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Colorado Water & Growth Dialogue

Rocky Mountain Land Use Institute
March 17, 2017

A Growing Opportunity

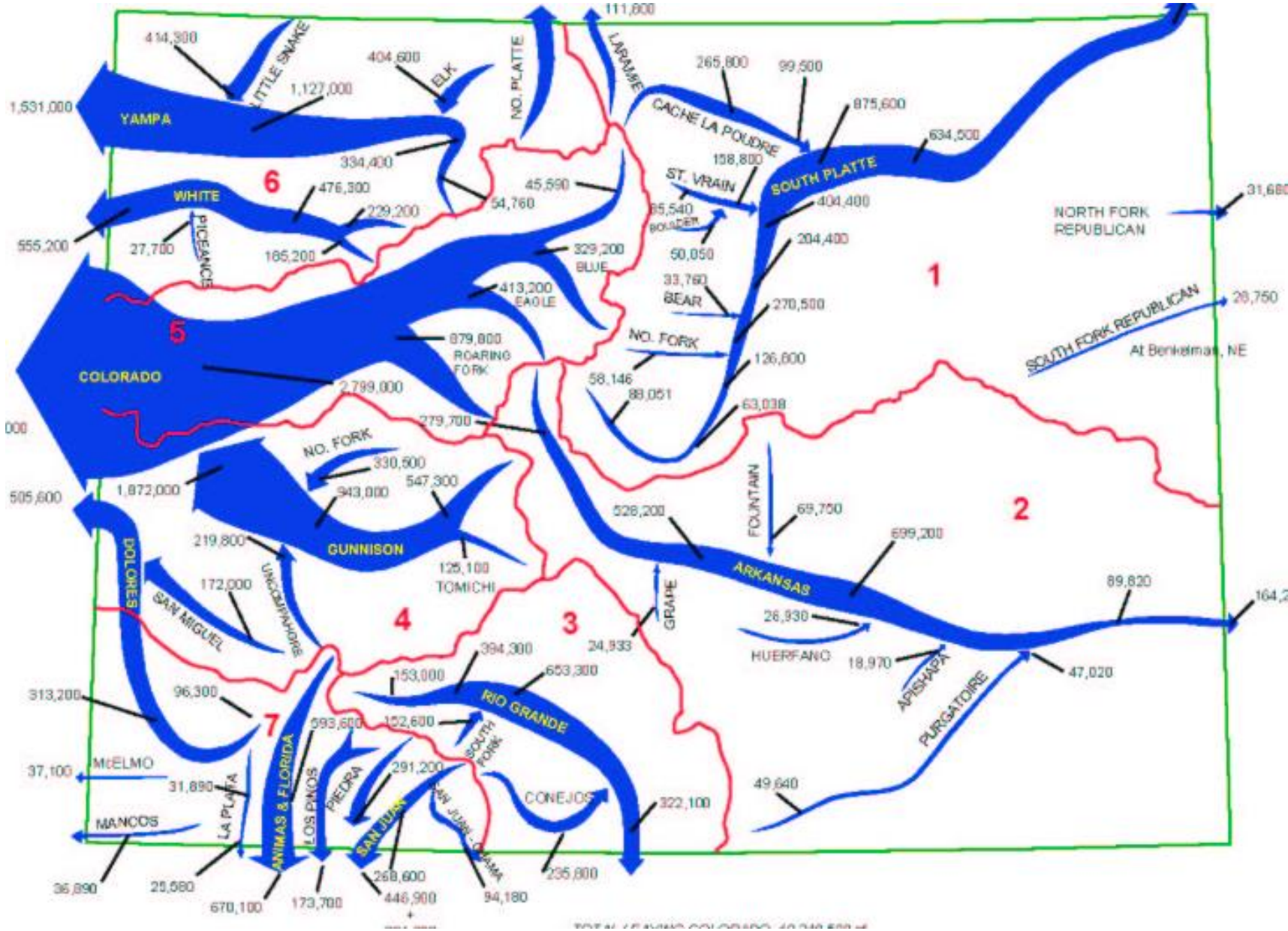
- At some point in the next 30-50 years Colorado's population will double and hit 10 million people, greatly increasing the demand for water.
- By 2050, most people will live in buildings that are yet to be built.
- We typically deal with water supply gaps by developing new supply (water storage), reusing water in rivers, and reducing demand through conservation.
- The Colorado Water and Growth Dialogue is examining to what extent integrating land and water planning can reduce demand
- To date, there has been little integration of land and water planning

Goals

- Demonstrate how much water can be saved through the integration of water and land use planning;
- Develop a consensus-based set of recommended strategies;
- Provide local communities with data, information and a tool box of strategies so that they may make better informed decisions

Scope

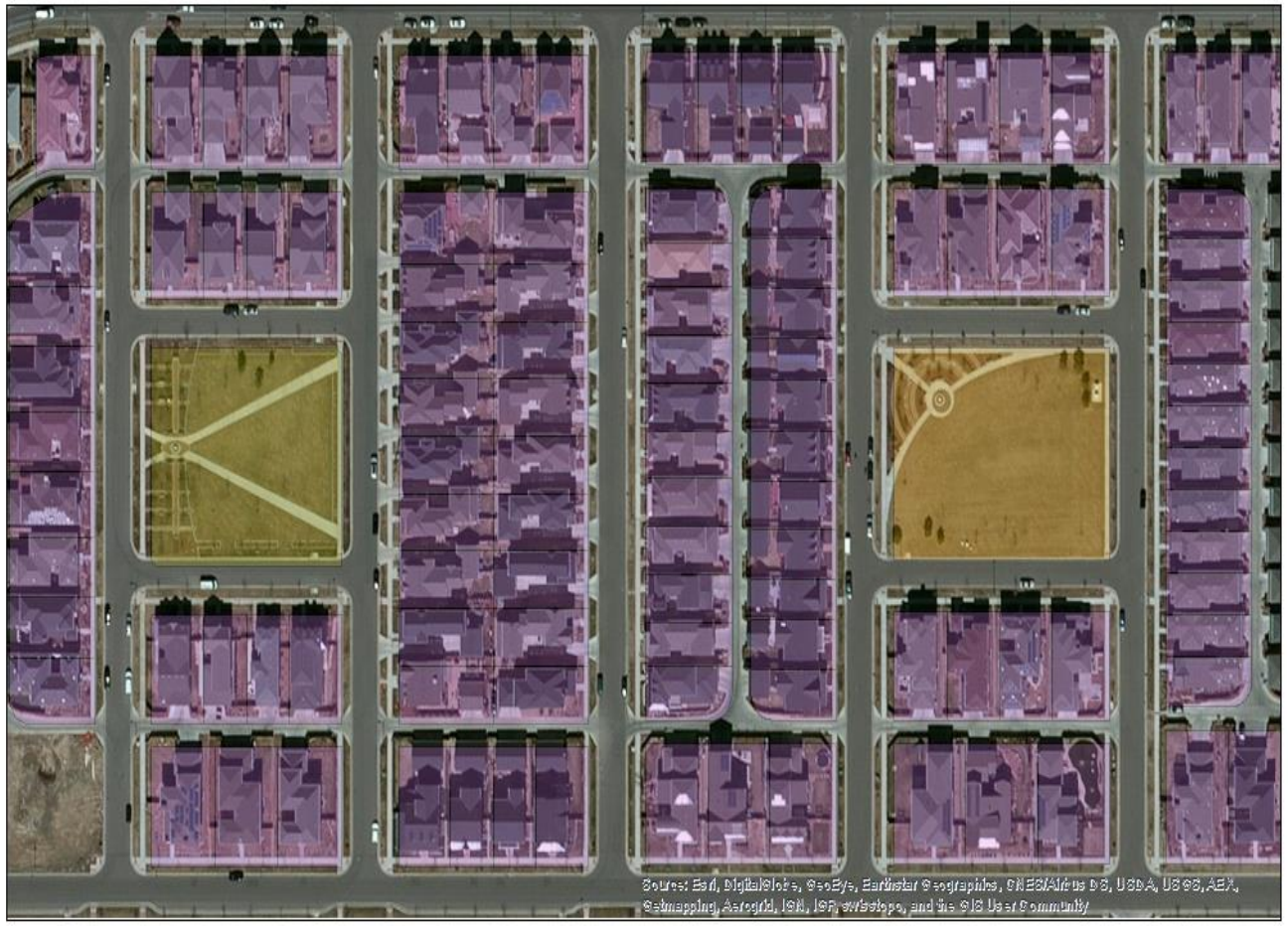
- **Focus**: Strategies to save water prior to residents moving into new homes.
- **Geography**: The DRCOG region
- **Planning time horizon**: 2040



Convening the right stakeholders

- Land planners
- Waters providers
- Developers
- Public officials and policy makers
- Economic development interests
- Other key stakeholders

Develop Smaller Single Family Lots



Legend

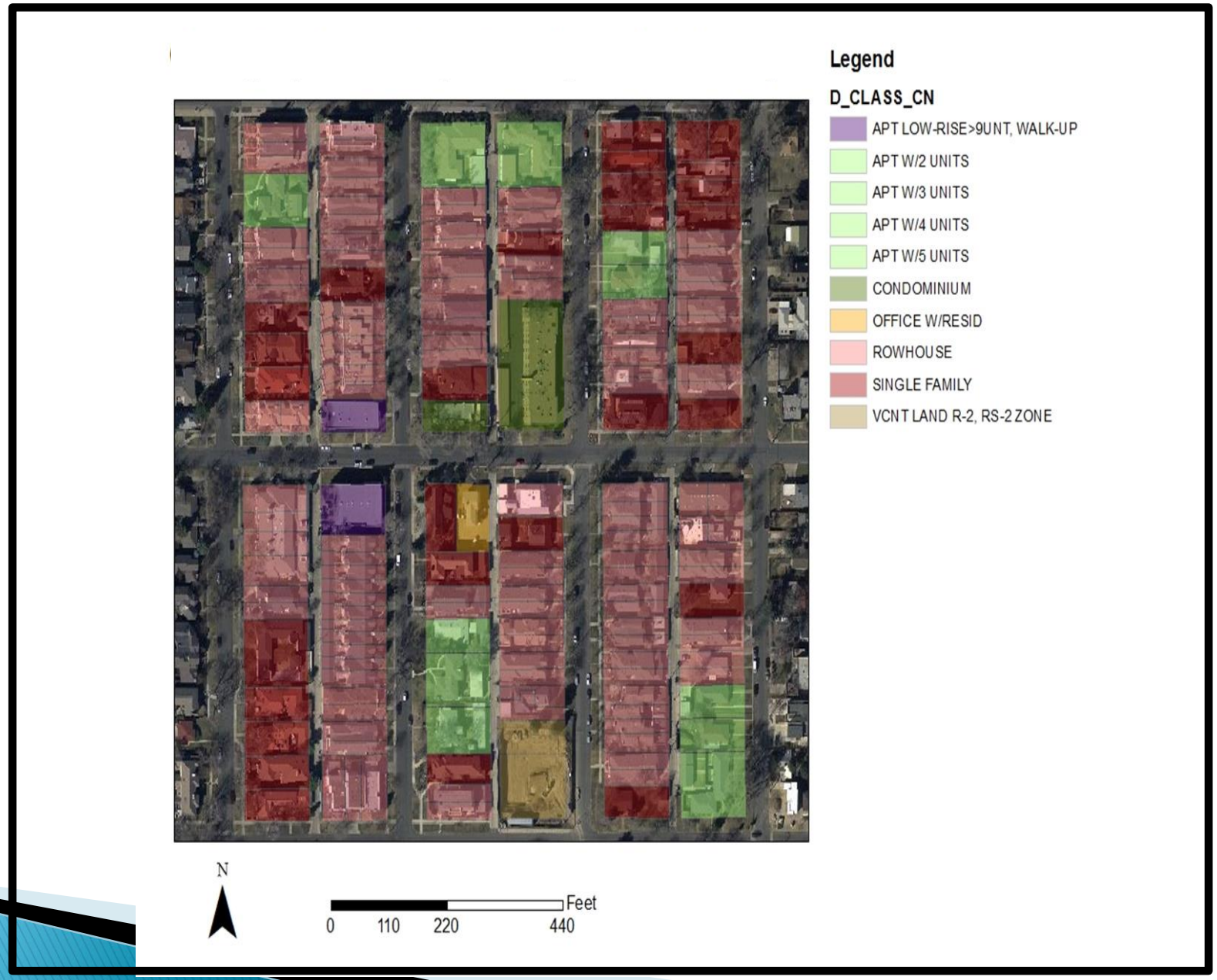
D_CLASS_CN

- SINGLE FAMILY
- VCNT LAND 0-1 ZONE
- VCNT LAND R-2, RS-2 ZONE

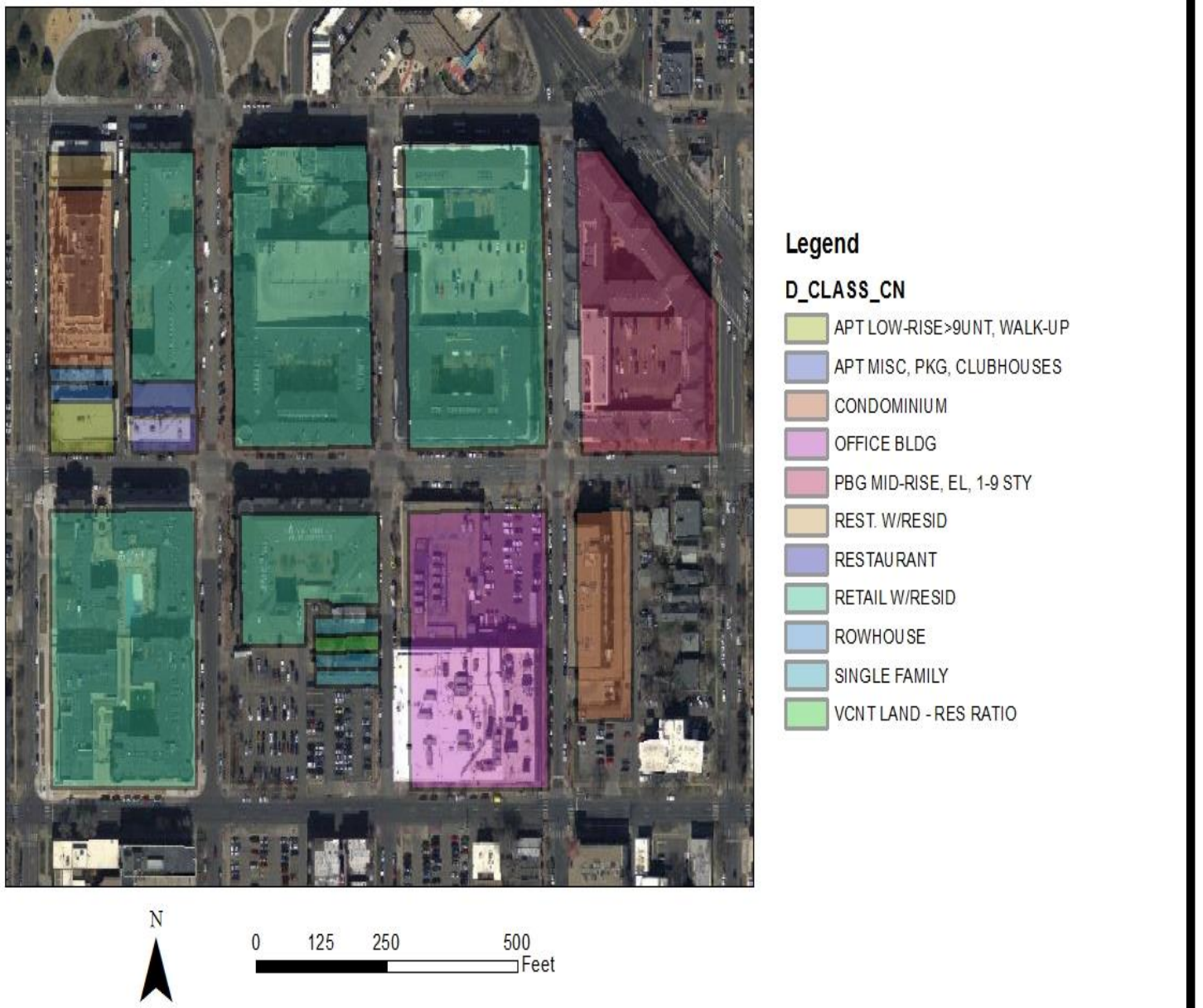
0 125 250 Feet

N

Change from Single Family to Multifamily



Increase Density of Multifamily



Density

2010 Census	People per Square Mile
New York	27,000
	26,000
	25,000
	24,000
	23,000
	22,000
	21,000
	20,000
	19,000
	18,000
San Francisco	17,000
	16,000
	15,000
	14,000
	13,000
Chicago	12,000
	11,000
	10,000
	9,000
Baltimore	8,000
	7,000
Denver Water Service Area 2050	6,000
St. Louis	5,000
Denver Water Service Area 2010	4,000
	3,000
	2,000
Nashville	1,000

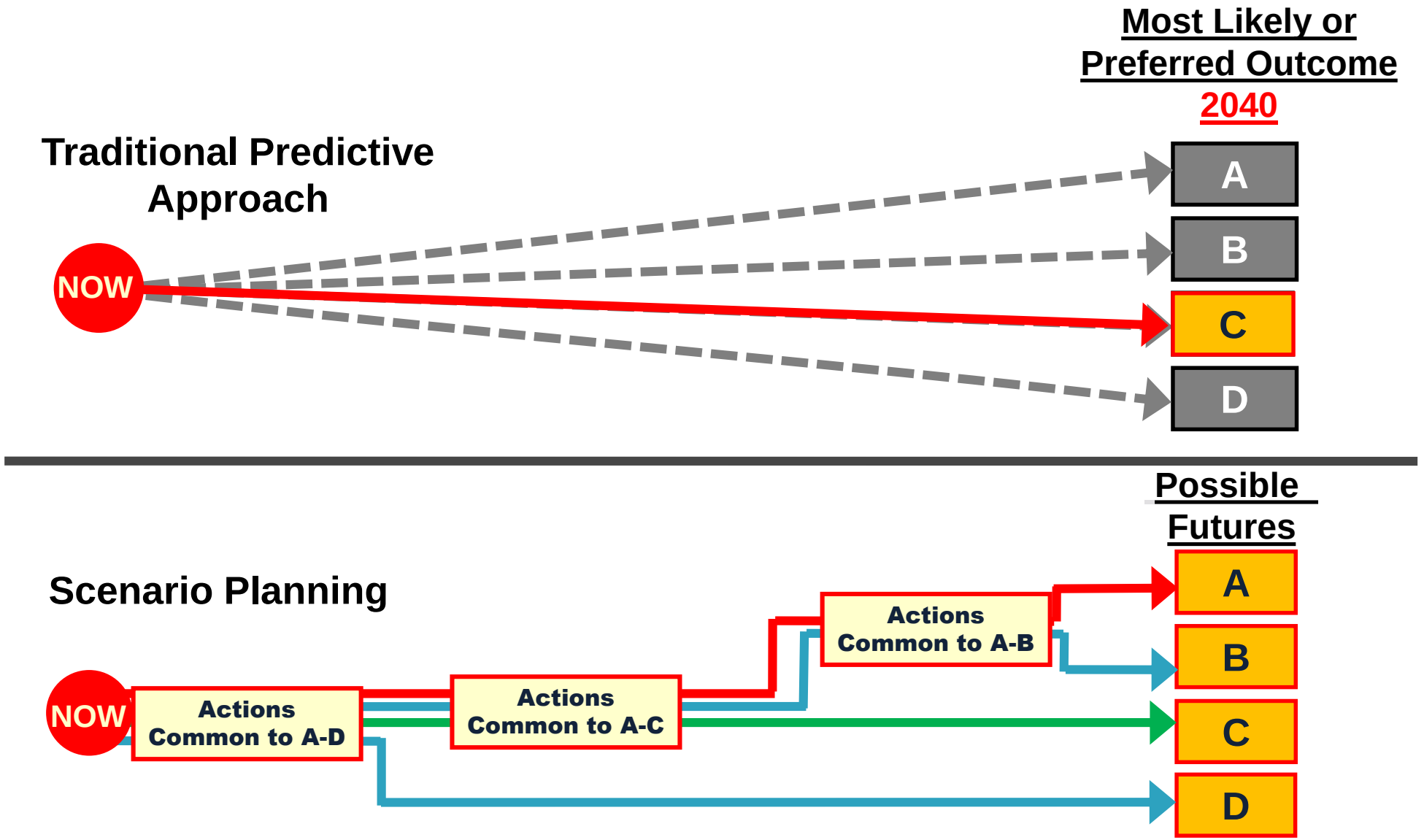
Restrict Use of Turf

40% turf

20% turf

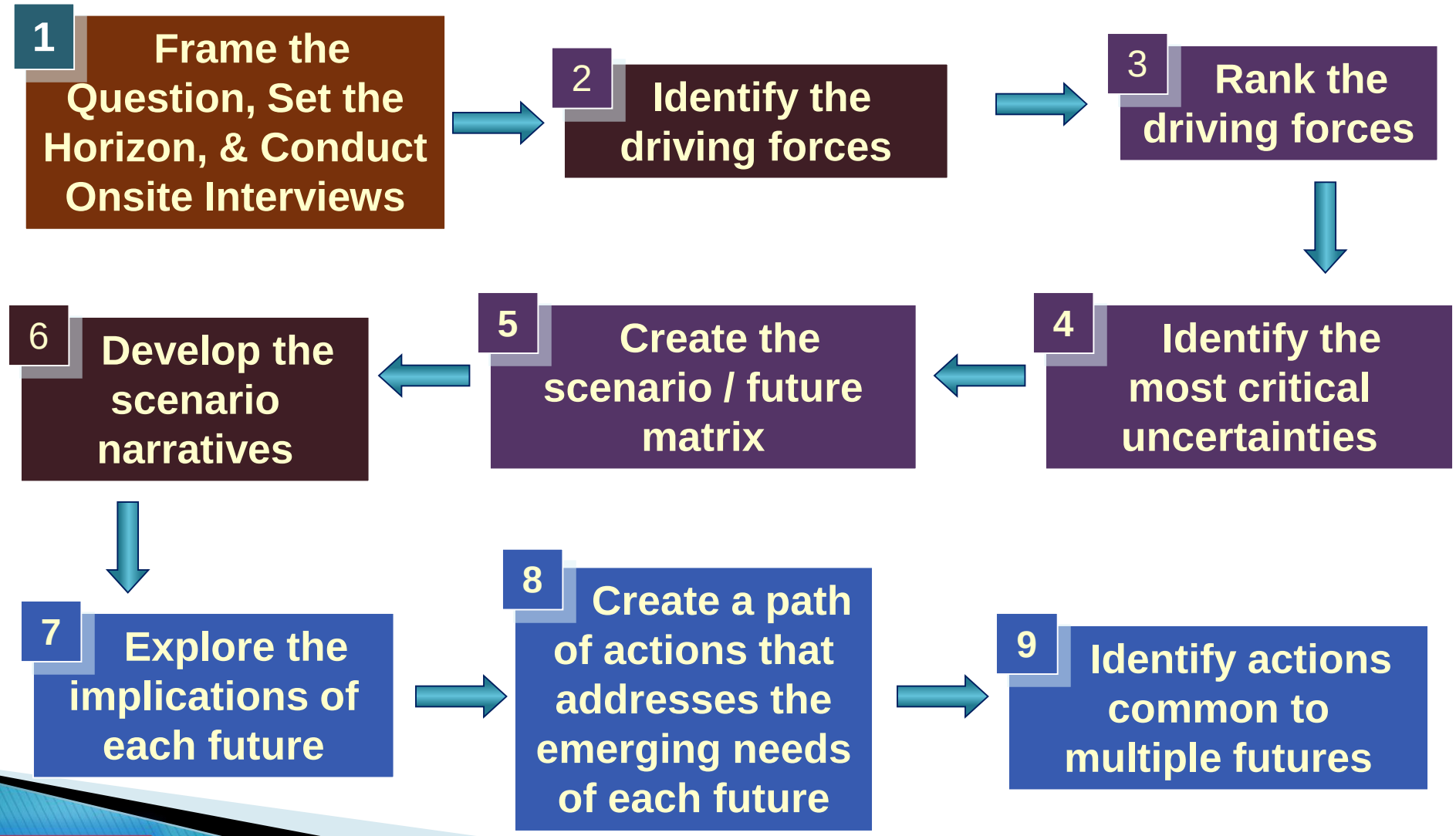
No turf

Traditional planning vs scenario planning



Source: Modified from Tucson Water

A Structured Deliberative Process



Exploratory Scenario Planning – Focal question

How can changes in urban form and landscaping practices for new growth and redevelopment assist in meeting future urban water demand along the Colorado Front Range?

Analyses being conducted and tools developed:

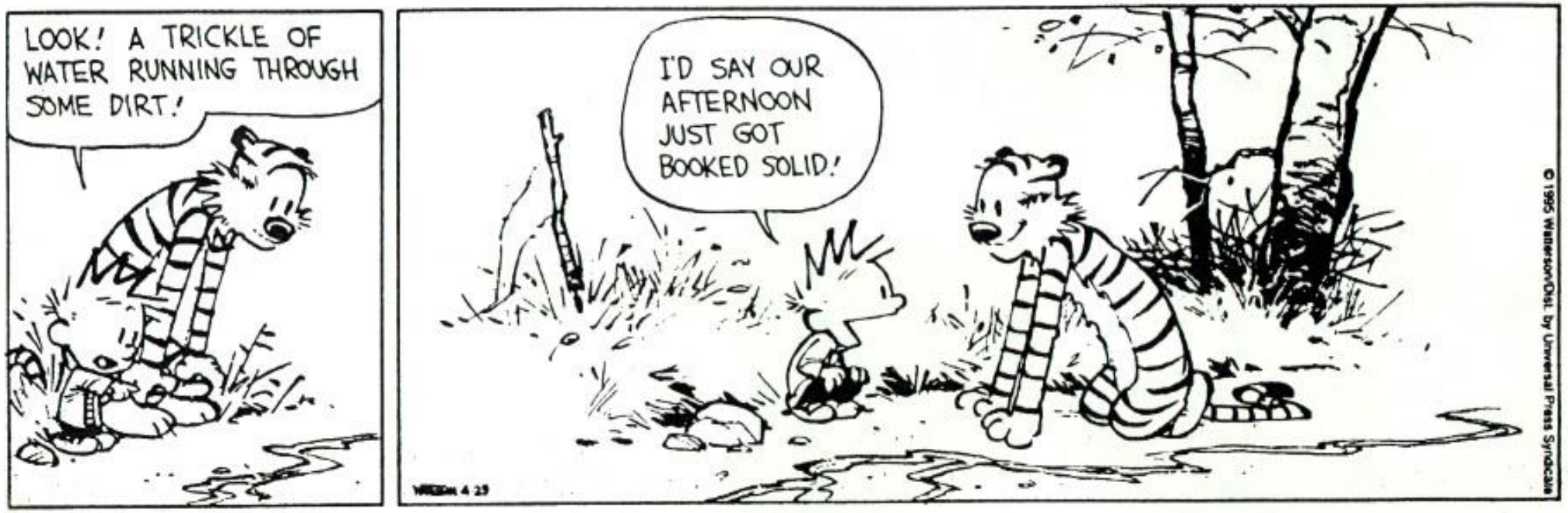
- Exploratory Scenario Planning
- Quantitative scenario planning
- Landscaping policy
- Residential Land Use and Water Demand Tool

Tools and Resources

- A final report due out Summer 2017 that will include:
  - A set of water saving strategies for communities
  - Data on density and landscaping

- Open access to and trainings on the Residential Land Use and Water Demand Tool

Calvin and Hobbes by Bill Watterson



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The Dance Between Water Use and Residential Density

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Residential Density and Water Use

- Commonly held perception:

  Per capita water use declines as residential density increases.

- Emerging research:

  More complex and not as certain.

Water Research Foundation Project 4633:
Urban landscape water use research evaluation

- In Portland and Phoenix, negative correlation between zoning and building area (Shandas & Parandvash, 2010, Ouyang et al. 2014).
- Portland, outdoor water responsive to building density, Phoenix it was vegetation (Breyer 2012).
- Phoenix socioeconomic factor spatial patterns negatively related to water use (Randall 2014).
- Tucson reduced landscaping/water use related to the distance to natural amenities (Halper 2011).
- Tucson presence of a pool most significant factor in models of MFoutdoor water use (Agthe, Billings and Bruce 2002).
- Austin though lot and house size correlated with water use, effect was small (Tinker et al. 2005).
- Central California climate accounts for 80% of difference between similar density and lot size located in different regions (Hanak and Davis 2006).
- Salt Lake City commercial more frequently over watered compared to residential (Farag et al. 2011).
- Businesses value lush landscapes more than residential to attract customers while residential values how it is used (Endter-Wada et al. 2008).

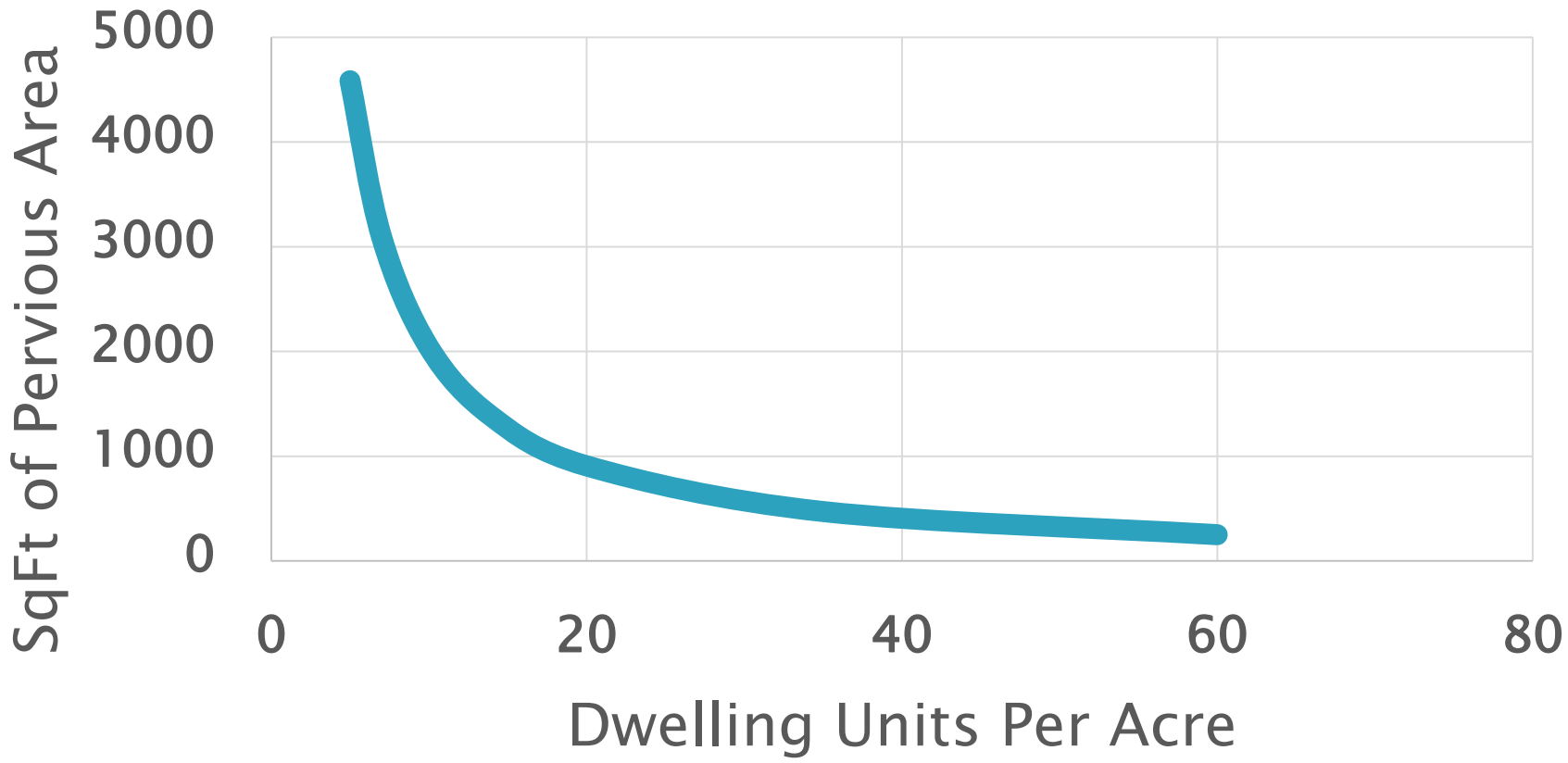
Complexity and Uncertainty

- Water use results from the needs of complex and adaptive systems – Social, Economic, and Environmental.
- Can we predict the future? Not really!
- Think about it in terms of complexity and uncertainty.

Residential Water Demand: Complex

- Indoor Water Demand
  - Human Consumption, Sanitary (Flushing, Bathing, Cleaning), Washing (Clothes, Dishes)
  - A function of people and their personal needs
- Outdoor Water Demand: Everything else
  - Irrigating Landscaping, Pools, Washing, Cooling Towers
  - A function of what? A mix of factors: Square Feet, Units – people
- Many related factors within complex systems

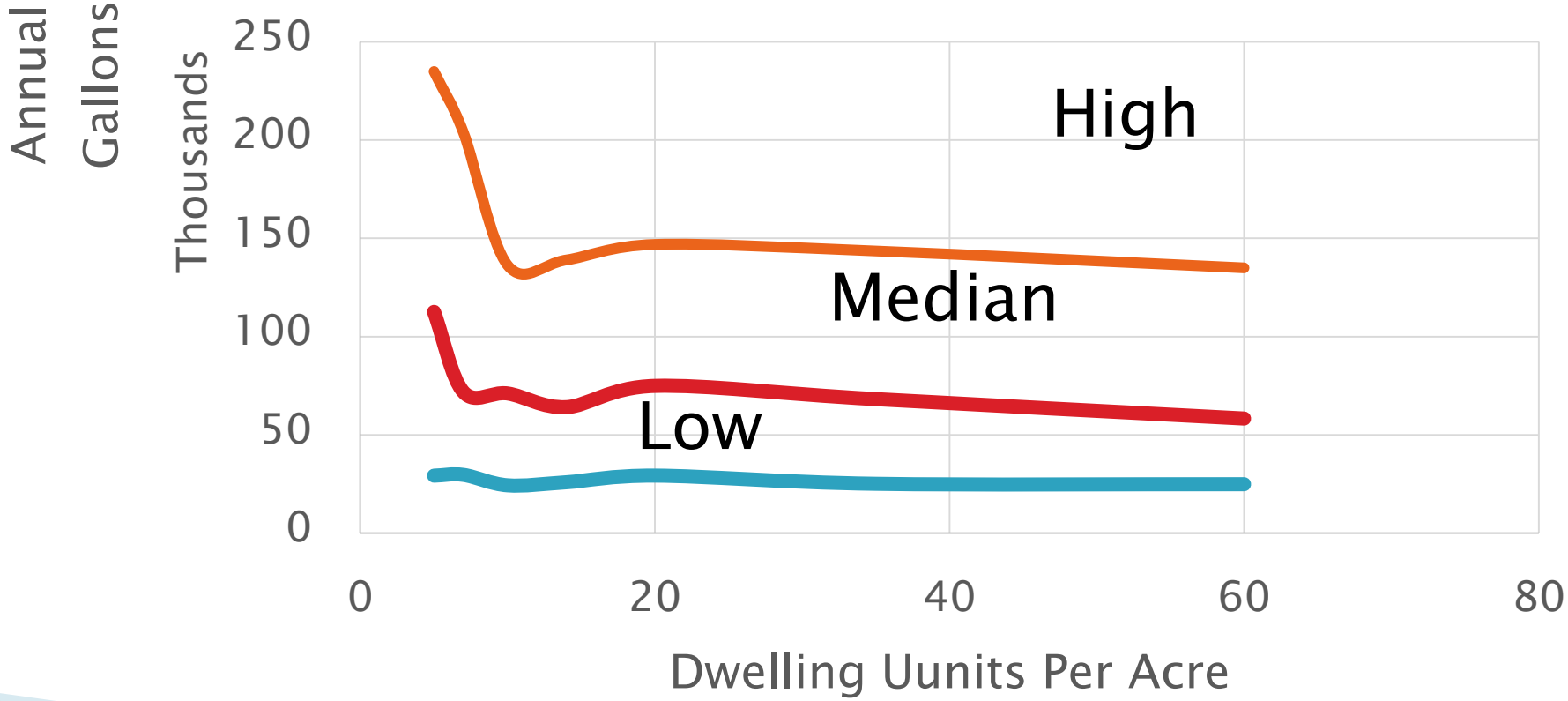
Pervious SqFt Per Dwelling Units Per Acre



Residential Water Demand: Uncertain

- Indoor Water Demand
  - People – Factors that affect personal water needs
    - Income, Culture, Age, Politics (Environmental)
  - Infrastructure – Factors that affect efficiency
    - Toilet, Showerhead, clothes washer, treatment
  - Range:25 GPCD to 150 Gallons Per Capita per Day
- Outdoor Water Demand
  - Personal Choice : Factors that affect landscape irrigation needs
    - Housing choices and Landscape area size
    - Plant choices
    - Maintenance and Infrastructure Choices
  - External : Factors that affect irrigation needs
    - Climate: Hotter / drier or wetter
    - Regulation: Development review and enforcement
  - Range : 2 to 300 Gallons Per Square Foot Per Year.

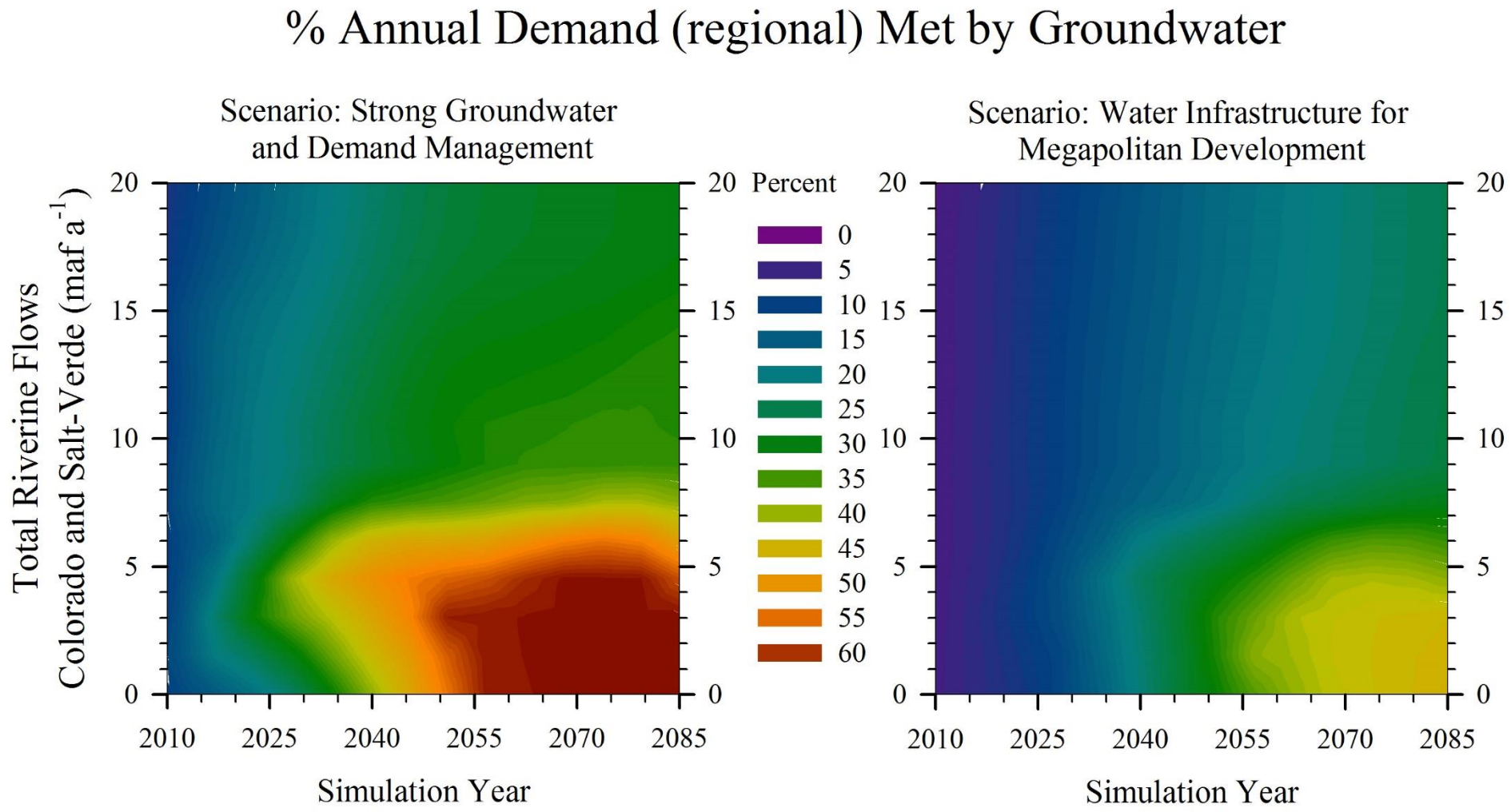
Range of Annual Per Unit Water Use By Dwelling Units Per Acre



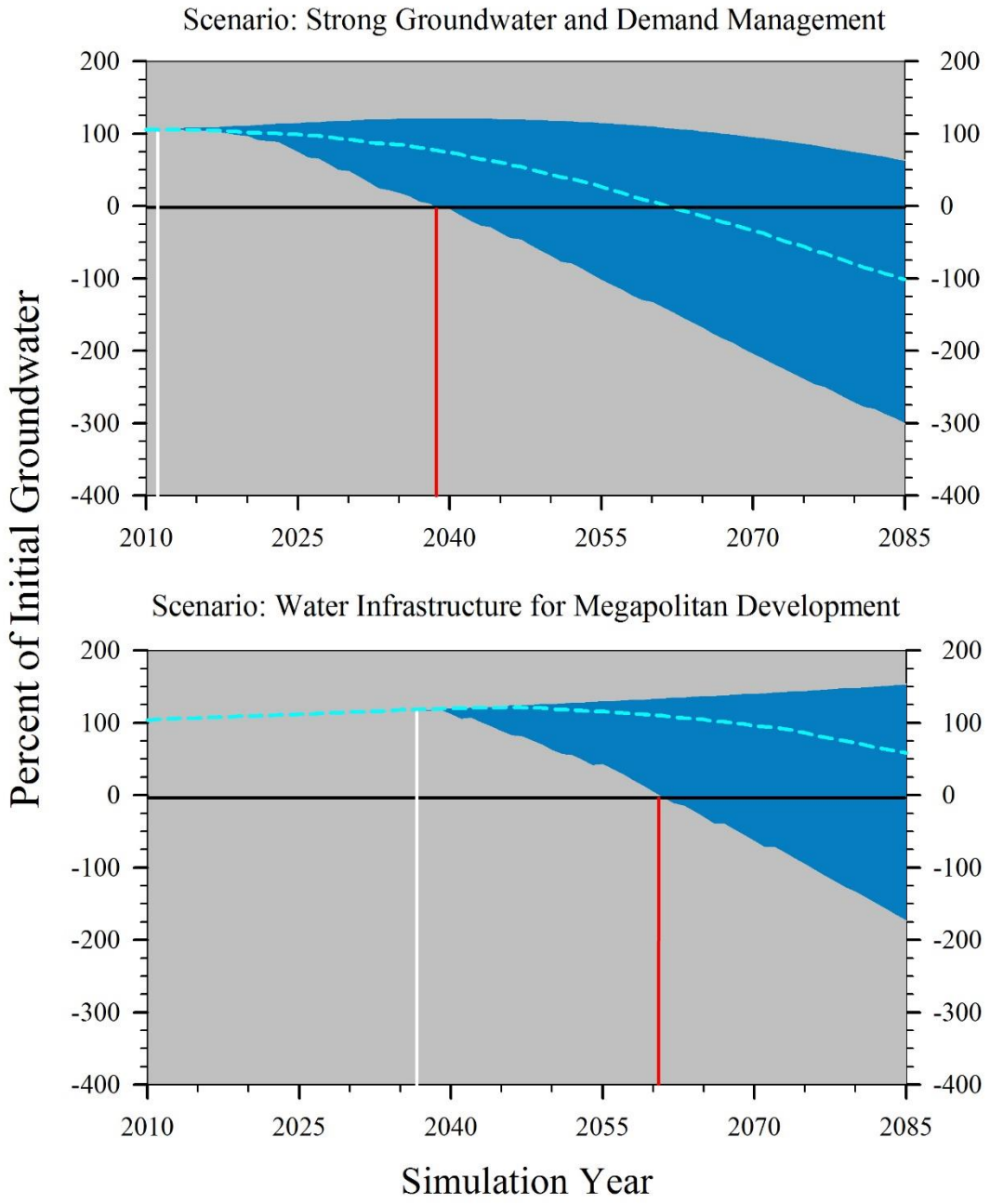
Colorado Water and Growth Exploratory Scenario Analysis

- Looking for the strategic aspects of relationship between residential density and water use.
  - Using Denver's Residential Water Demand Model
  - Identify scenarios based on the variation and uncertainty of factors related to land use that affect water use
  - Create scenarios of different residential density.
  - Estimate water use across the factor and land use scenarios.
  - Look for patterns that suggest strategic insight.
- Strategic insights can be used by water managers and land use planner to plan for possible futures and influence key factors that impact water demand.

WaterSim Results



Case Example: Phoenix, Arizona



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