

This presentation premiered at WaterSmart Innovations

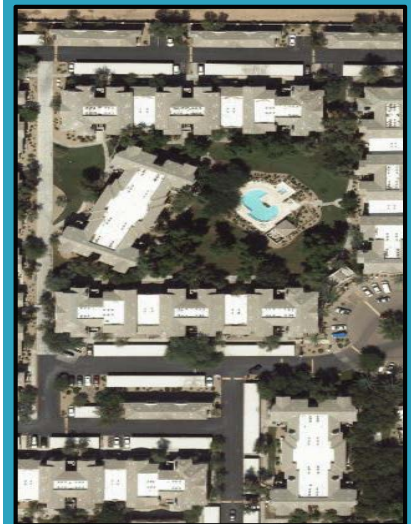
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EVALUATING WATER CONSERVATION POTENTIAL WITHIN THE MULTIFAMILY SECTOR



City of Phoenix Water Services Department



OVERVIEW

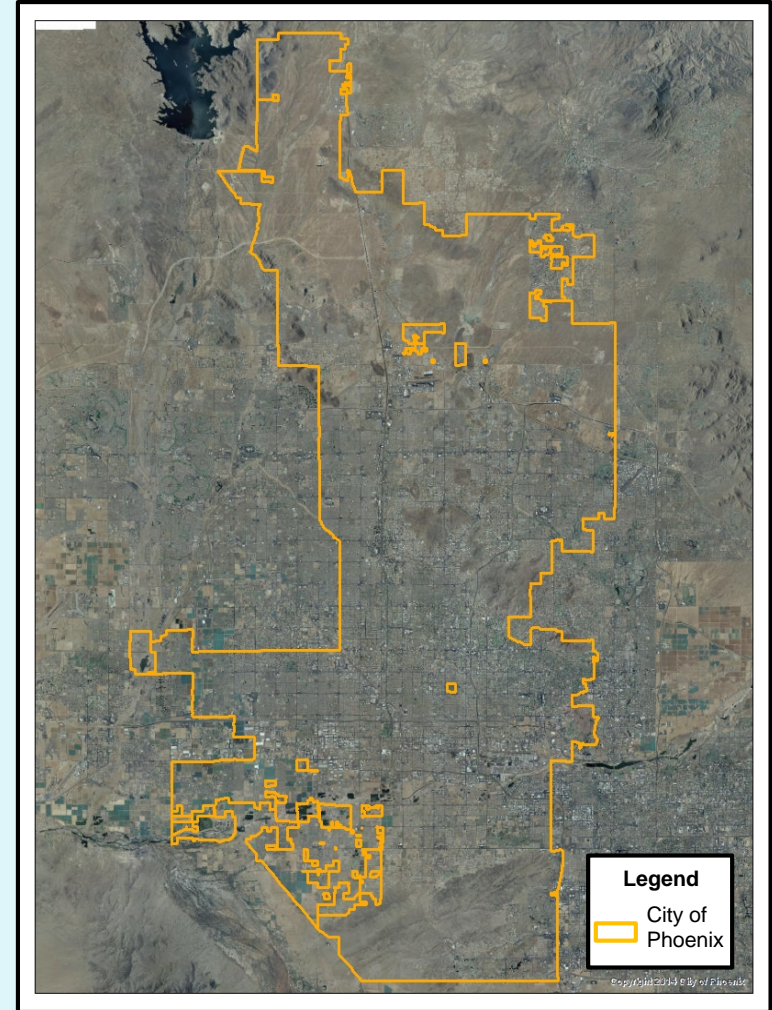
- **Why study multifamily water demand?**
- **Background of multifamily developments in Phoenix**
 - Types and Trends
- **Multifamily Data Analysis**
 - Data obstacles and complexities
 - Water use analysis
- **What we learned and what is the next phase of research?**

WHY STUDY MULTIFAMILY WATER DEMAND?

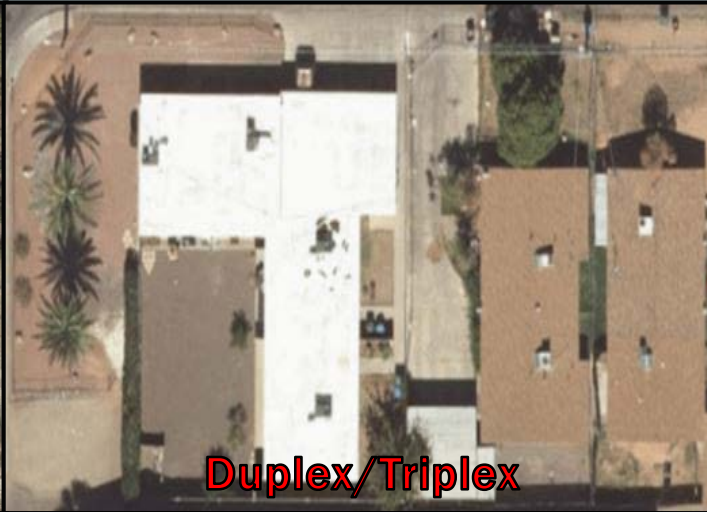
- **To gain a better understanding of multifamily water use**
 - Needed a better understanding of basic information (per unit use over time)
 - Information for tracking multifamily is complicated - not just the one-to-one relationship like single family (one meter to one residence)
- **Where were we at?**
 - Water consumption trends for existing multifamily developments (pre-1995)
- **Where are we at?**
 - Changes in water consumption for existing multifamily developments
 - Water consumption for newer multifamily developments (post-1995)
- **How low can we go?**
 - High efficiency indoor and outdoor fixtures
 - Landscape changes – lush vegetation to xeriscape
- **Inform our future water demand forecasts and projections for water resource planning**

PHOENIX CHARACTERISTICS

- Average annual rainfall 7-8 inches
- Total Population– 1,502,287
- Service Area – 540 square miles
- Approximately 2450 developments in database
 - Rental Units – 1500 developments
 - Condominiums – 950 developments
- Multifamily housing sector accounts for roughly 15% of total water use for Phoenix



DEVELOPMENT TYPES



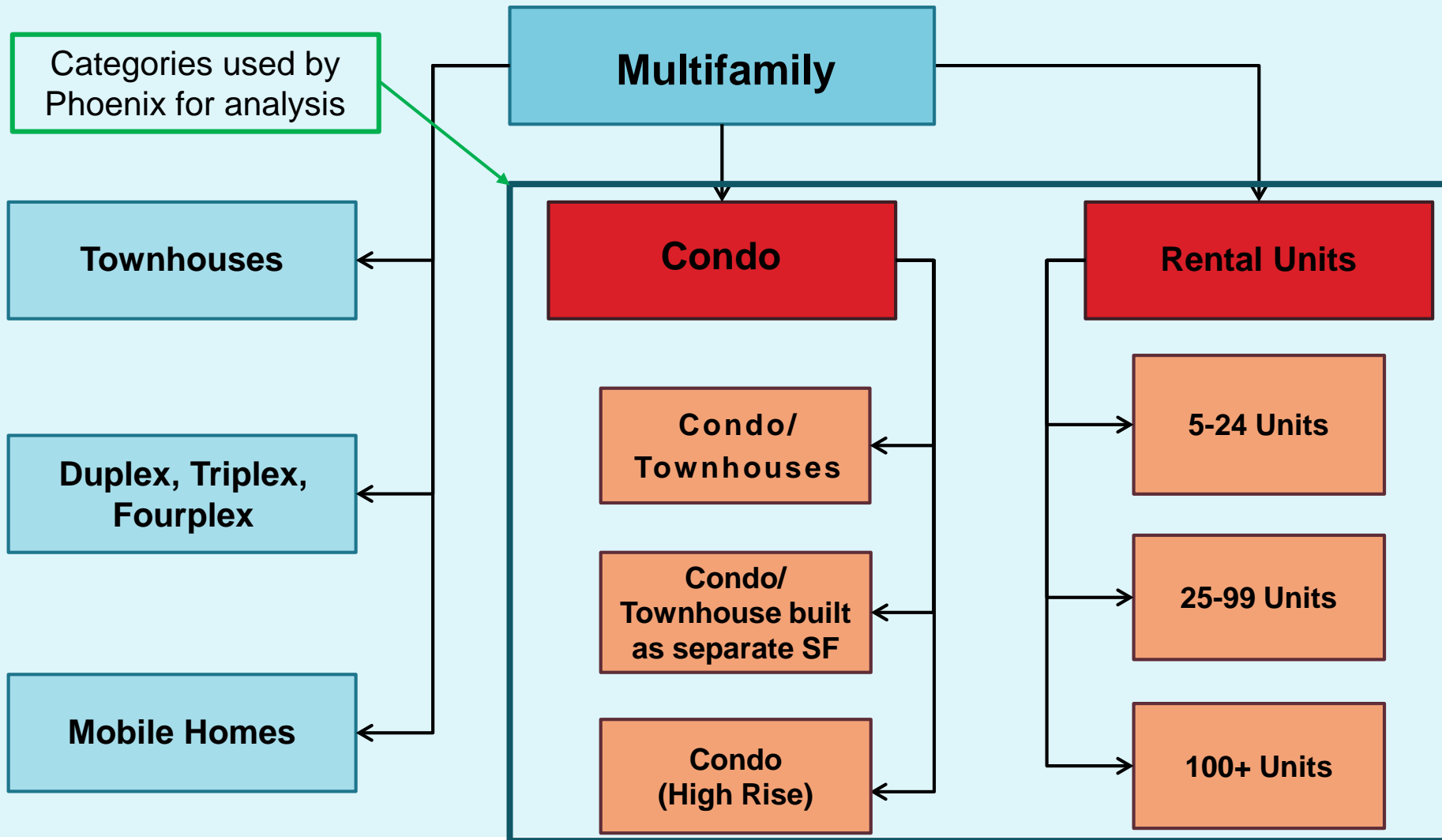
POTENTIAL MULTIFAMILY SUBSECTORS

- **ICI sectors have similar end use characteristics**
 - Hospitality (extended stay)
 - Retirement Communities
 - Timeshare
 - Dormitories
 - Correctional Facilities
 - Mixed-use (residential/retail)



DEVELOPMENTS TYPES

MARICOPA COUNTY ASSESSOR DATA CATEGORIES



DEVELOPMENT CHARACTERISTICS

■ Rental Units

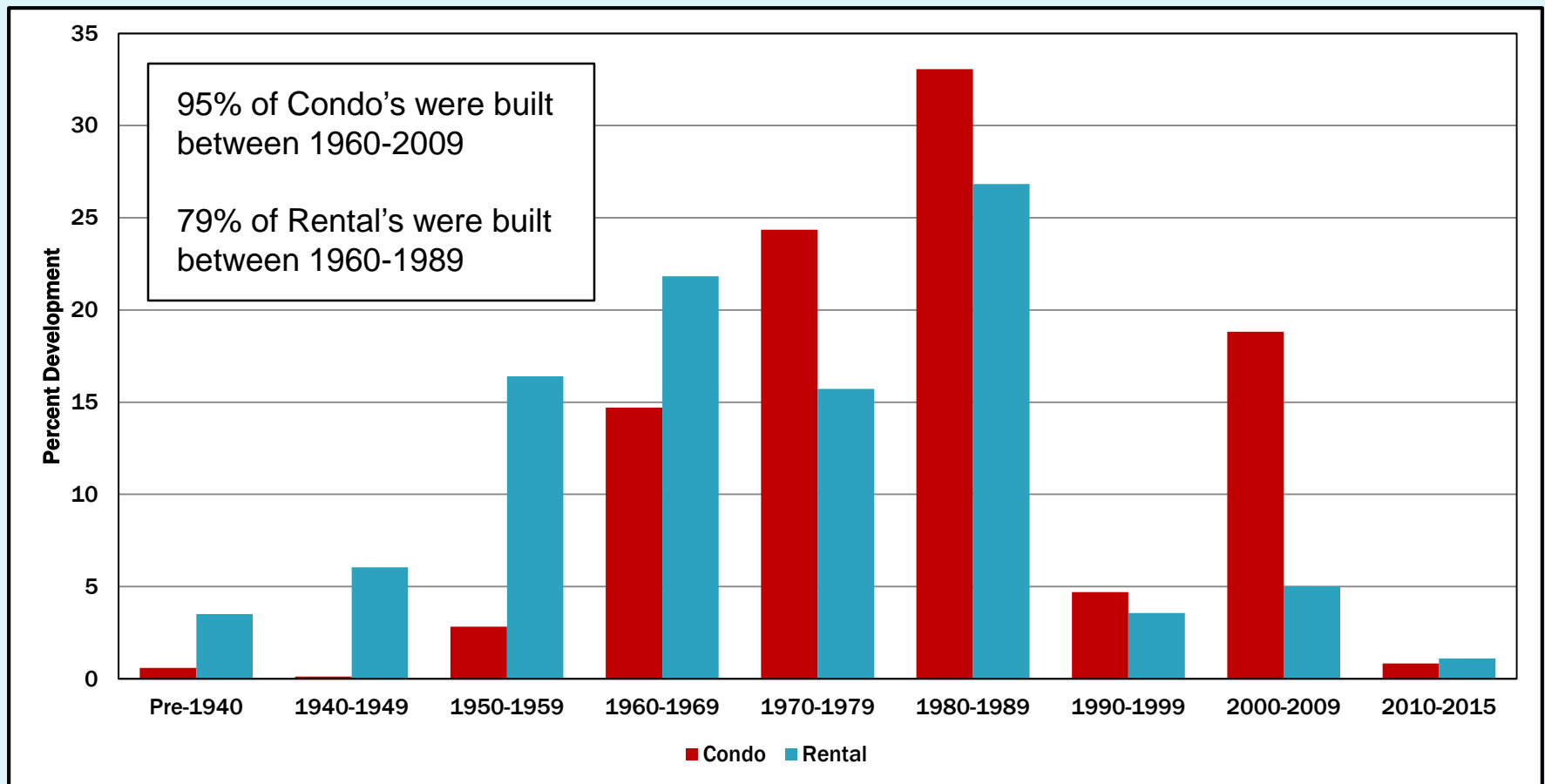
- Unified ownership – records aggregated to development
- Communal space – pool, clubhouse, laundry facility (newer have in-unit laundry), landscaped areas, playgrounds
- Master metered properties
- Developments with pools
 - 48 % of rental units – some developments have multiple pools
- Development with cooling towers
 - 4% of rental units - median build age 45 years old (tend to be older or high rise)

■ Condominiums

- Owner-occupied – individual records
- Combination of townhouse, row houses, patio homes and high-rise
- Both communal and private space – can have a combination of private and common pools/landscape within a development
- Both individually and master metered properties
- Developments with cooling towers – generally high rise
 - 3% of condominium developments
- Developments with pools
 - 75% of condominiums – some development have both common and private pools

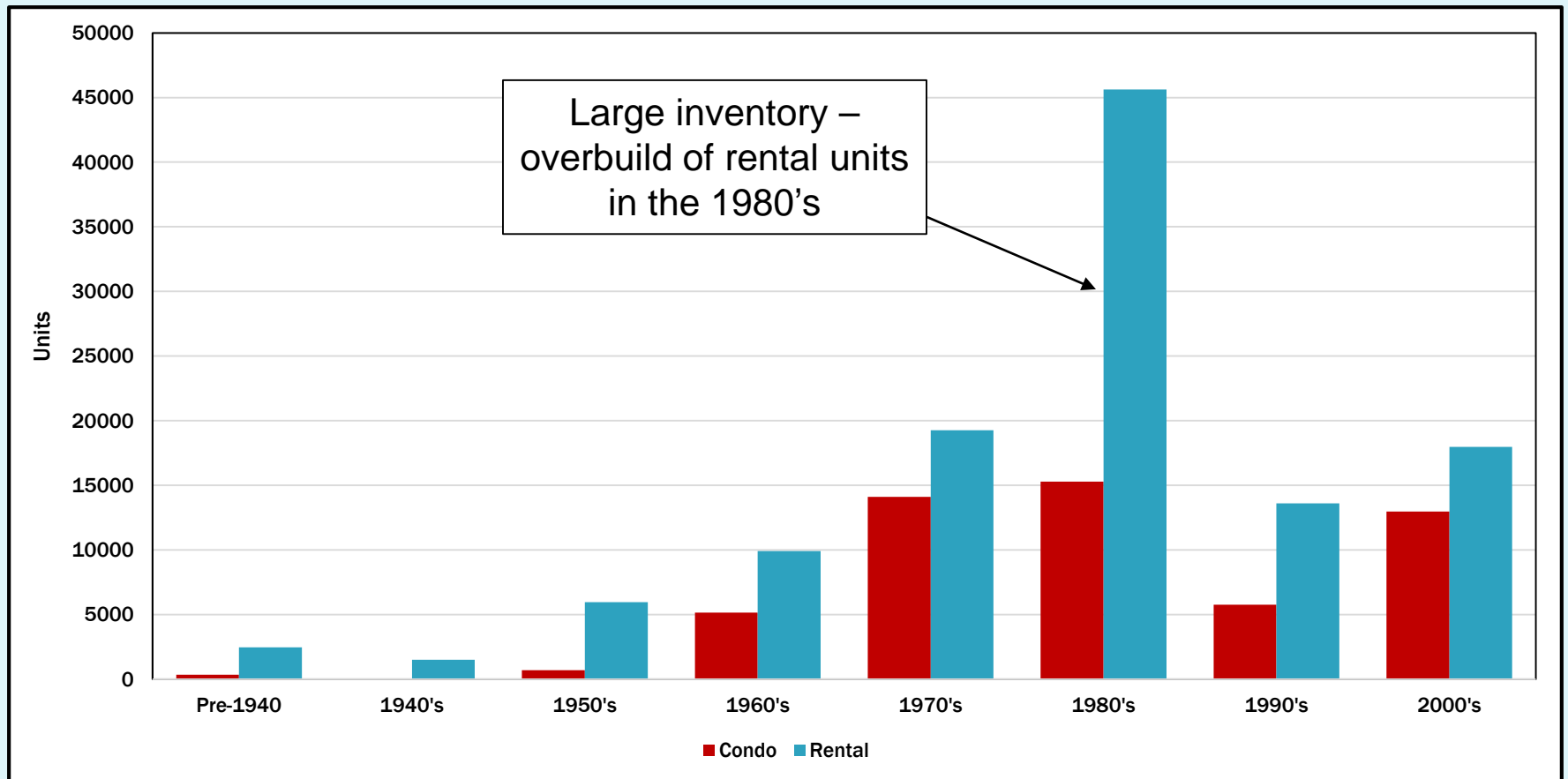
DEVELOPMENT TRENDS

Developments Built by Decade



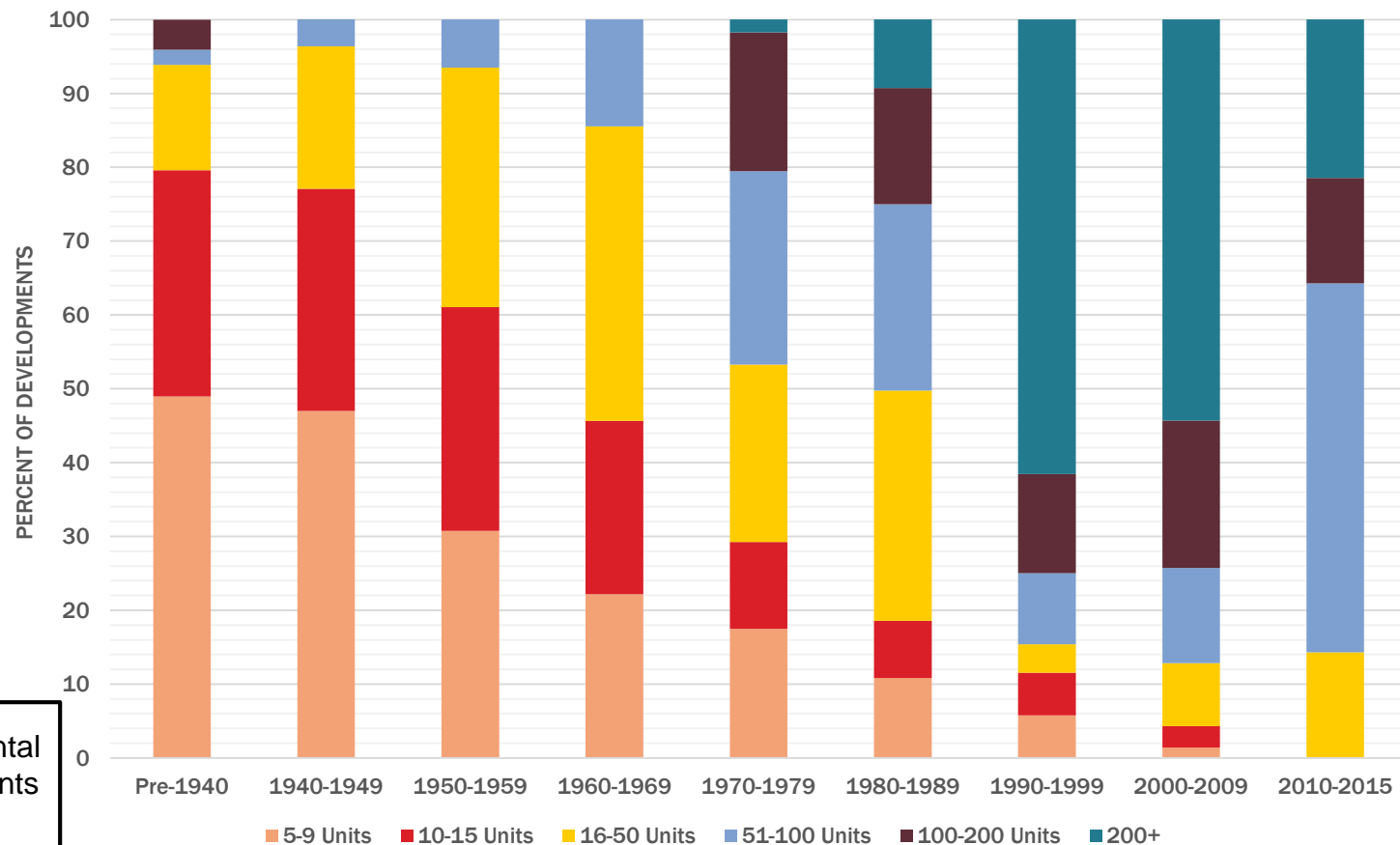
DEVELOPMENT TRENDS

Number of Units by Decade



DEVELOPMENT TRENDS

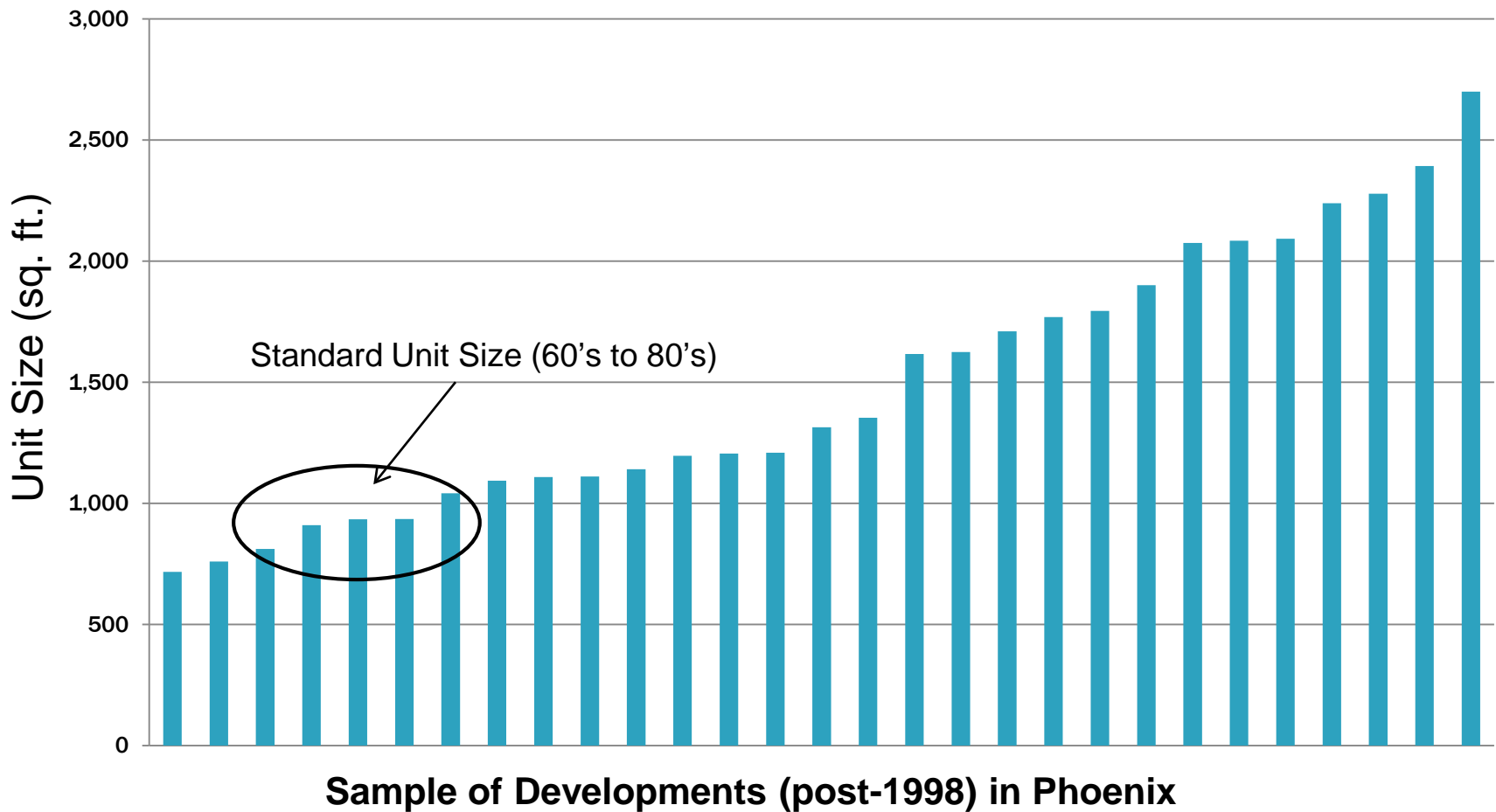
Rental Unit Type by Decade



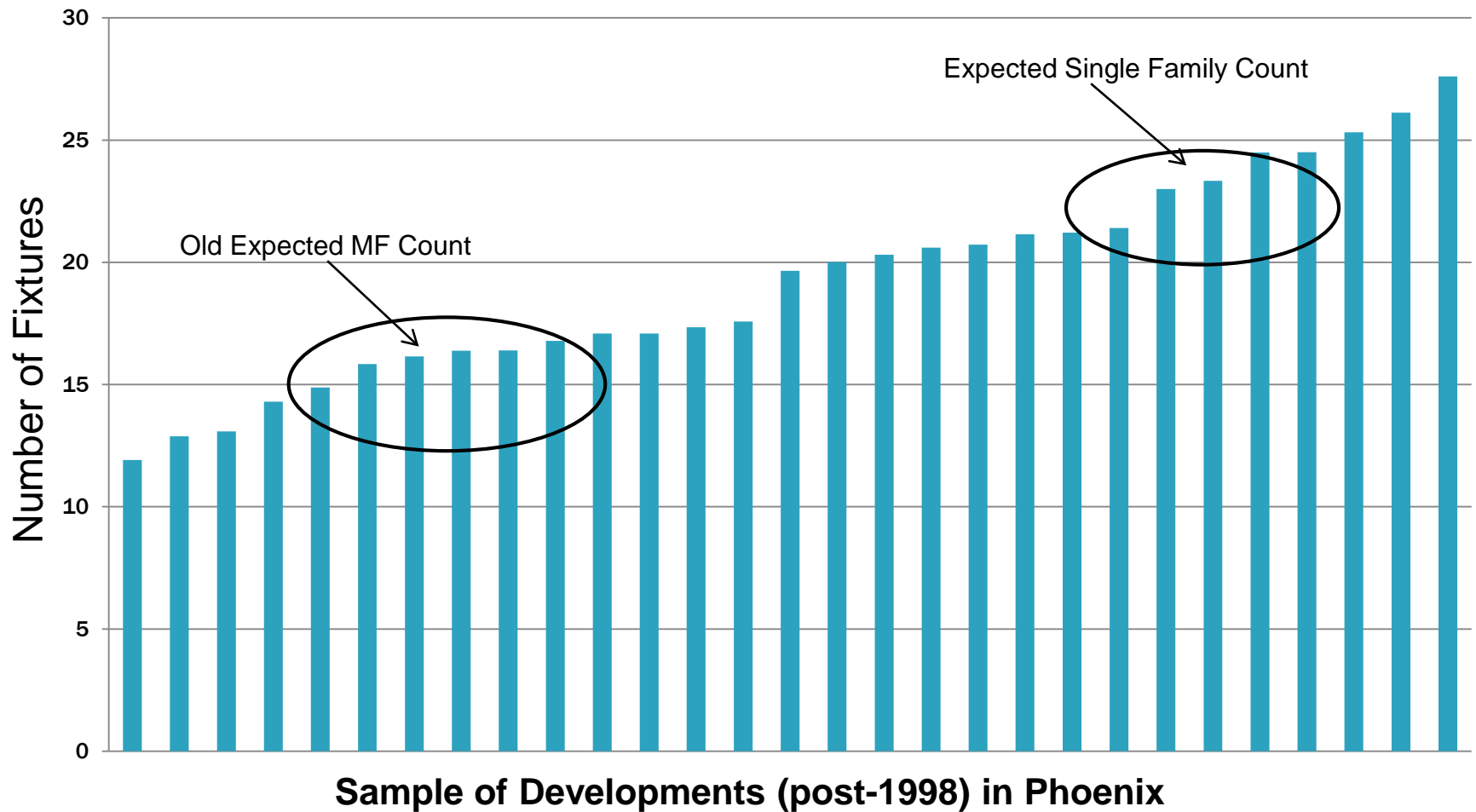
Existing rental developments consist of fewer units.

Newer rental development consist of more units.

DEVELOPMENT TREND BY AVERAGE UNIT SIZE



DEVELOPMENT TREND BY PLUMBING FIXTURE COUNT



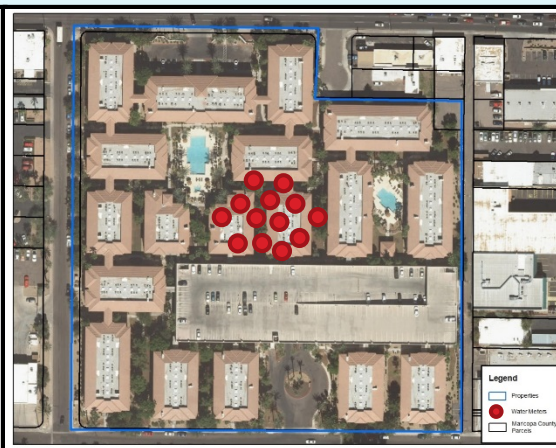
DATA COMPLEXITIES

■ Data Complexities

- Multiple Sources
 - different structures and formats
- Association between parcels, water meters and multifamily developments
 - Different types of relationships between parcels and meters
 - One to one, one to many, many to many



One to One



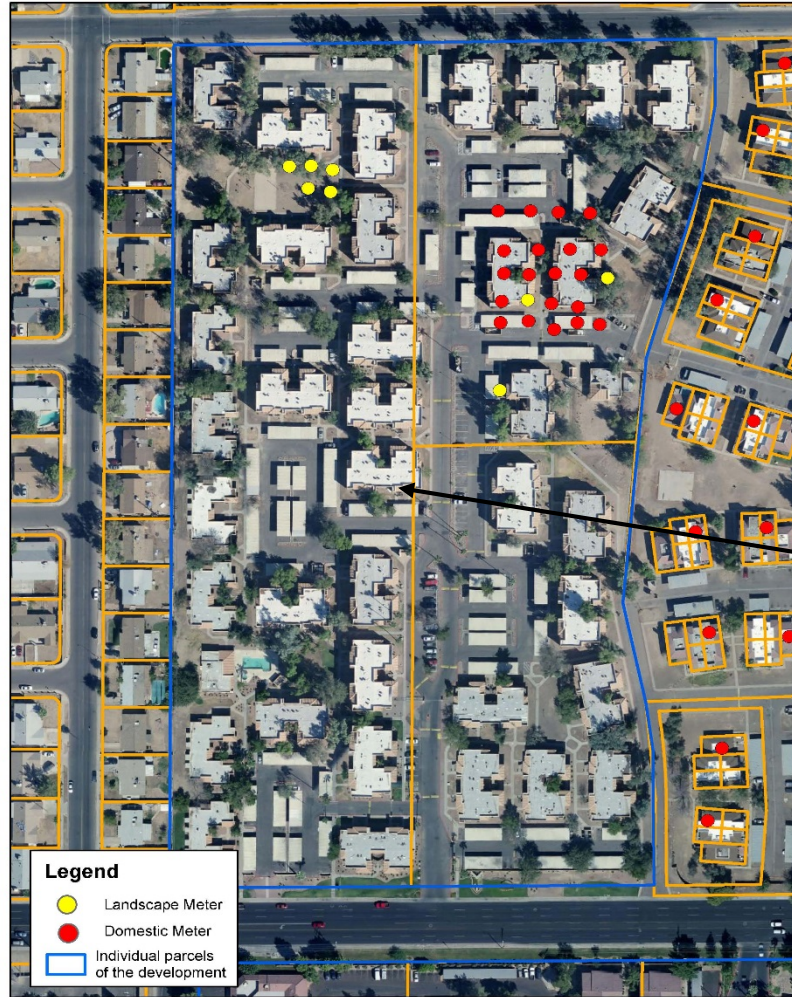
One to Many



Many to Many

DATA OBSTACLES USING GIS TO CREATE MULTIFAMILY DEVELOPMENTS

Individual
Parcels

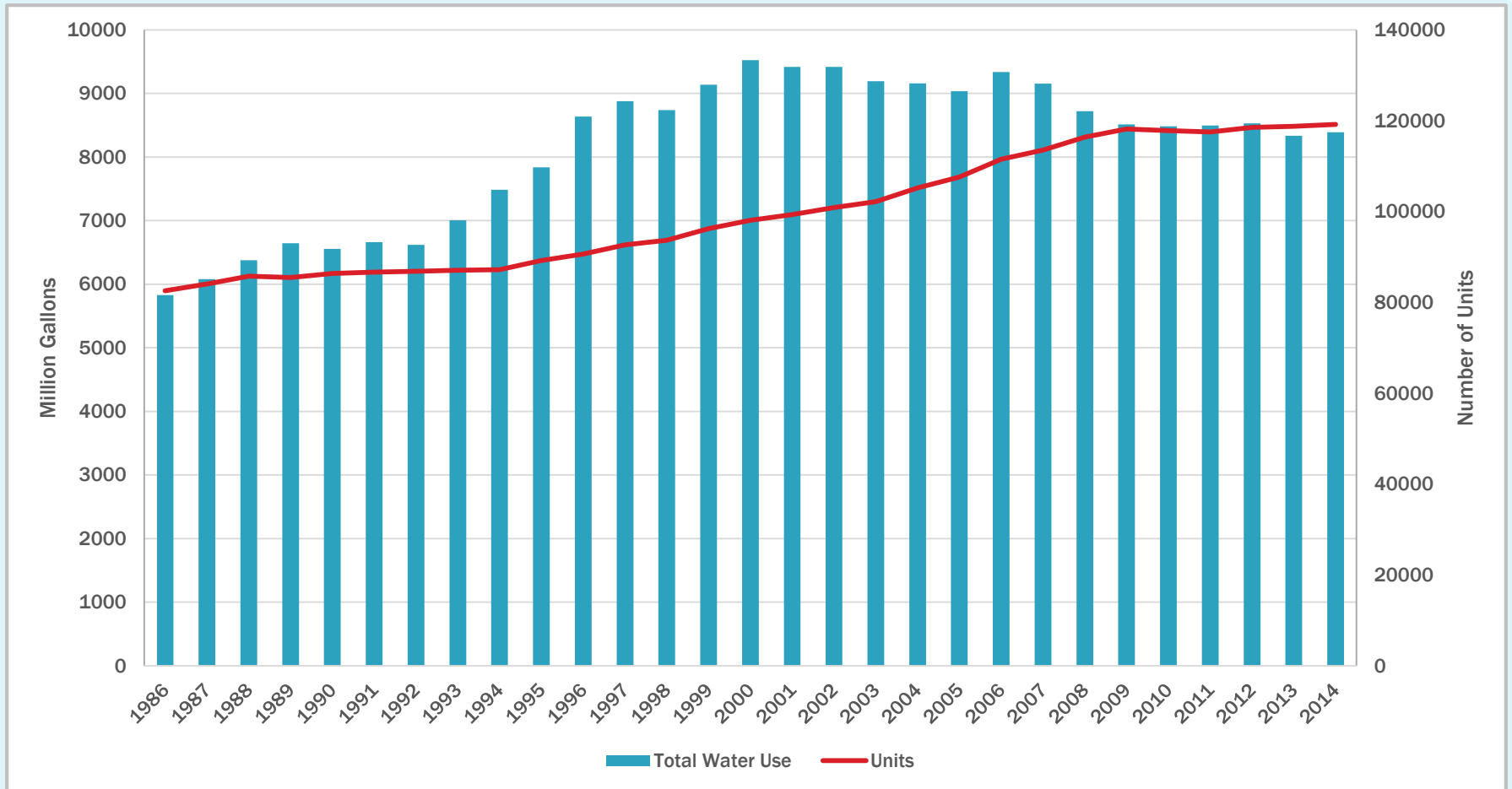


Meters not
associated with all
parcels in
development

Dissolved into
single
development

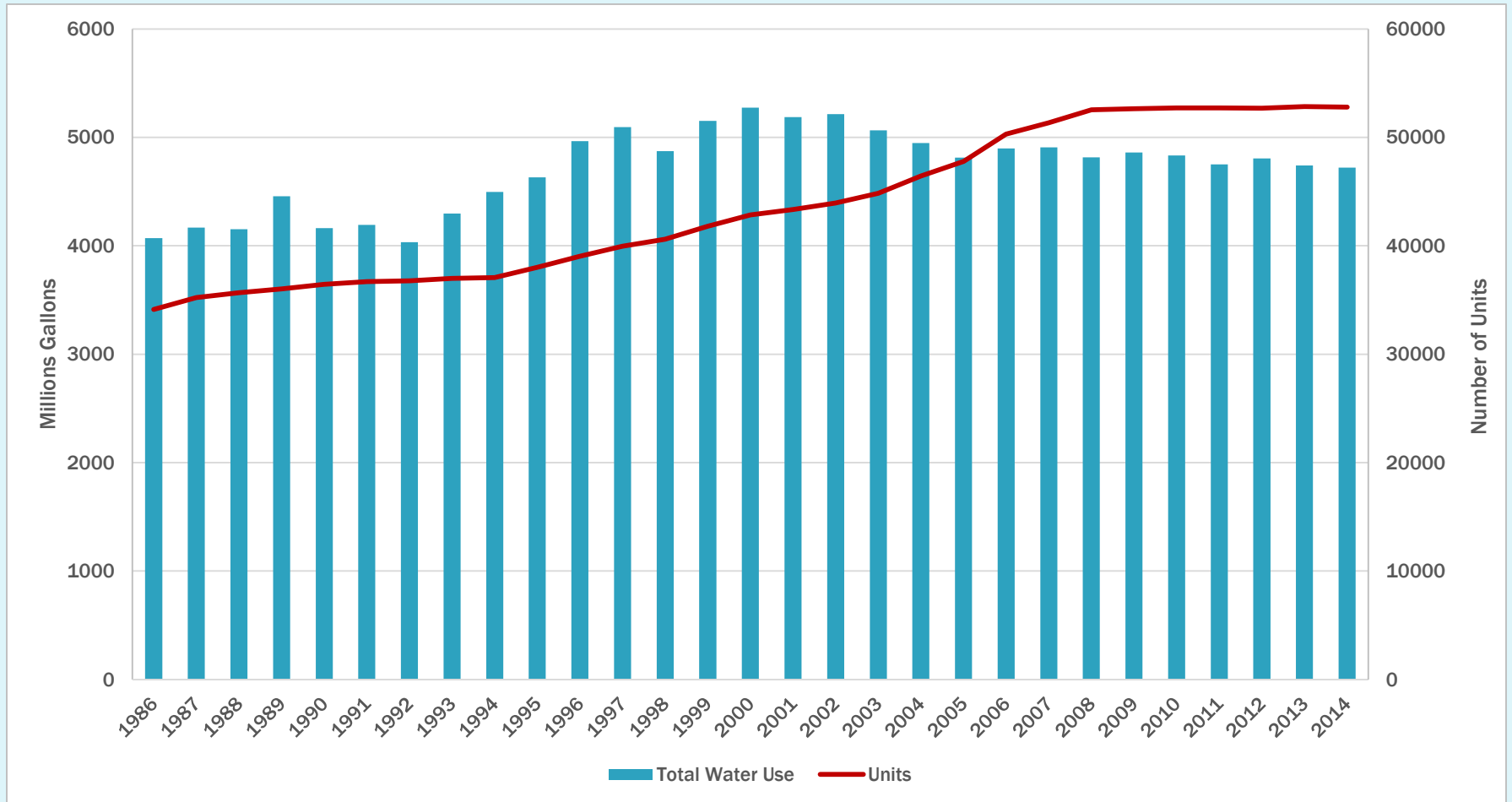
WATER USE TRENDS

Number of Units versus Aggregate Water Use (Rental Units)



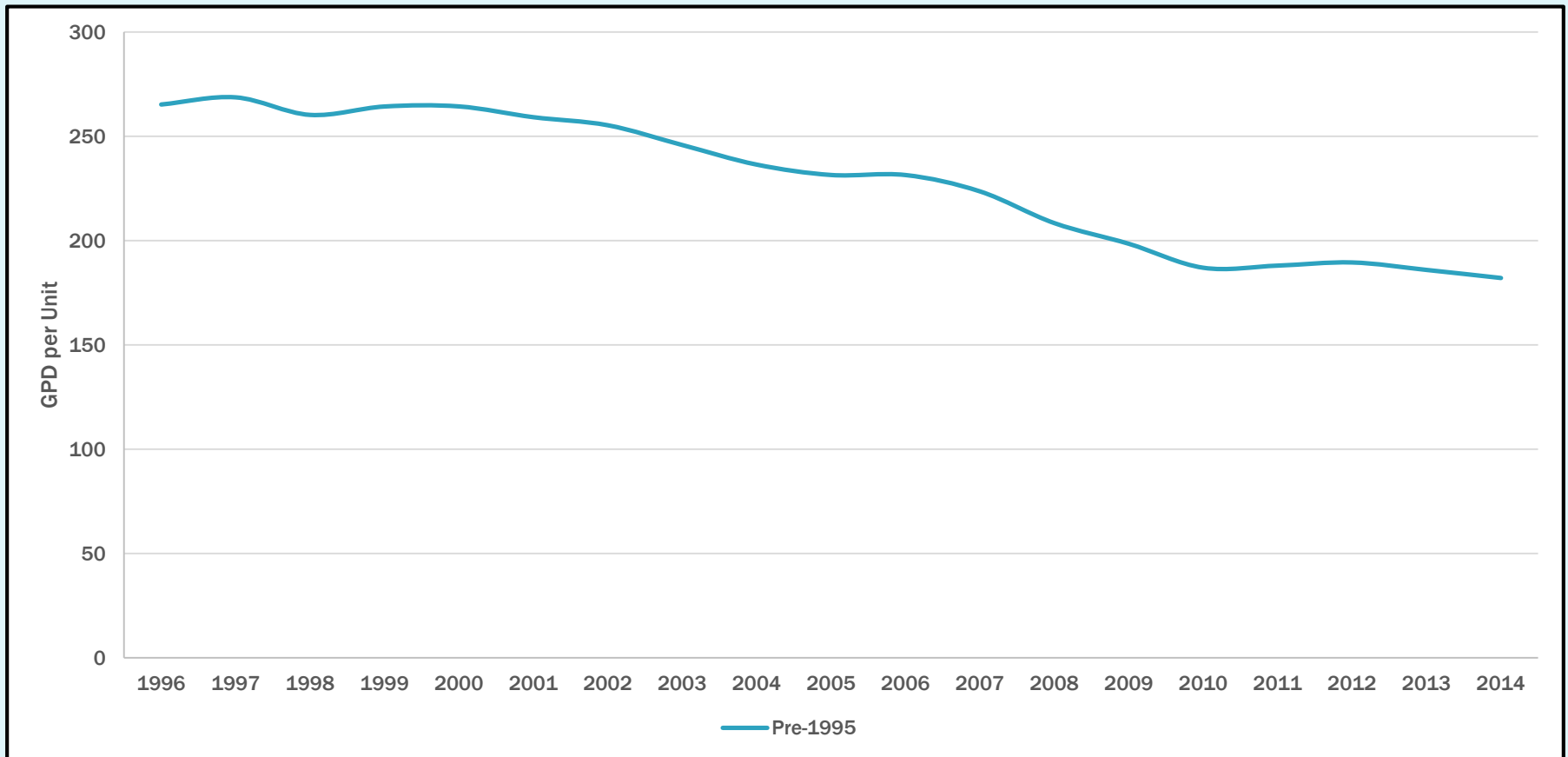
WATER USE TRENDS

Number of Units versus Aggregate Water Use (Condo's)



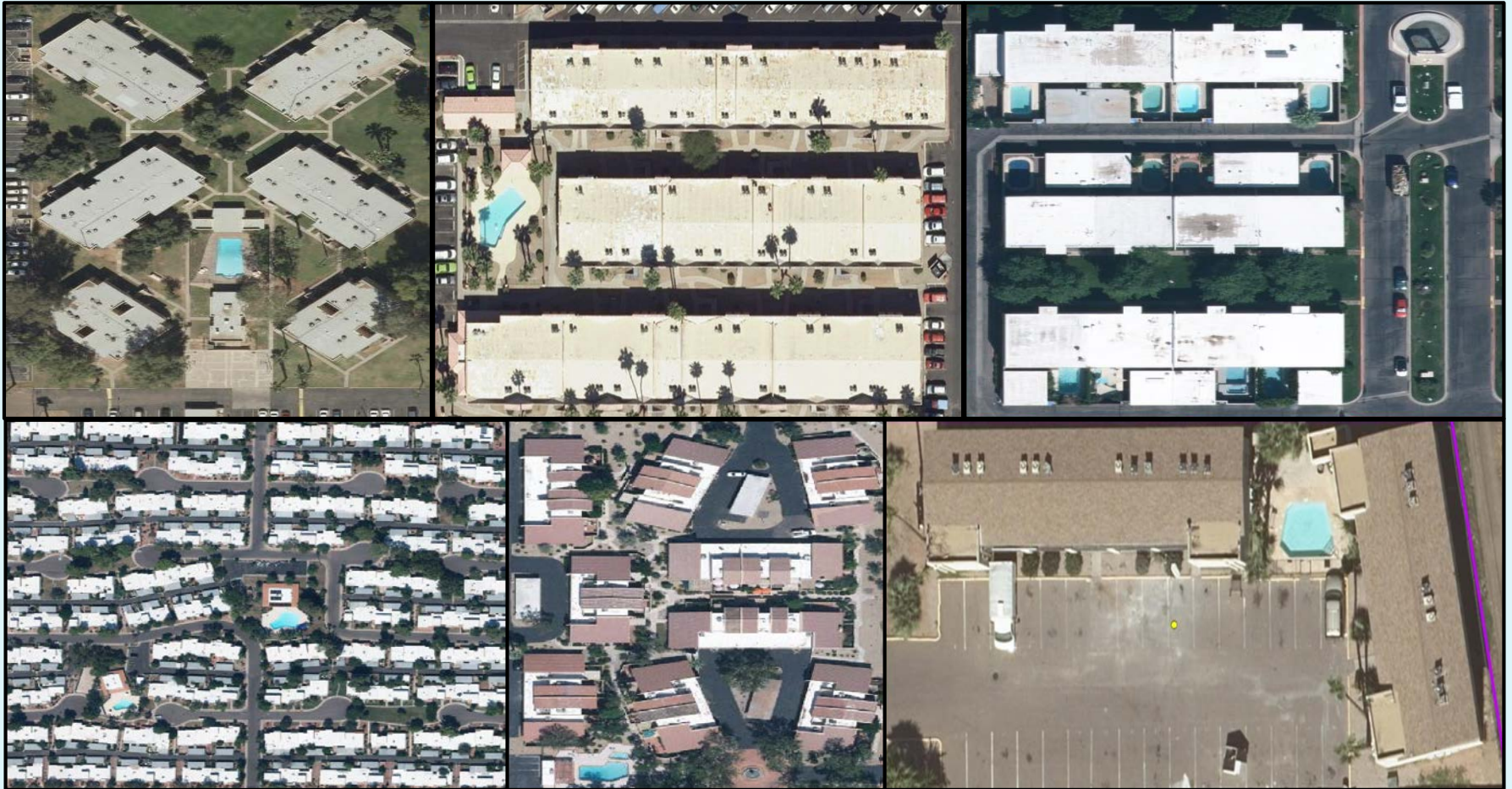
WATER USE TRENDS

Historical Average Water Use (Multifamily Developments pre-1995)



LANDSCAPE ANALYSIS

Multifamily Landscapes



LANDSCAPE ANALYSIS

- **Landscapes are changing over time**
 - Shift from turf to more arid landscape
 - Shift from pool to no pools
- **How many developments are changing and at what rate?**
- **Is the transition in landscape more dominant in different multifamily development types?**

2010



Lush vegetation with turf

2014



Arid landscape with a few trees

LANDSCAPE ANALYSIS

EVALUATING LANDSCAPE TRANSITIONS

- **Determining landscape characteristics using aerial imagery – remote sensing/visual interpretation**
 - Multiple year, high resolution, 4-band imagery
- **Categorizing based on landscape characteristics**
 - Vegetation amount, vegetation type, presence/size of pool

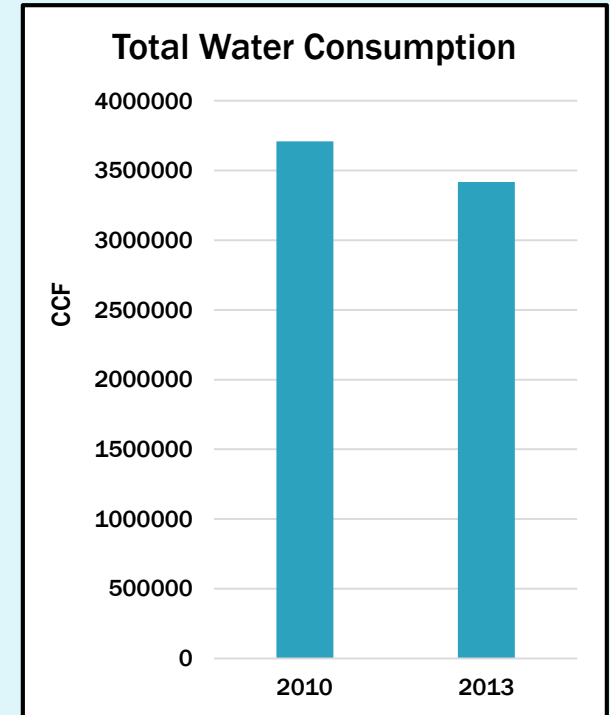
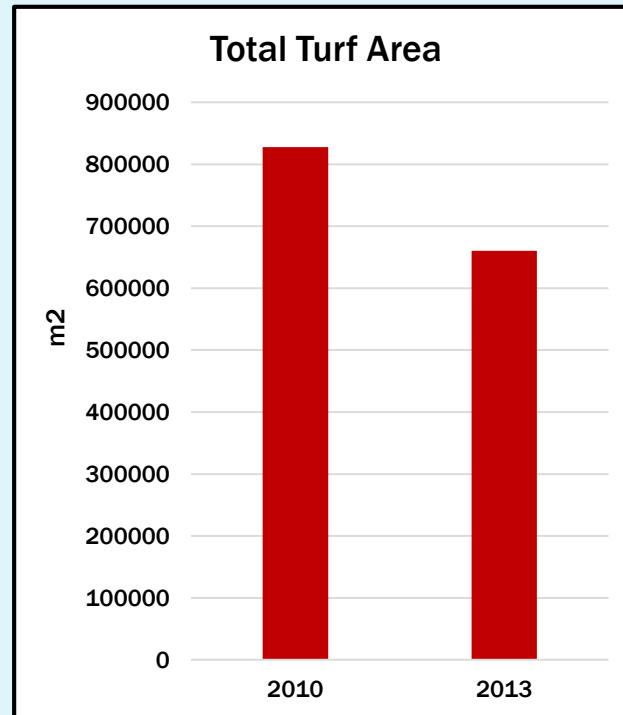


- Turf = 279 m²
- Trees = 46 m²
- Pools = 44 m²
- Parcel = 1669 m²

LANDSCAPE ANALYSIS

Evaluating Landscapes in Multifamily over Time

- Sample of 580 multifamily developments
 - rental and condominium
- Using the calculated vegetation area from remote sensing to compare overall trends
 - temporally and spatially



*Preliminary data for overall trend – still calibrating methods and analyzing data

ONGOING/FUTURE RESEARCH

- **Include site specific data**
 - Site visits/audits
 - occupancy rates, number of residents, types of fixtures, amenities (pools, laundry, etc.)
 - Datalogging
 - Differentiate fixture types
 - Landscape characteristics
 - landscape classification
 - Imagery analysis/coding system
- **Expand inventory for multifamily subsectors**
- **Refine water demand forecasts**

WHAT WE KNOW?

■ What we know?

- Majority of multifamily developments are older (in age), smaller (average unit size) and have fewer total number of units (50 or less units)
- Newer developments tend to be larger (average unit size), more total number of units per development (100+) and generally have more efficient fixtures (due to efficiency standards)
- Multifamily water consumption is gradually declining even with an increase in the number of units and/or developments
- Existing developments (pre-1995) have a higher GPD per unit than newer developments (post-1995)
- New developments tend to have less water intensive landscapes (more arid/sparse)
- Existing developments appear to be transitioning from more water intensive to less intensive landscapes

WHAT IS THE NEXT PHASE?

■ What's Next?

- Delve deeper into the key drivers of water decline
 - Appliances, fixtures, landscaping
- How fast are existing developments replacing inefficient fixtures?
- How fast are developments changing to even more efficient standards (products on the market that exceed current efficiency standards)?
- What are the drivers behind the transition to less water intensive landscapes (arid)?

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