



Connecting world class research with real-world water challenges

Colorado State University

Integrated Urban Water Management WaterNow Alliance Summit

Boulder Colorado, April 20 2017

*Mazdak Arabi, PhD
Borland Endowment Professor of Water Resources
Civil and Environmental Engineering*

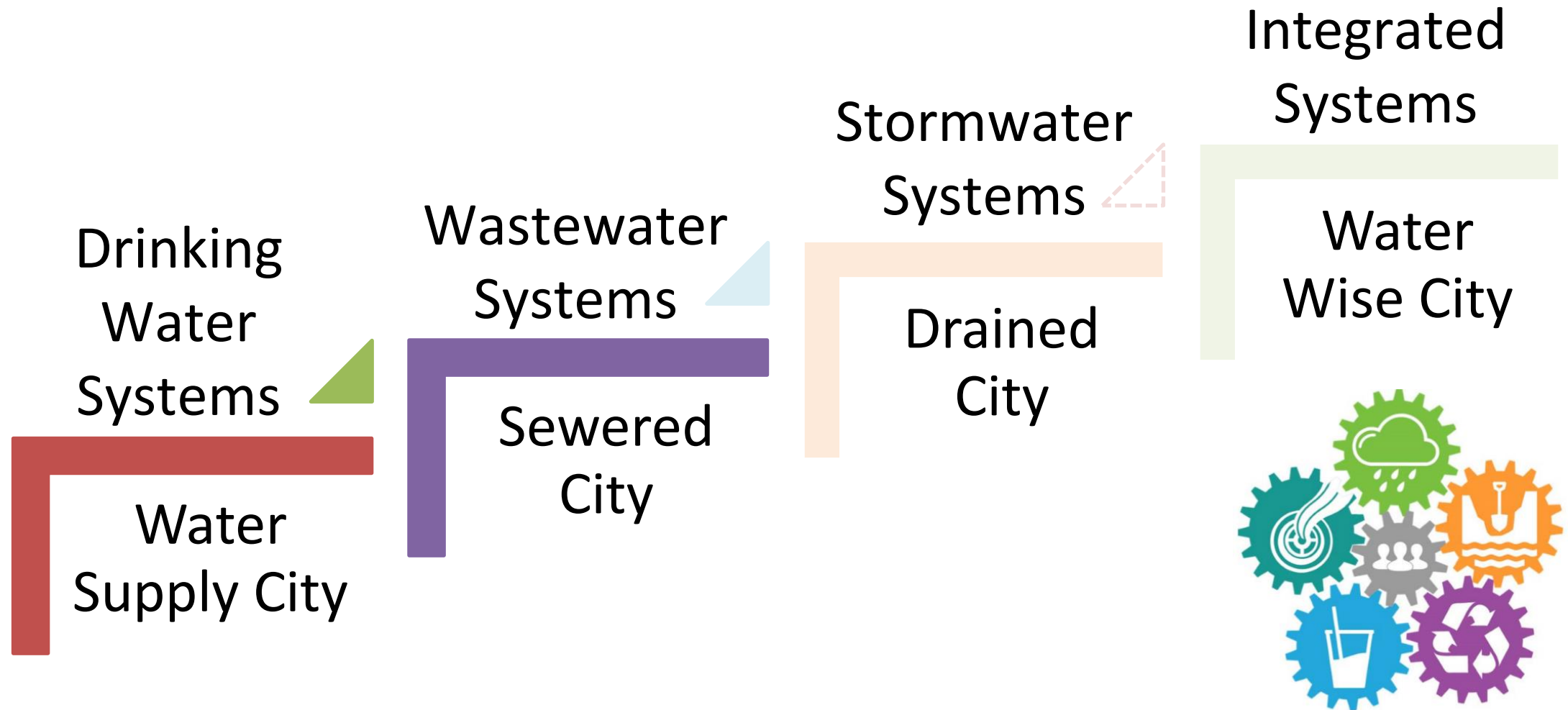
URBAN WATER CHALLENGE

Resources are limited, we need to do more with less

Urbanization is both an opportunity for growth and a threat to livability

An uncertain future underlines the planning of our cities

INTEGRATED URBAN WATER SYSTEMS



SERVICE PROVISION → RESOURCE MANAGEMENT



PATHWAYS TO INTEGRATED URBAN WATER

A wide-angle photograph of the Golden Gate Bridge in San Francisco, taken from a high vantage point on the bridge's deck. The bridge's iconic red-orange towers and suspension cables are prominent. The sun is low on the horizon to the left, creating a brilliant orange and yellow glow that reflects on the water. The sky transitions from a deep orange near the horizon to a clear blue at the top. In the distance, the city skyline and hills are visible across the water.

**Technological
Policy
Financial**

The background of the slide is a photograph of the Golden Gate Bridge in San Francisco during sunset. The bridge's red-orange towers and suspension cables are silhouetted against a sky with vibrant orange, yellow, and blue hues. The water of the bay is visible in the foreground.

PATHWAYS TO INTEGRATED URBAN WATER

**Technological
Policy
Financial**

Data underpins identification and assessment of viable pathways

- Challenges of storing and sharing large datasets
- Analytics for data discovery in time and space
- Data access and security
- Cloud solutions for enhanced accessibility and scalability

MANY QUESTIONS

How much can
demand be
reduced?



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How much can demand be reduced?



Most effective strategies to implement in my area?



MANY QUESTIONS

How much can demand be reduced?



Most effective strategies to implement in my area?

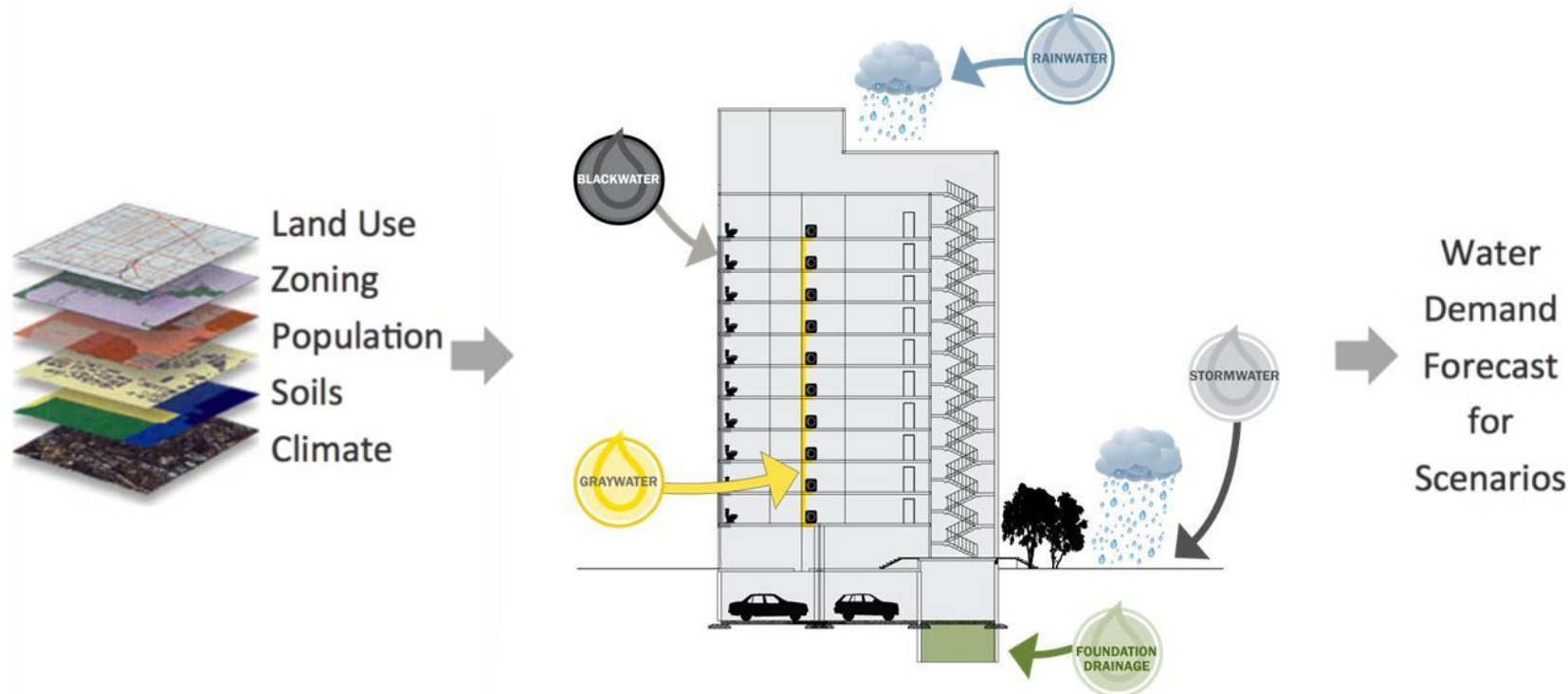


Resilient strategies under alt. growth patterns or climate change?



INTEGRATED URBAN WATER MODEL (IUWM)

To forecast urban water demand and project potential savings from conservation and use of alternative water sources over varying climatic conditions and land uses.



DEMAND REDUCTION STRATEGIES



Indoor and
Outdoor
Conservation



Graywater
Reuse



Stormwater
Use



Effluent
Reuse

Map**IUWM****1. Create/select service area boundary**

- ☐ Point Buffer
- ☐ Line Buffer
- ☐ Polygon
- ☒ Rectangle
- ☐ Upload a Boundary
- ☐ Within Layer Extent
- ☐ Known Boundary

2. Select analysis subunits

- ☒ U.S. national dataset:
- ☐ User layer:

3. Select population dataset / layers

- ☒ U.S. national dataset:
- ☐ User layer:

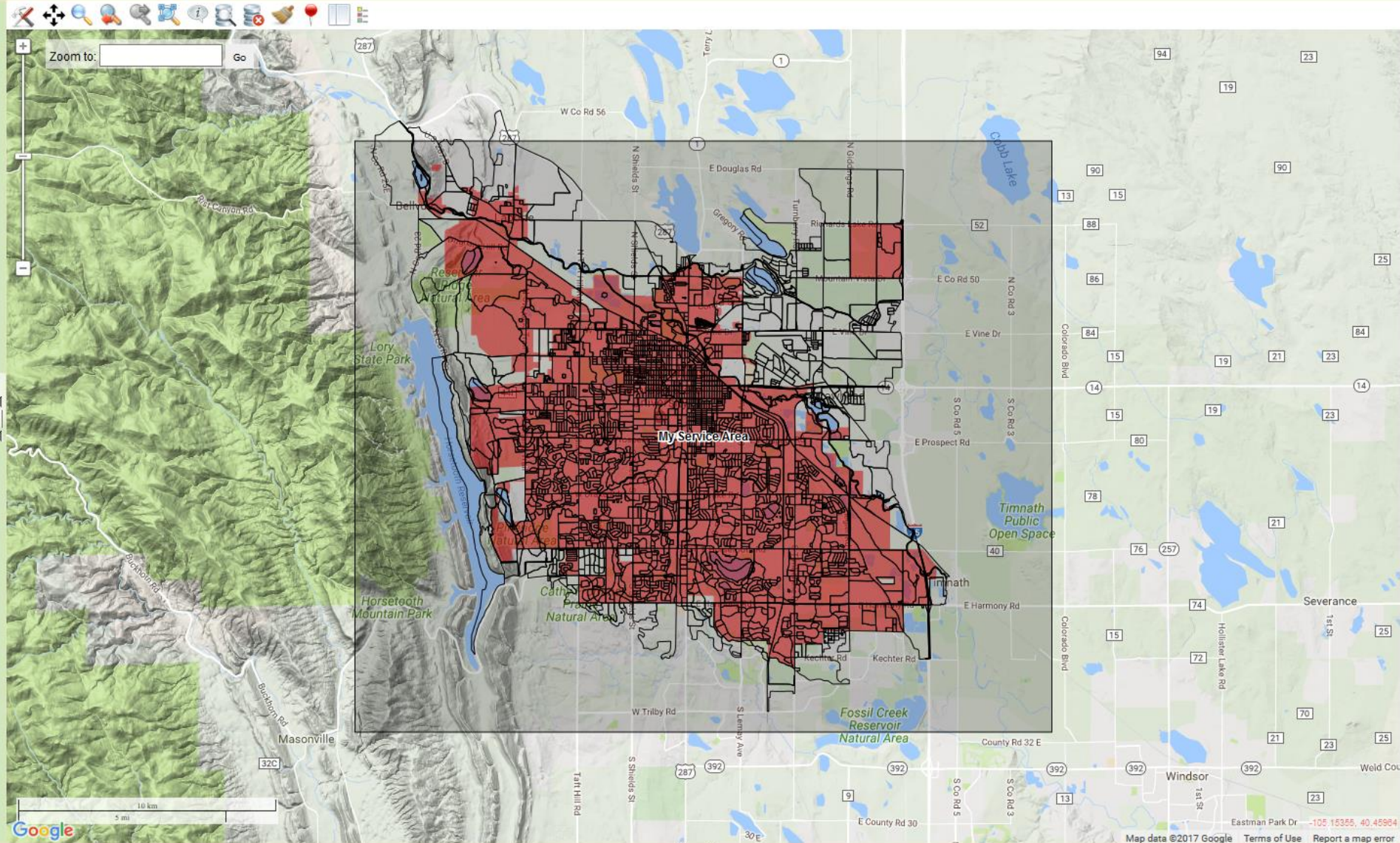
4. Select land use dataset / layers

- ☒ U.S. national dataset:
- ☐ User layer:

5. Select climate dataset

- ☒ U.S. national dataset:
- ☐ User data:

First line is the header and is ignored. File format is 'ID', 'Station ID', 'Date (YYYY-MM-DD)', 'Tmin (F)', 'Tmax (F)', 'Precip (in)'

Current Service Areas ☒ Show placemarks

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Map IUWM

1. Create/select service area boundary

- ☐ Point Buffer
- ☐ Line Buffer
- ☐ Polygon
- ☒ Rectangle
- ☐ Upload a Boundary
- ☐ Within Layer Extent
- ☐ Known Boundary

2. Select analysis subunits

- ☒ U.S. national dataset: Single Subunit
- ☐ User layer: <Choose>

3. Select population dataset / layers

- ☒ U.S. national dataset: Census Block 2010
- ☐ User layer: <Choose>

4. Select land use dataset / layers

- ☒ U.S. national dataset: NLCD 2011
- ☐ User layer: <Choose>

5. Select climate dataset

- ☒ U.S. national dataset: PRISM
- ☐ User data: <Choose>

First line is the header and is ignored. File format is 'ID', 'Station ID', 'Date (YYYY-MM-DD)', 'Tmin (F)', 'Tmax (F)', 'Precip (in)'

Generate

Current Service Areas

Fort Collins Census (1)

Edit Run Output Delete

☒ Show placemarks

Edit Practices for Fort Collins Census Block Groups

Current scenario: Graywater
Create Delete

Parameters Practices Climate Subunits

Graywater Reuse

Percent of graywater available for indoor residential and outdoor reuse: 100 (%)

Percent of graywater available for indoor CII reuse: 0 (%)

Reuse Purpose	% Adoption	Storage Capacity per Household in Gallons
Residential Flushing	0	0
Irrigation	0	0
Combined Flushing and Irrigation	80	130
Residential Potable	0	0
Combined Potable and Irrigation	0	0
Indoor Commercial, Industrial, and Institutional (CII)	0	0

Stormwater Use
Wastewater Reuse
Irrigation Conservation

Cancel Save

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Map

Timnath

Cibola Lake

Timnath Public Open Space

Severance

Windsor

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Map IUWM

- Create/select service area boundary**
 - ☐ Point Buffer
 - ☐ Line Buffer
 - ☐ Polygon
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 - ☐ Upload a Boundary
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- Select analysis subunits**
 - ☒ U.S. national dataset: Single Subunit
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 - ☐ User layer: <Choose>
- Select land use dataset / layers**
 - ☒ U.S. national dataset: NLCD 2011
 - ☐ User layer: <Choose>
- Select climate dataset**
 - ☒ U.S. national dataset: PRISM
 - ☐ User data: <Choose> Create

First line is the header and is ignored. File format is 'ID', 'Station ID', 'Date (YYYY-MM-DD)', 'Tmin (F)', 'Tmax (F)', 'Precip (in)'

Generate

Current Service Areas

Fort Collins Census (1) Edit Run Output Delete

☒ Show placemarks

Edit Practices for Fort Collins Census Block Groups

Current scenario: Graywater Create Delete

Parameters **Practices** **Climate** **Subunits**

Graywater Reuse

Percent of graywater available for indoor residential and outdoor reuse: 100 (%)

Percent of graywater available for reuse: 100 (%)

Reuse Purpose
Residential Flushing
Irrigation
Combined Flushing and Irrigation
Residential Potable
Combined Potable and Irrigation
Indoor Commercial, Industrial, Institutional (CII)

Stormwater Use

Wastewater Reuse

Irrigation Conservation

Cancel

Edit Practices for Fort Collins Census Block Groups

Current scenario: Hot Dry Create Delete

Parameters **Practices** **Climate** **Subunits**

Climate source: WeatherFile2

Climate table: fort_collins_east_weather.csv

Temperature Offset

-100% 10% 100%

Precipitation Scaling

-100% -10% 100%

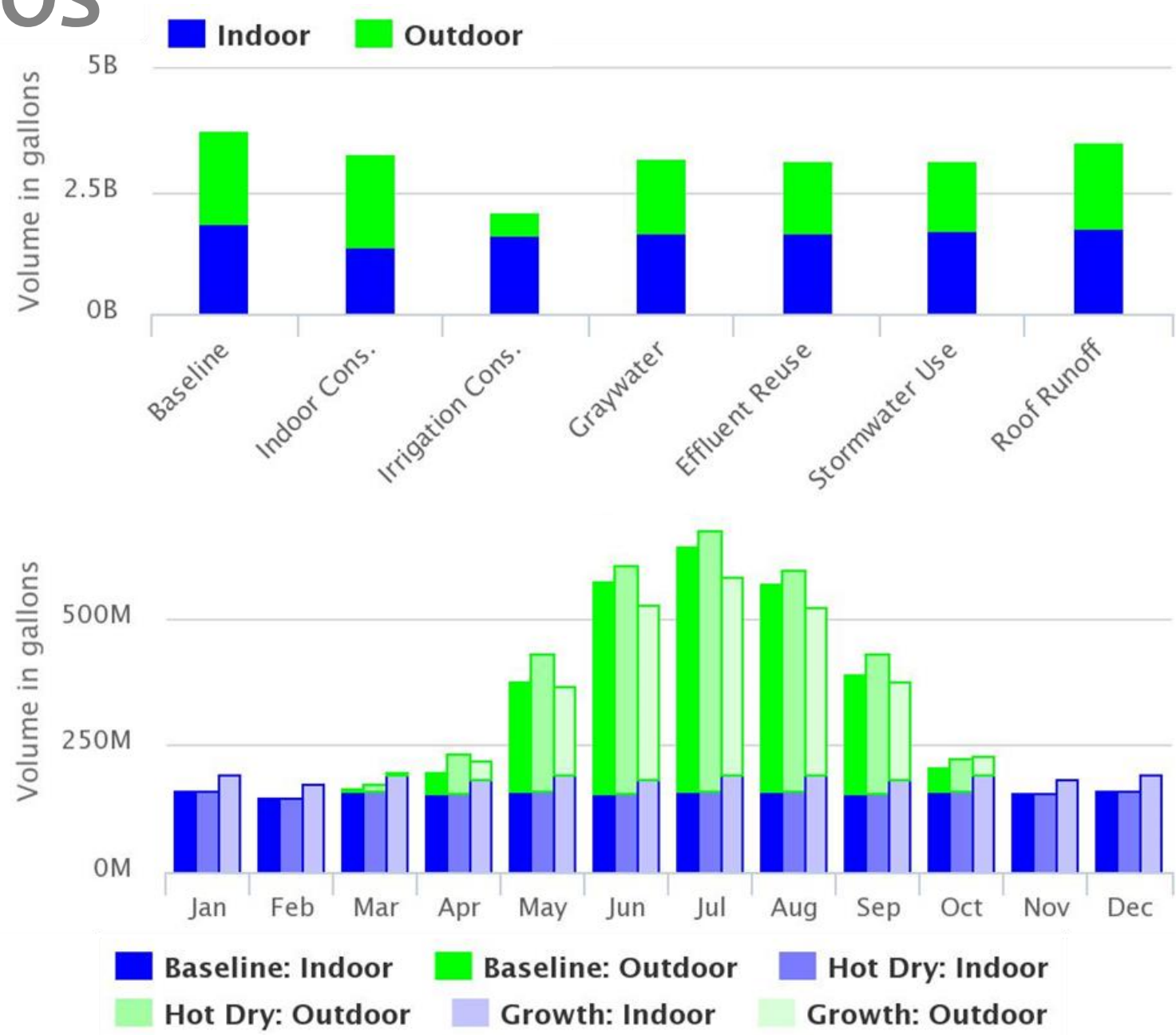
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SCENARIOS



SCENARIOS

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Projects

Group: City of Fort Collins Water Systems

View Group Comments

Create New Group...

+ Share Project

Open

Rename

Remove

Name	Owner	Date
IUWM_demand	sshavel	2017-03-23 12:24:58
Fort Collins Flood Inundation Maps	marabi	2017-03-23 18:11:08
Poudre_watershed_model_supply	tasdighi	2017-03-26 06:56:44
CLEAN - Fort Collins	tcwible	2017-03-27 17:02:11
CFA - Fort Collins	tcwible	2017-03-27 21:42:40
Poudre Water Allocation	marabi	2017-03-28 18:45:53

Search:

Type	Size
Integrated Urban Water Management Model r2016a	
swat	
CLEAN Nutrient Dashboard	
Flow Analysis	

Active Group: City of Fort Collins Water Systems

Edit

Share

Remove

Members

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Carol Webb (cwebb)

Hadi Heidari (Hheidari)

Jill Oropeza (joropeza)

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Thank you.

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