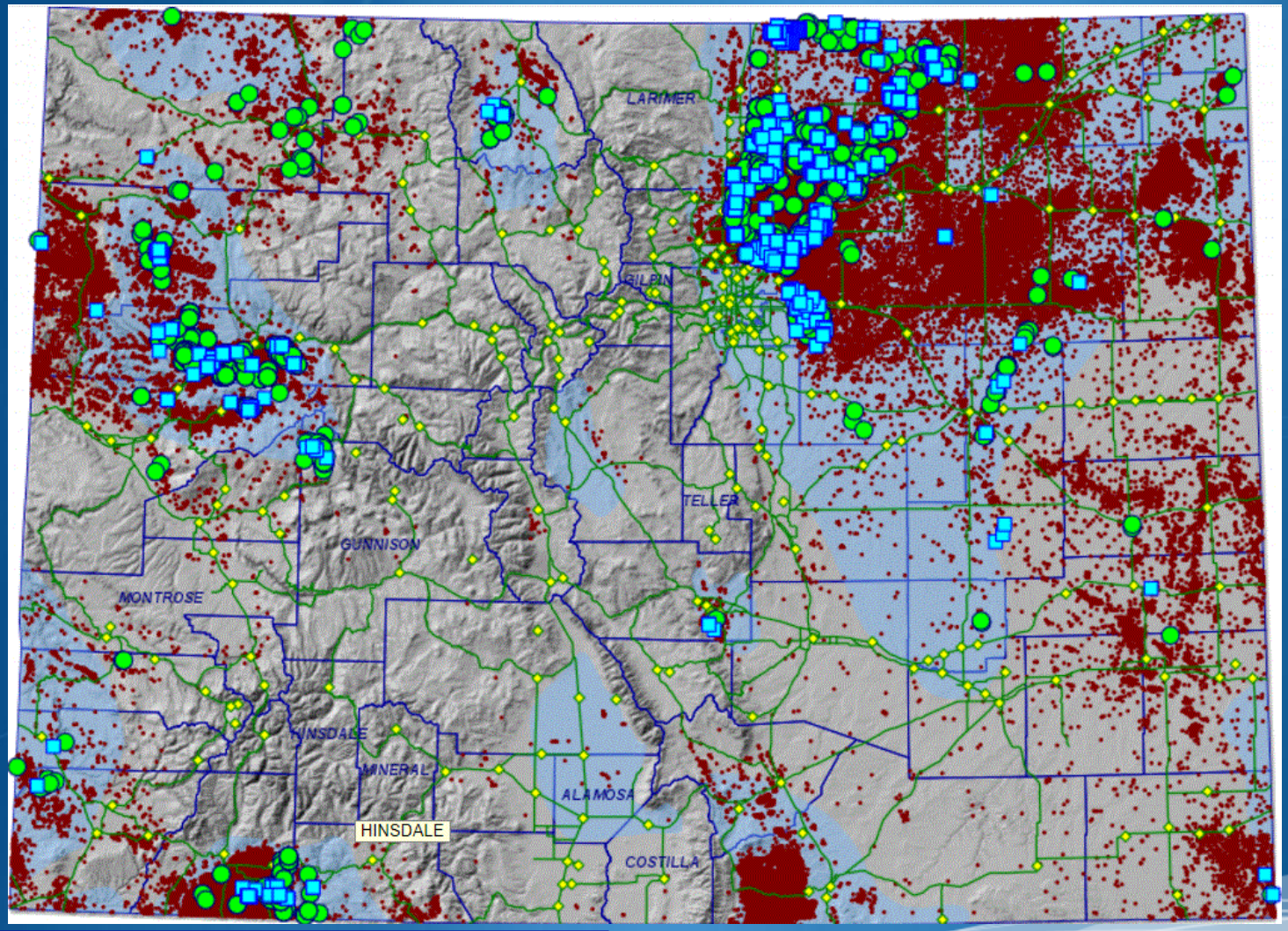
Oil and Gas Extraction



Source: COGCC GIS Online

- = Approved well
- = Pending well
- = Permitted, historic & abandoned wells

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Oil and Gas Extraction

Annual Colorado water demands vary

- # of wells drilled, depth, length…
- ~0.1 – 0.15% of total water withdrawals
- Locally impacts can be significant in areas (e.g. Weld County)

Many O&G operators in Colorado recycle water:

- Decreases need to secure water supplies
- Cuts downs on truck traffic through communities
- Decreases volume of water that must be disposed of
- Can cut costs

Reusable municipal return flow lease

- Anadarko Petroleum's 2012 5-yr lease w/Aurora to divert ~1,500 AF/yr reusable return flows from the South Platte

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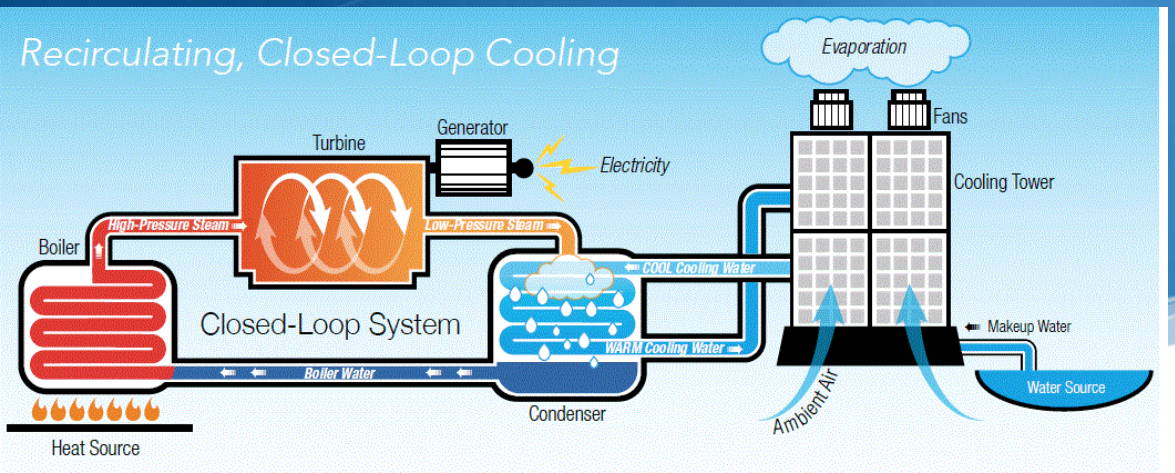
Thermoelectric Power Plants

Water required for electricity generation varies considerably, depending on fuel and cooling technology

- Most water consumed is to cool and condense steam in thermoelectric power plants
- Colorado's energy sector has decreased water use and continues to as renewables and no/low water cooling systems come online
- As a result, reuse opportunities in Colorado associated with power plants are limited.
- 3 thermoelectric power plants in Colorado use reclaimed water: Cherokee, Drake and Rawhide.

Image: CFWE Headwaters Magazine Fall 2013



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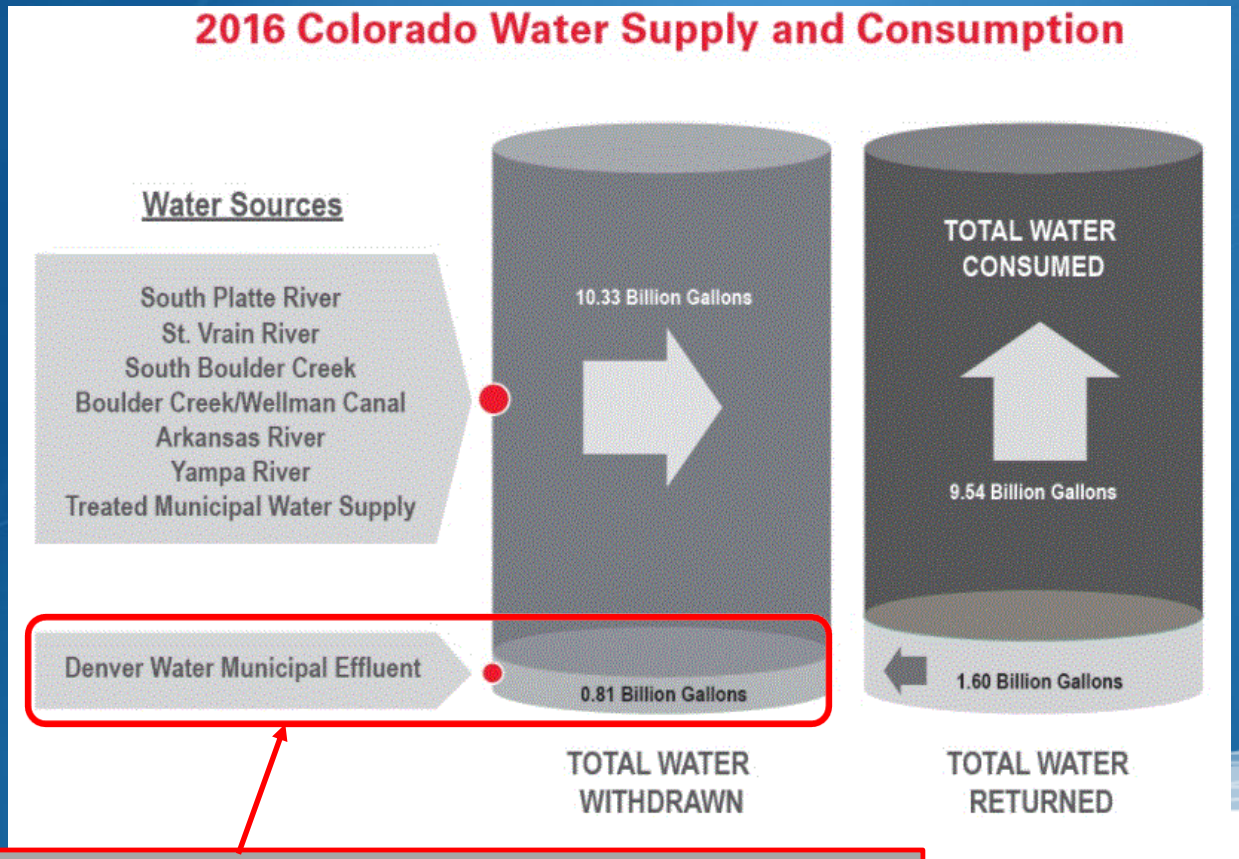
Xcel Example

Xcel serves ~60% of Colorado's energy load

"By far, the majority of Xcel Energy's water use is for generating electricity, compared to water used in office buildings."



Source: Xcel Energy Water Management website

= ~2,500 AF or 8% of total water withdrawn by Xcel in Colorado
= ~40% of Cherokee Power Plant total water consumed

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Key Takeaways

- We are moving in the right direction to use resources efficiently in water and energy sectors
- Water reuse can play an important role
- Water reuse – potable and non-potable – is increasing attractive
  - In part due to costs - including energy
  - Less energy intensive than many new supply options
  - Additional opportunities to control energy intensity (efficient pumps, plant design, treating so is fit for purpose…)
- Fresh water inputs to the energy sector are decreasing
  - As power plants switch to renewables, more efficient technologies, use reclaimed water where practical
  - As oil and gas operators increase use of water recycling and creative water agreements

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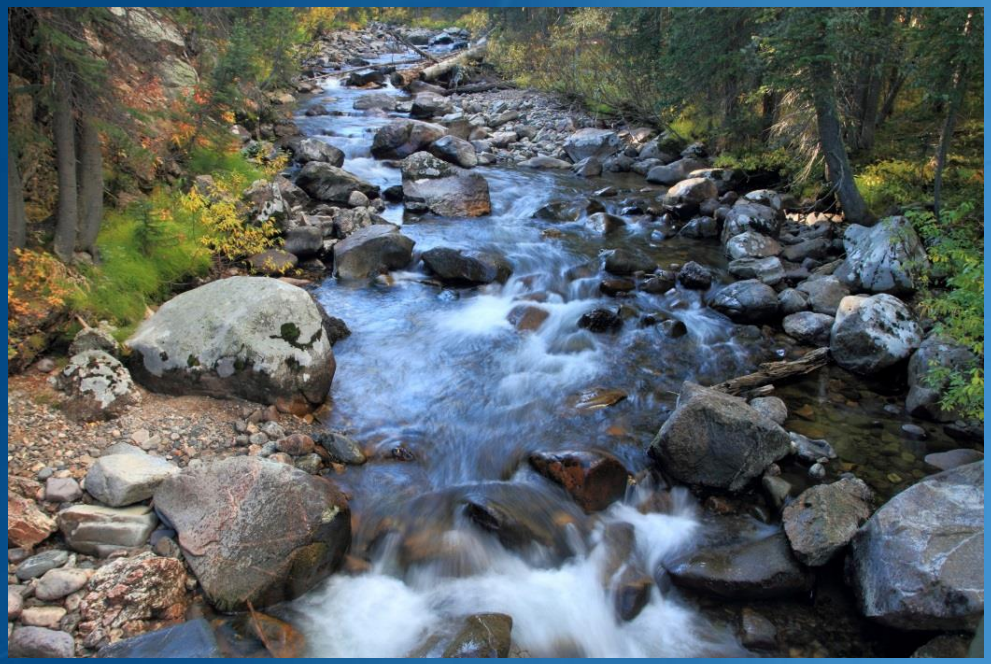
Thank You



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