MULTIFAMILY

PAST, PRESENT AND FUTURE RESEARCH

Overview

1. Background

2. Research
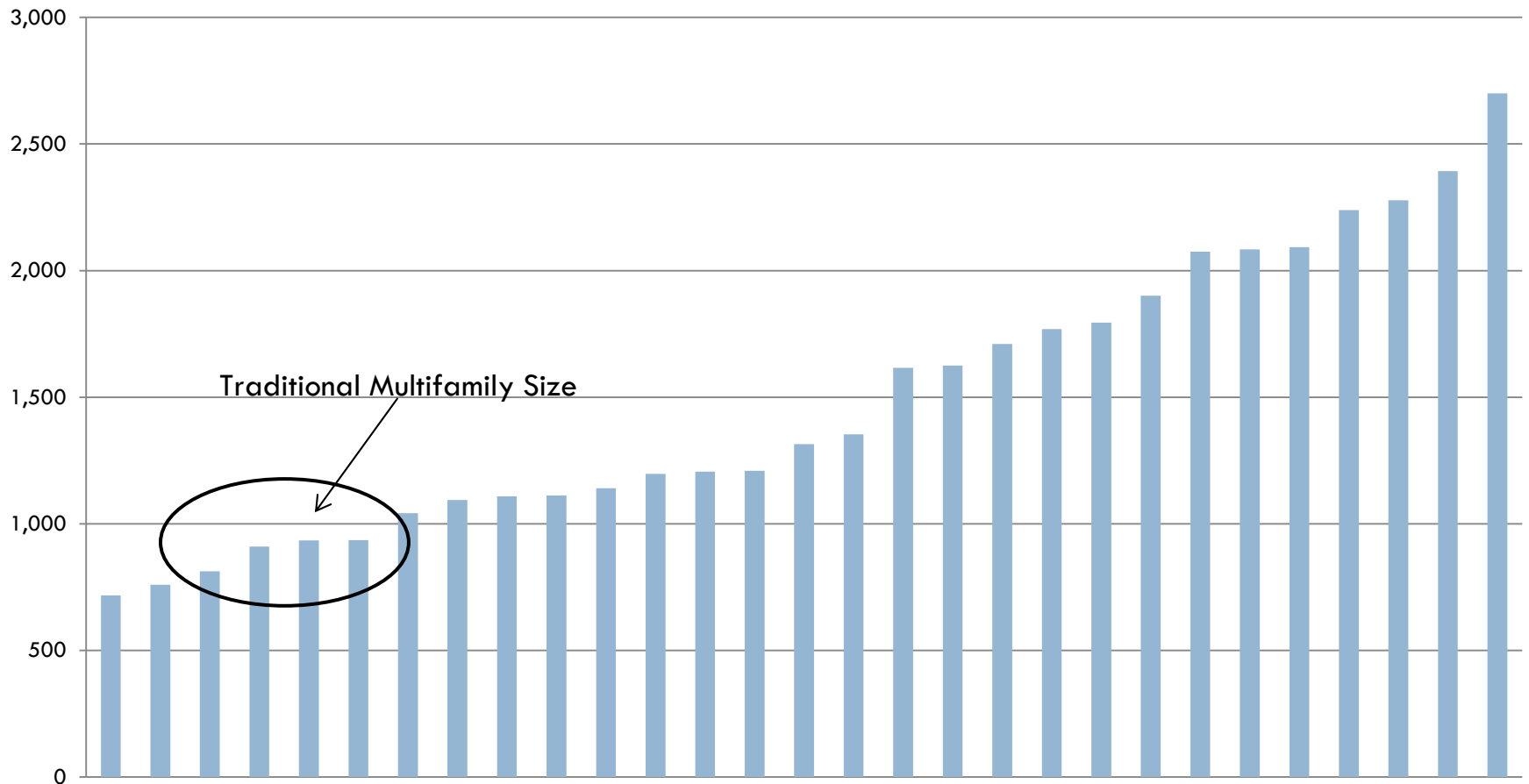   a. Past
   b. Present
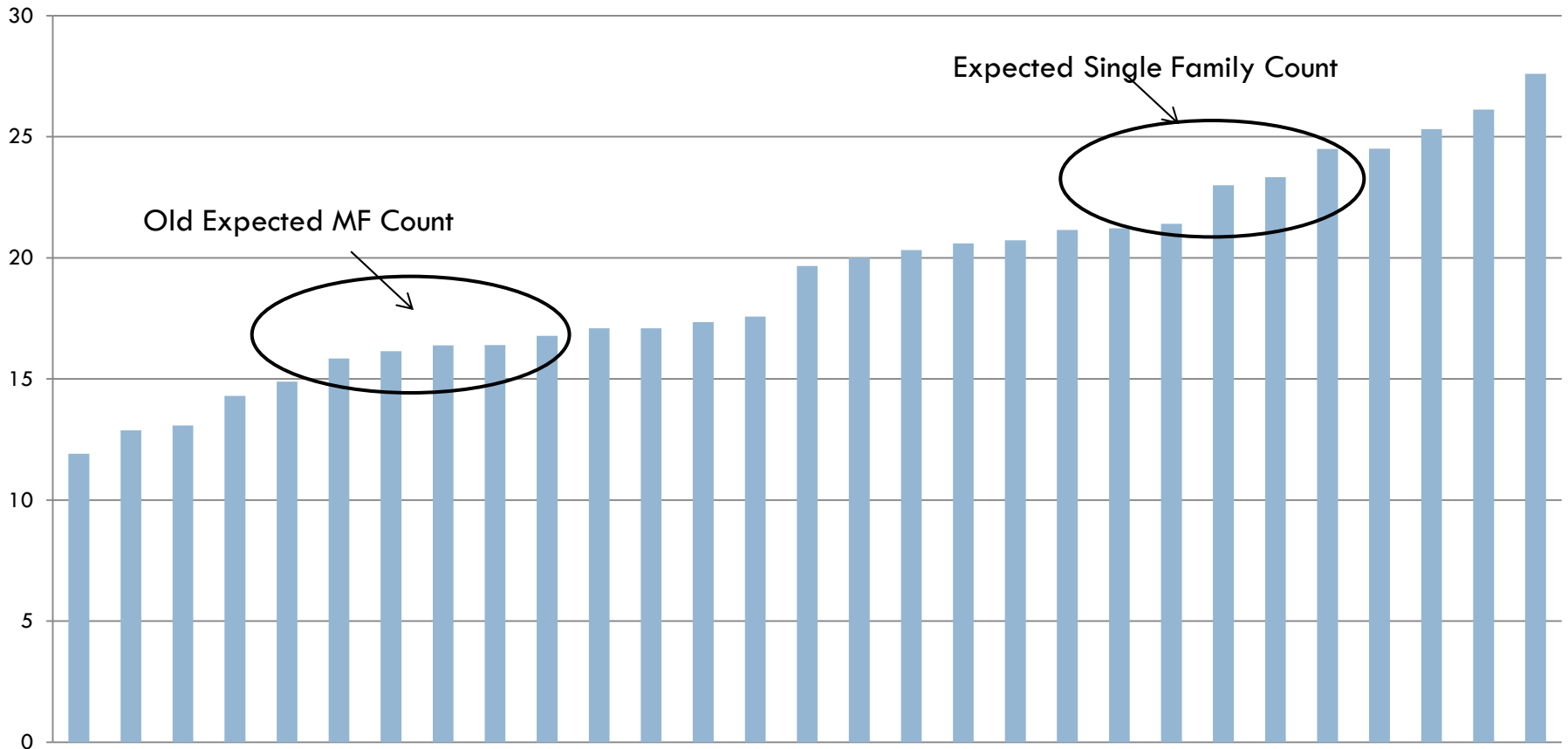   c. Future

Multifamily Developments

Multifamily Unit Size

**Recent (Post 1998) City of Phoenix Multifamily Developments
By Average Size of Units in Square Feet**
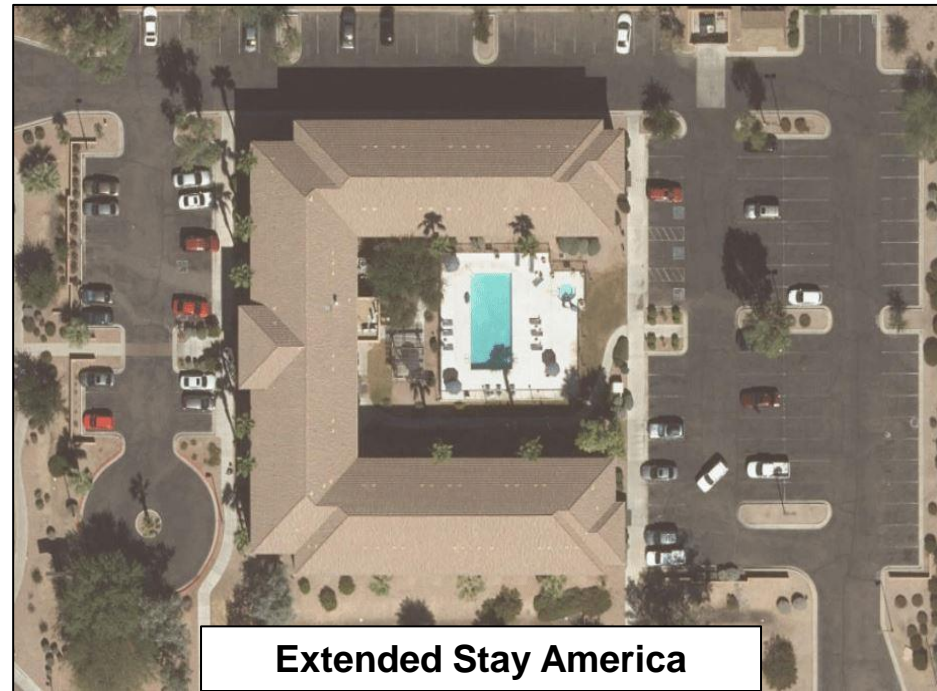
Multifamily Fixtures
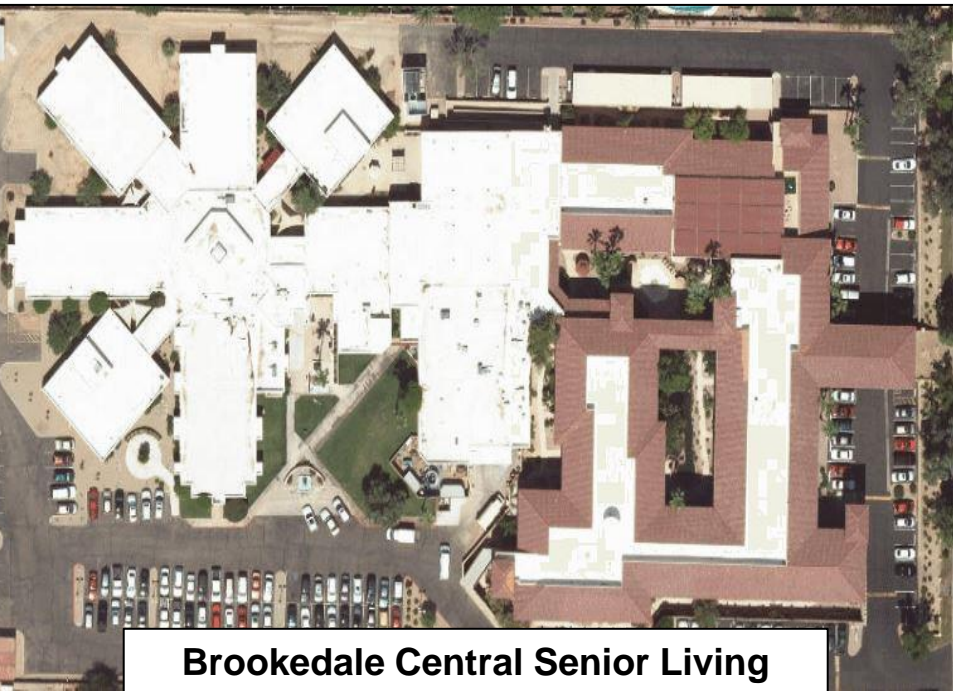
**Recent (Post 1998) City of Phoenix Multifamily Developments
By Average Number of Fixture Units**

Potential Multifamily Subsectors

ICI sectors have similar end use characteristics

- Hospitality (extended stay)
- Retirement Communities
- Timeshare
- Dormitories
- Correctional Facilities
- Mixed-use (residential/retail)

Brookedale Central Senior Living

Extended Stay America

Previous Research

2008 Hazen and Sawyer
- Demand management plan update
- Goals:
  - Begin to disaggregate sector
  - Characterize presence and efficiency of end uses
  - quantify curtailment potential
- Method: mail survey
  - Site level data
  - Water use matched to properties using address and customer characteristics
    - Attempted to match landscape meters to properties

2014 BBC/Keen
- ICI Phoenix research initiative
- Goal: Assessing structural changes in demand property characteristics
- Method: GIS
  - Water use spatially join to parcel
  - Enhanced data with Hazen and Sawyer site level data

BBC/Keen
Estimating Indoor Use

Indoor Use = 166 - 169 g/u/d
- Majority of water use indoor
- Major indoor uses
  - Toilets, showers, faucets
  - Clothes washers
    - In-unit laundry, common area, no laundry facilities

Comparing water use in multifamily properties by laundry condition, 2012

Laundry condition	Gallons per unit per day	Gallons per ksf per day
Properties with in-unit laundry facilities	219	265
Properties with common area laundry facilities	195	281
Properties with no laundry facilities	150	250

Note: ANOVA reveals significant differences at p <.01 for g/u/d, but no significant difference for g/ksf/d.
Source: Keen Independent calculations.

BBC/Keen
Estimating Outdoor Use

Outdoor use = 43 - 46 g/u/d, less than ¼ total use

- 125 developments (98% had irrigable landscape, 78% at least one pool
- Lower water use than single family – shared common area
- Not all properties have dedicated irrigation meters
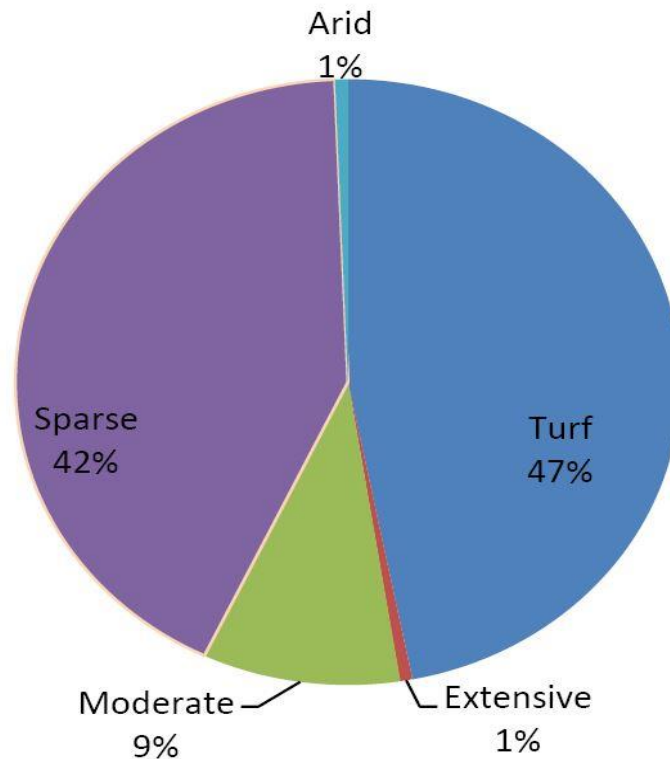- Variation of landscape types within and among developments

BBC/Keen Classifying Landscape

- Developed landscape categories based on City's single family landscape classification

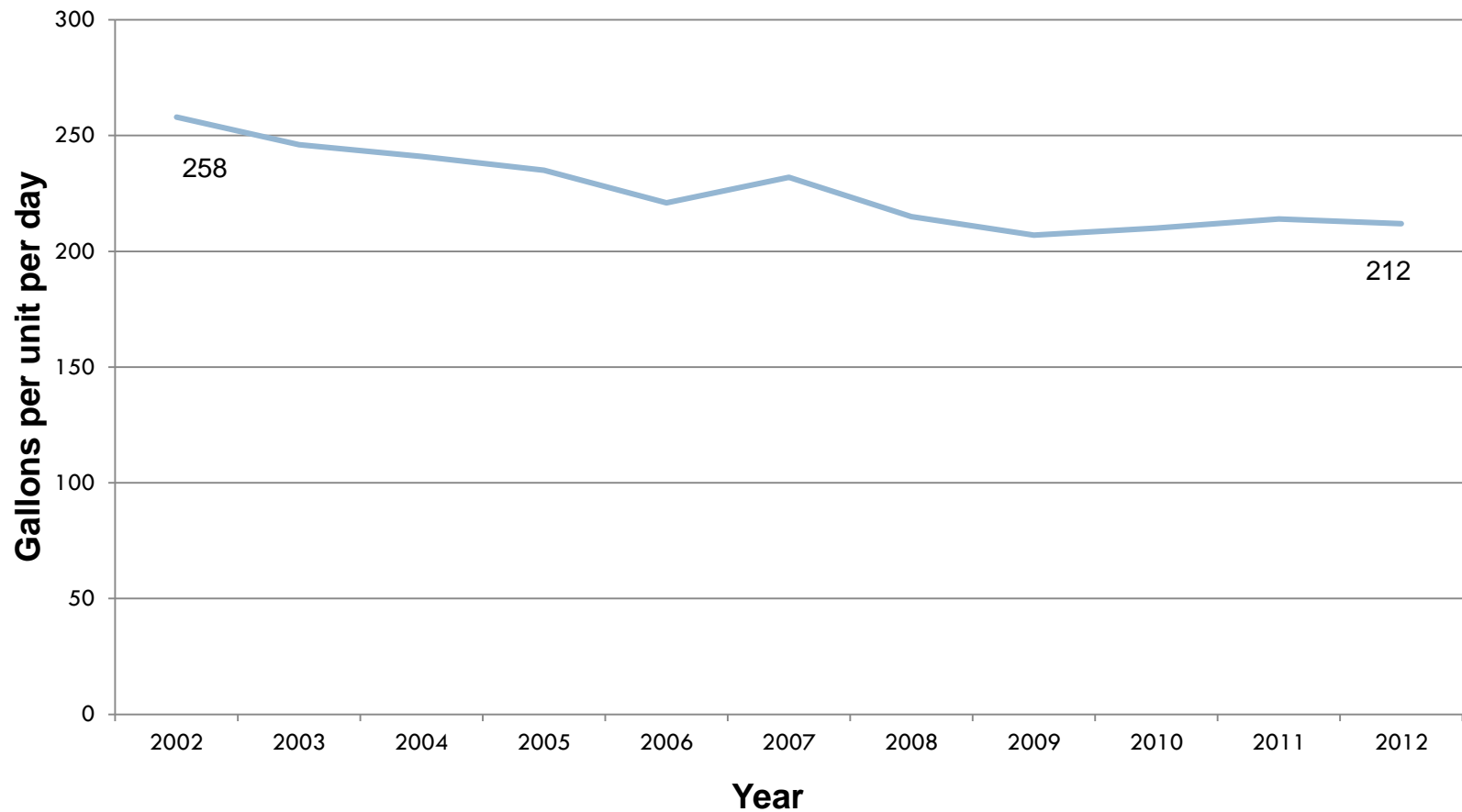Share of landscaped area for Phoenix multifamily properties, 2014

Source: BBC/Keen Independent Multifamily Report

BBC/Keen
Overall Trends

Average water use for sample properties, 2002-2012

Source: Keen Independent Calculations

Current Research
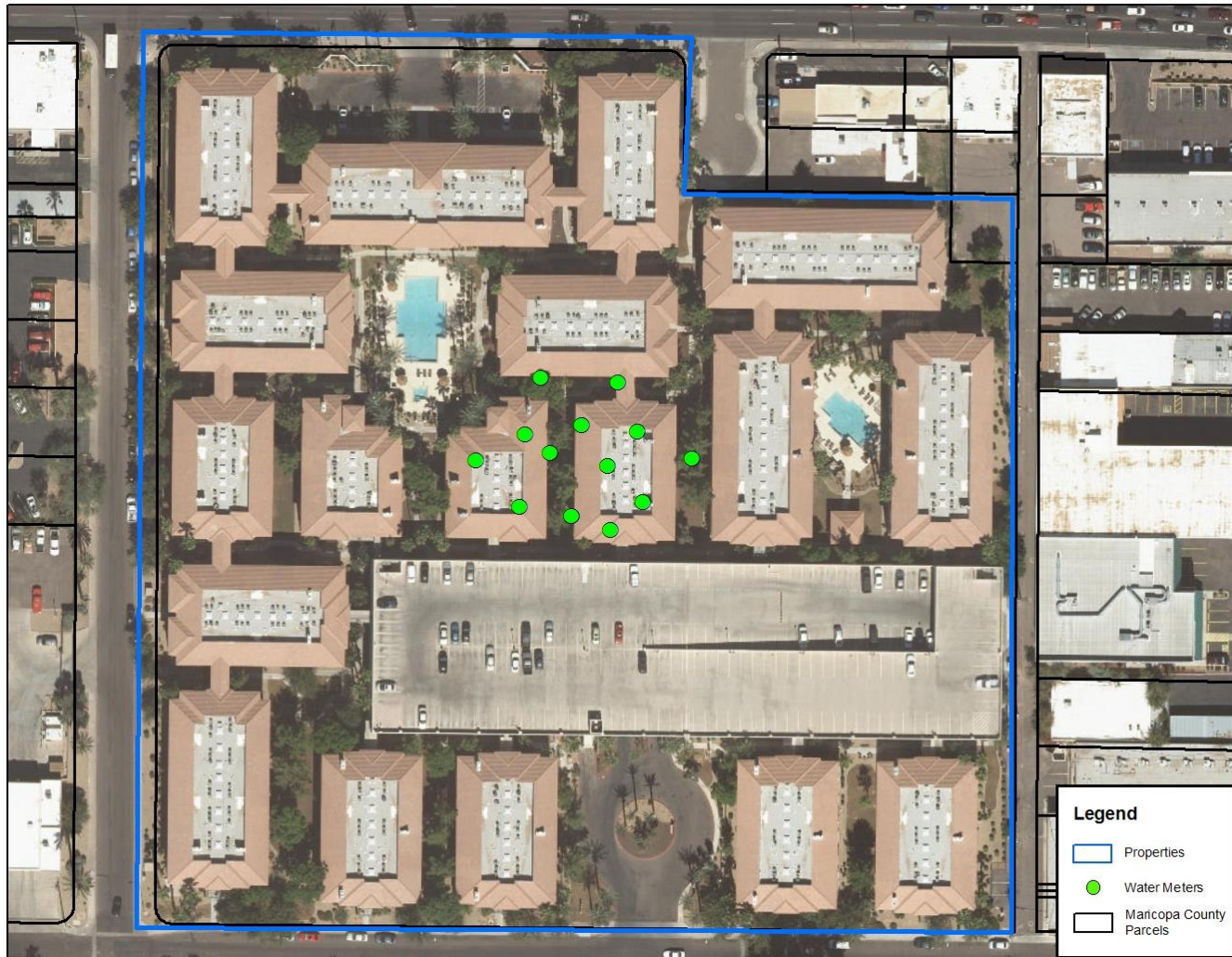# Multifamily Inventory

- **Creating a more expansive multifamily inventory (5+ unit developments)**

- **Data Acquisition**
  - Multiple sources
    - Maricopa County Database
    - COP water consumption
    - COP water meter shapefile
    - Maricopa County Parcel shapefile
  - Using aerial imagery to identify pools and cooling towers

- **Data Complexity**
  - Multiple sources – different structures and formats
  - Association between parcels, water meters and multifamily developments

Inventory Creation
Data Complexity

Legend

- Properties
- Water Meters
- Maricopa County Parcels

One to one relationship (meter to parcel/development) similar single family

Inventory Creation
Data Complexity

Many to one relationship (meter to parcel/development)

Inventory Creation
Data Complexity

Many to many relationship (meter to parcel)

Current Research
Overcoming Data Obstacles

- **Identifying and correcting the locations of incorrectly placed water meters in GIS Layer**

- **Applying spatial analysis to more accurately associate multifamily developments with water meters and property characteristics**
  - Creating multifamily developments from Maricopa County parcel shapefile
  - Spatial selection of all water meters which fall into multifamily development polygons
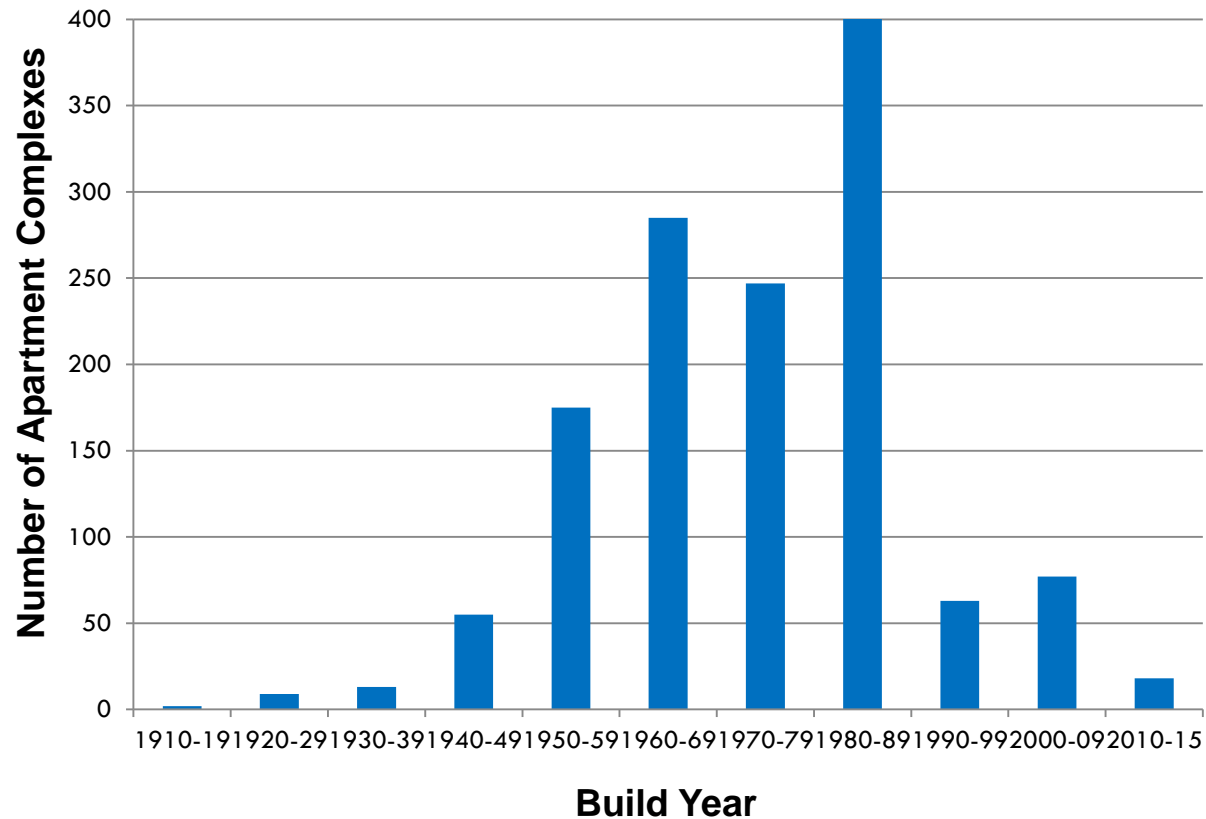
Inventory Database

- 1348 multifamily development polygons (5+ unit complexes)

- Database includes:
  - Building characteristics
  - Water consumption data
  - Unit counts for each multifamily development
  - Presence of pools (using GIS/assessor data)
  - Presence of cooling towers (using GIS)

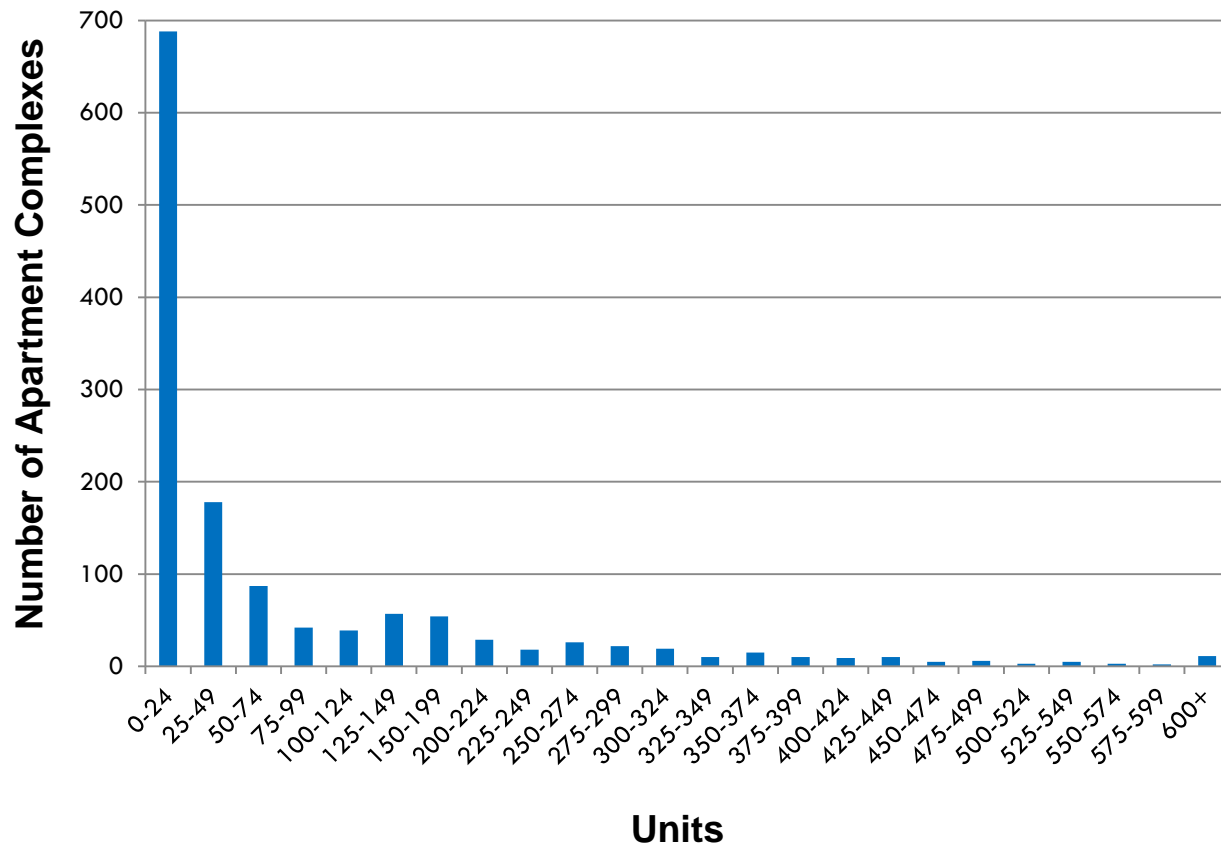|	Total Number Polygons (PUC 035-039)	Total Number Parcels	Unit Count	Water Meter Count
Properties (Polygons)	1,348	1,878	115,683	4,319

Top-down Data Analysis

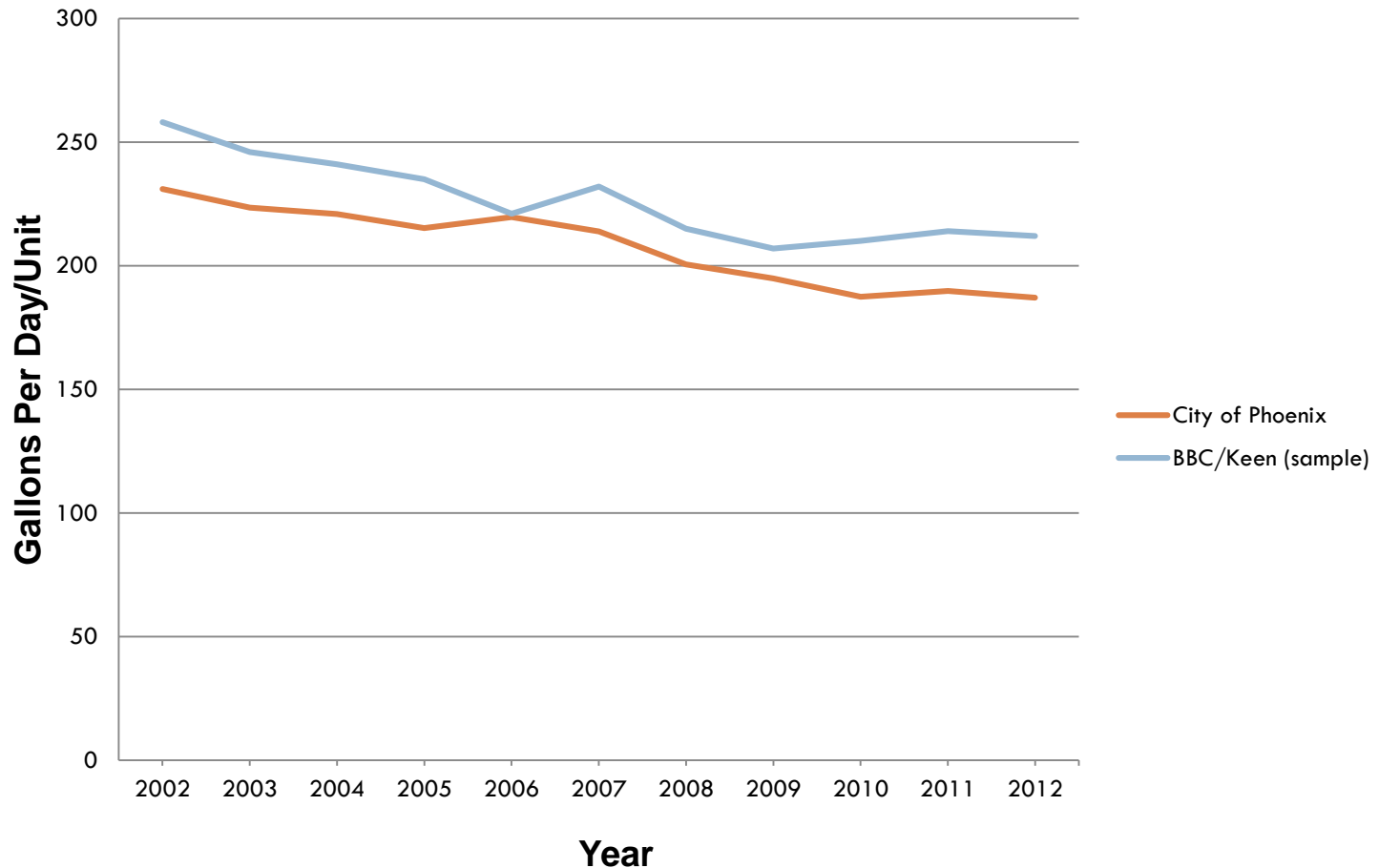## Multifamily Developments (5+ units) by Build Year

Top-down Data Analysis

Distribution of Multifamily Developments (5+ units) by unit count

Water Use Trend Comparison

Water Use for Multifamily Development (5+ units) 2002-2012

Future Research

- **Include site specific data for bottom-up analysis**
  - 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**

Landscape

Variation of landscape within multifamily developments

Projected End Uses and Average Use

Projected end uses for multifamily based on sample properties, 2032

Metric	Estimated oudoor water use	Estimated indoor water use	Estimated cooling tower water use	Estimated leakage water use	Average total water use for sample
Gallons per unit per day	63	86	21	25	196
Gallons per ksf per day	76	105	26	31	237

Source: Keen Independent calculations.

Projected end uses for multifamily based on all properties, 2032

Metric	Estimated oudoor water use	Estimated indoor water use	Estimated cooling tower water use	Estimated leakage water use	Average total water use for all properties
Gallons per unit per day	55	73	18	22	169
Gallons per ksf per day	76	106	26	31	239

Source: Keen Independent calculations.

MULTIFAMILY

Past, Present and Future Research

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City of Phoenix