



KEYSTONE
POLICY CENTER

Colorado Water & Growth Dialogue

Water Resources Review Committee
September 20, 2016

A Growing Opportunity

- ▶ By 2050, Colorado's population is projected to double, greatly increasing the demand for water.
 - ▶ Colorado is already a water short state.
 - ▶ By 2050, most people will live in buildings that are yet to be built.
 - ▶ To date, there has been little integration of land and water planning
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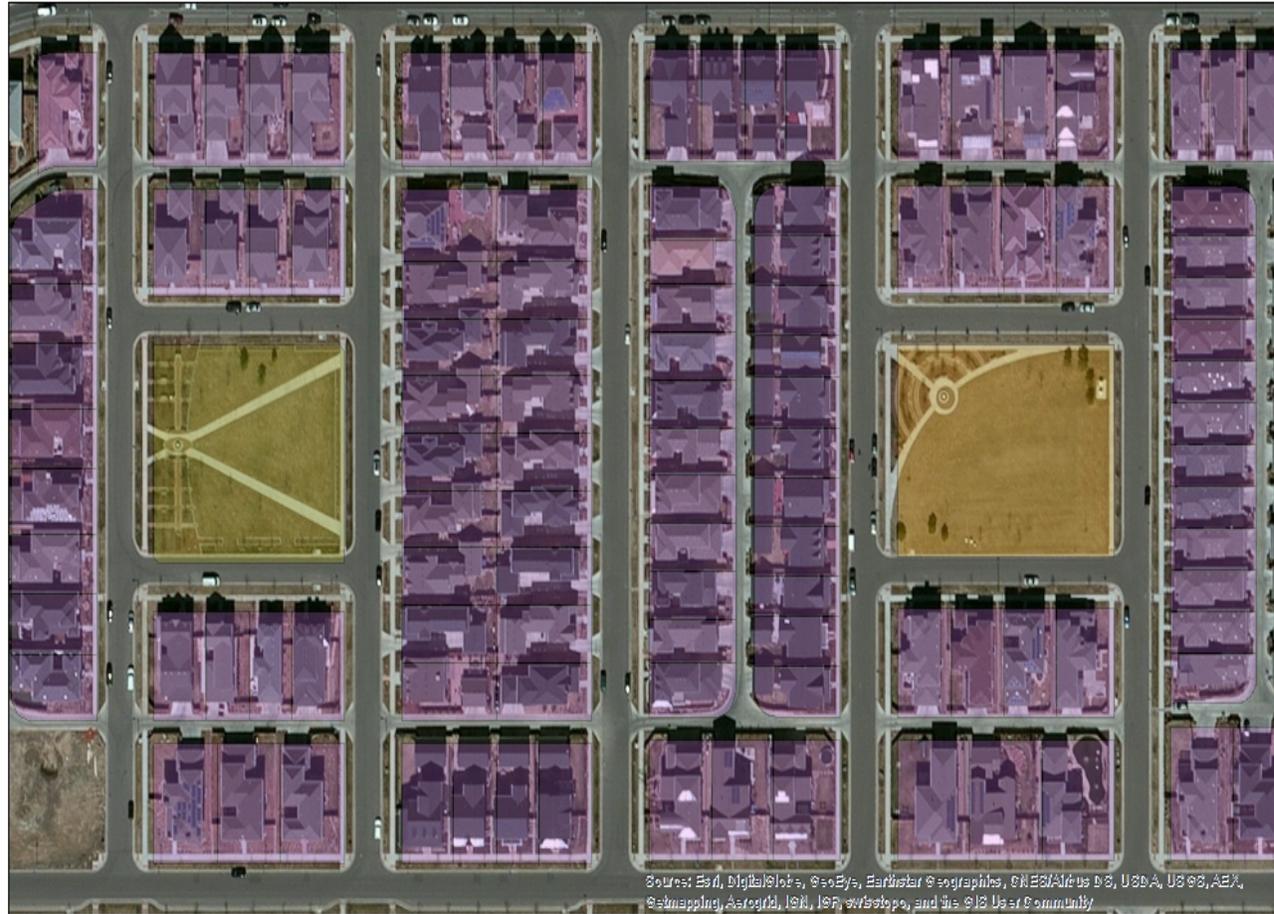
Goals

- ▶ 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
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Scope

- ▶ **Focus:** Strategies to save water prior to residents moving into new residents. Excludes retrofitting and modifying customer behavior.
 - ▶ **Geography:** The Denver Water and Aurora Water service areas
 - ▶ **Planning time horizon:** 2040
 - ▶ **Stakeholders:** Water providers, land use planners, developers, economic development interests, public officials, and other key stakeholders
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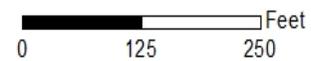
Develop Smaller Single Family Lots



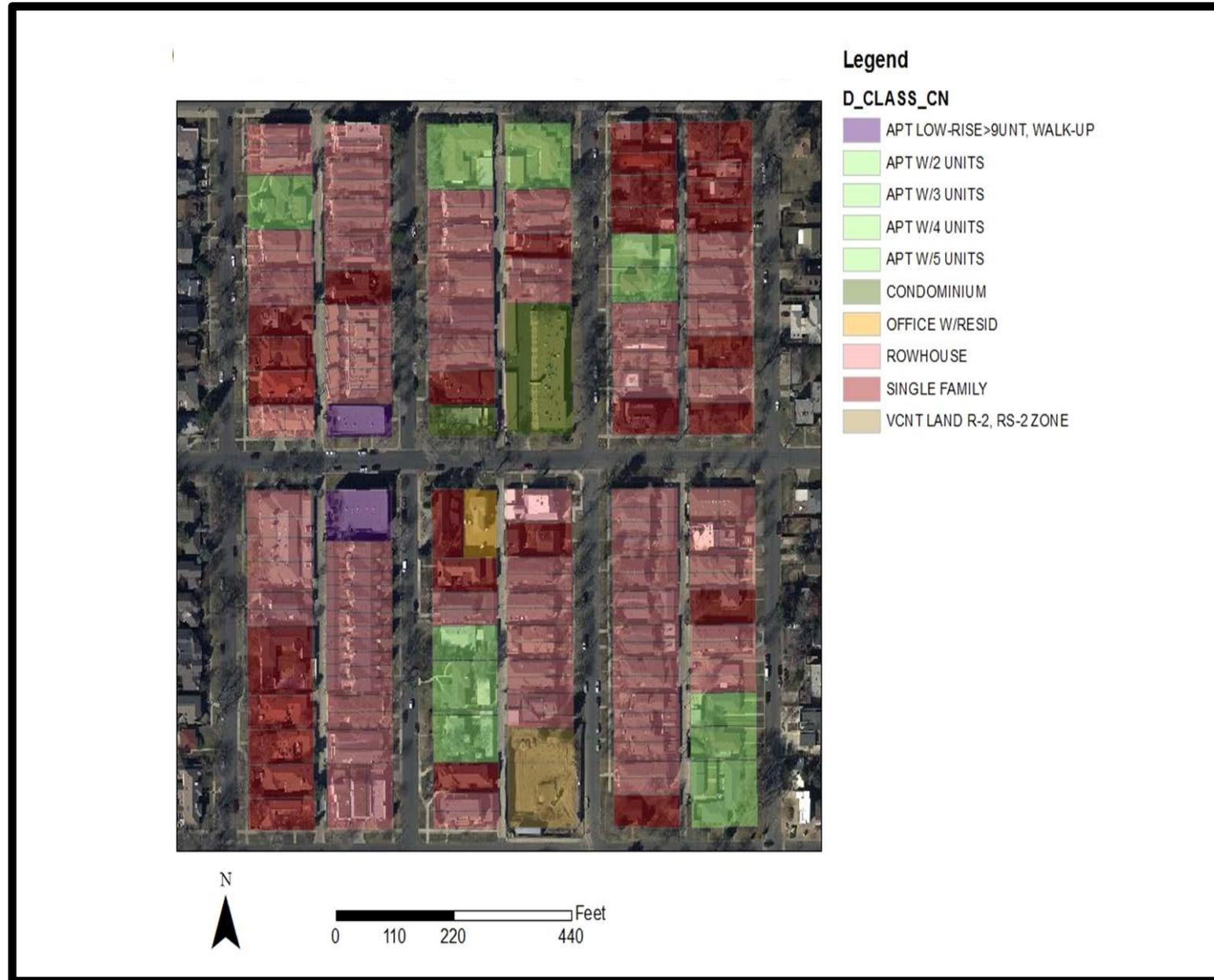
Legend

D_CLASS_CN

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



Change from Single Family to Multifamily



Increase Density of Multifamily



Legend

D_CLASS_CN

- APT LOW-RISE>9UNT, WALK-UP
- APT MISC, PKG, CLUBHOUSES
- CONDOMINIUM
- OFFICE BLDG
- PBG MID-RISE, EL, 1-9 STY
- REST. W/RESID
- RESTAURANT
- RETAIL W/RESID
- ROWHOUSE
- SINGLE FAMILY
- VCNT LAND - RES RATIO



0 125 250 500 Feet

Restrict Use of Turf



40% turf



20% turf



No turf

Density

<u>2010 Census</u>	<u>People per Square Mile</u>
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

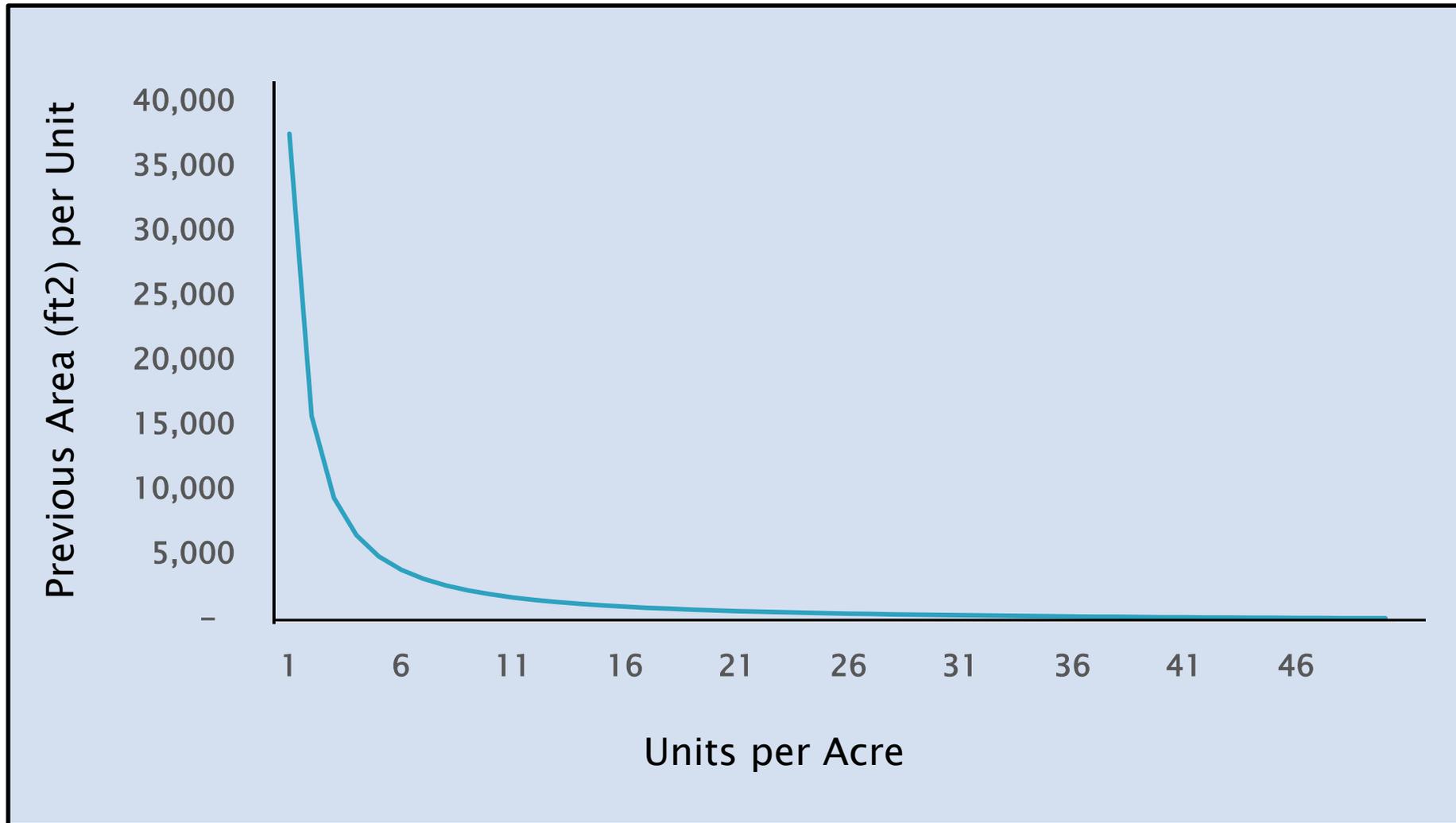


Stapleton Development



85 lots
8,000 people per square mile

Residential Density Reduces Outdoor Water Use



DENSITY COMPARISON MODEL



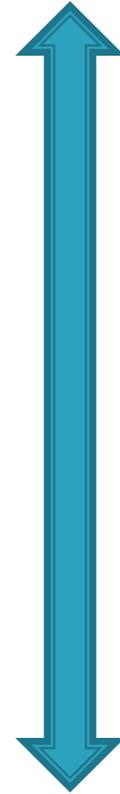
Annual Demand, AF	1.2
Indoor, AF	0.3
Seasonal, AF	0.9
Population	5
GPCD	199



Annual Demand, AF	16.2
Indoor, AF	15.0
Seasonal, AF	1.2
Population	244
GPCD	59

Land Use and Residential Density – high-level findings

1. Smaller Lots (\pm 5,000 sq. ft.) consume less water than larger lots.
2. Townhouses consume less water than small lots.
3. Low to Mid-rise multi-family consume less water than townhouses



35–65%
water savings per
capita compared to
typical single family
homes

Residential Land Use and Water Demand Tool

SECURITY WARNING: Macros have been disabled. [Enable Content]

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Key		Table 1. Population Distribution by Product Type			Table 2. User Assumptions			Table 3. User Guides	
Changeable User Input	Calculated Output								
		Table 1. Population Distribution by Product Type			Table 2. User Assumptions			Table 3. User Guides	
Scenario Name					Persons per Household		Indoor GPCD	Units per Acre Guide	
Total Population	100,000	100,000	100,000		Large Single Family		Large Single Family	Product Type Observations	
Large Single Family Population	25,000	10,000	5,000		Typical Single Family		Typical Single Family	Large Single Family	
Typical Single Family Population	10,000	25,000	5,000		Small Single Family		Small Single Family	Typical Single Family	
Small Single Family Population	25,000	10,000	25,000		Townhome		Townhome	Small Single Family	
Townhome Population	10,000	25,000	10,000		3-Story Walkup		3-Story Walkup	Townhome	
3-Story Walkup Population	5,000	20,000	25,000		Mid-Range Multifamily		Mid-Range Multifamily	3-Story Walkup	
Mid-Range Multifamily Population	5,000	5,000	20,000		High Density Multifamily		High Density Multifamily	Mid-Range Multifamily	
High Density Multifamily Population	20,000	5,000	10,000					High Density Multifamily	
					Average Units per Acre		Seasonal GPSF (pervious)		
					Large Single Family		Large Single Family	Seasonal Gallons per Square Foot Guide	
					Typical Single Family		Typical Single Family	Seasonal GPSF (Pervious)	
					Small Single Family		Small Single Family	Inefficient for Bluegrass	
					Townhome		Townhome	Efficient for Bluegrass	
					3-Story Walkup		3-Story Walkup	Highly Efficient for Bluegrass/Some Xeriscape	
					Mid-Range Multifamily		Mid-Range Multifamily	Xeriscape	
					High Density Multifamily		High Density Multifamily	Little or No Seasonal Use	
								Seasonal GPSF (Pervious) Observations	
								Large Single Family	
								Typical Single Family	
								Small Single Family	
								Townhome	
								3-Story Walkup	
								Mid-Range Multifamily	

Table 4. Model Output			
Estimated Acres of Development	#DIV/0!	#DIV/0!	#DIV/0!
Pervious Area Required (acres)	0	0	0
Annual Indoor Demand, AF	0	0	0
Annual Seasonal Demand, AF	0	0	0
Total Annual Demand, AF	0	0	0
Overall GPCD	0	0	0
AF per Acre per Year	#DIV/0!	#DIV/0!	#DIV/0!

Other approaches and results

1. Limits on irrigation – regardless of lot size – are effective
 2. Higher density development will need less water due to lowering the amount of landscaping
 3. Improved water pricing, sub-metering and water budgets can lower water demand
 4. Improved plumbing codes have potential if mandated
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What Tools to Focus On

- Zoning Regulations
Minimum densities; limits on irrigated turf
 - Building Codes
Can require water saving techniques & technologies
 - Comprehensive Plans
Only if they are implemented, can serve to bring land use and water planners together and serve as a framework
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