



# Tools and Methodology for Supply and Demand Projections for the 2025 Plan of Operation

Stakeholder Briefing November 9, 2022

# Agenda

- Welcome and Opening Remarks (Grignano)
- Context & Modeling Approach (Seasholes)
- Key Planning Issues and Factors (Baji & Seasholes)
- Q & A
- Next Steps
- Closing (Grignano)



# **Meeting Logistics**

- Comments and questions may be sent by email to: questions@cap-az.com
- Meeting material will be posted on the CAP website under "Meetings" / "Briefings and Roundtables" www.cap-az.com





# **Plan of Operation**

- By statute, CAGRD operates under a 10-year Plan of Operation.
- All Plans have been developed with public input and have been approved by ADWR.
- The current 10-year Plan of Operation was approved by ADWR on August 5, 2015.
- Describes the projected obligations and supplies to meet those current and future obligations.
- Recently, CAGRD staff has begun a multi-year effort to develop the next Plan of Operation.



# **2025 Plan of Operation Process Timeline**





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#### **Context & Modeling Approach**

Ken Seasholes Manager, Resource Planning & Analysis



## **CAGRD Obligation Projections**

#### **CAGRD's Requirement:**

 "...an estimate of the district's projected groundwater replenishment obligations for the one hundred calendar years following the submission of the plan for current members and potential members based on reasonable projections of real property and service areas that could qualify for membership in the ten years following the submission of the plan."

#### **ADWR's Determination:**

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 "The district has made a reasonable estimate of its projected replenishment obligations for the one hundred calendar years following the submission of the ten year plan."



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## **Projecting Water Supply & Demand**

<u>Some</u> of the interrelated factors that affect water supply and demand :

- Growth
- Shortage
- Climate Variability
- Socio-Economics
- Policy Changes
- Behavioral Shifts

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- "Driving Forces" = High levels of
uncertainty and
complexity
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#### **CAP Models and Databases**



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## Joint Shortage Analysis Model (JSAM)

- Model for analysis of CAP impacts at the priority pool level
- Receives Lake Mead elevation output, by hydrologic trace, from CRSS
- Applies tier reductions, shortage sharing formulae, utilization assumptions, etc.
- Used by CAP, ADWR and AWBA to support:
  - Modeling and Analysis Workgroup (MAWG)
  - NIA reliability analysis
  - Long-range planning efforts



## **CAP Service Area Model (CAP:SAM)**

Tool for projecting supply and demand for water providers, irrigation districts, tribes, and others in CAP's three county service area

• Over 150 entities; 16 supply types; annual timestep

Accounts for complex legal and physical characteristics of users and supplies

- Assured Water Supply Rules
- Recharge & recovery accounting
- Shortage impacts
- Agricultural allotments & crop mix
- Et cetera



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## **CAP Service Area Model (CAP:SAM)**

CAP:SAM performs many interrelated supply and demand calculations, broadly organized into four conceptually simple steps

- 1. Project Demands
- 2. Determine Available Supplies
- 3. Request Supplies
- 4. Fulfill Demands



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CAP:SAM is specifically designed to be able to generate "what if?" scenarios



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#### **Scenario Planning Steps**



Driving forces of water supply, demand and reliability (e.g., growth, climate variability, agricultural trends, etc.)





- Combinations of multiple, internally consistent factors
- Represents a plausible narrative about how the future may unfold





- Magnitude and spatial distribution of water demand through time
- Supply availability



#### **Goal:** Test an envelope of plausible futures



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# Key Planning Issues and Factors: Residential Growth

Viviane Baji

Planning Analyst II, Resource Planning & Analysis



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#### **Modeling New Residential Development**

New development must be modeled for existing and projected CAGRD member areas

Housing is a regional phenomena

Spatial pattern of growth is key to understanding future CAGRD membership

Land use allocation modeling approach is appropriate



#### **Modeling New Residential Development**

- 1. Gather housing outlook insight
  - Reviewing county-level projections, data, and modeling approaches
  - Expert focus groups for developing scenarios
  - Interviews with state and regional planning agencies
- 2. Model new growth using land use allocation model tool
- 3. Produce new housing projections by water provider for continued analysis in CAP:SAM
- 4. Repeat steps 2 and 3 for scenario development



#### **Housing Outlook Focus Groups**

Four 90-minute, virtual meetings throughout November

ந்தி 6-8 participants in each meeting

Pre-survey questionnaire, >50% response rate

Home Builders
 Developers

Academic

-Redevelopment & Infill Experts (scheduled)

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## **A GIS Approach to Modeling Growth**

- CommunityViz Scenario 360 is an ArcGIS Extension that adds interactive analysis tools and a decision-making framework to the ArcGIS platform
- CommunityViz GIS tools to analyze and visualize growth patterns across the CAGRD Service Area
- Intuitive workflows for the nuts and bolts of spatial growth pattern modeling
- Utilizing GIS and tabular data from planning agencies, including the regional councils (MAG, CAG, PAG)

#### COMMUNITY VIZ<sup>®</sup> Urban Analytics for Planners





### **CAP CommunityViz Modeling Steps**



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AMA

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PINAL AMA

PIMA

COUNTY



#### **Establishing the Buildable Area**

#### Areas to Remove

#### Protected areas

- Federal, State and Local Parks & Preserves
- Water Bodies

#### Tribal Lands

#### **Developed** areas

- **Residential suburbs**
- Commercial zones
- **Transportation routes**

**Non-Residential Development Areas** 

#### Remaining area

- Zoned for future residential development
- Flagged for residential redevelopment



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#### **Carrying Capacity**

#### Area X Density = Carrying Capacity

Single Family Density Class	Units/Acre
Very Low	0.1-0.2
Low	0.2-1
Medium Low	1-2
High	2-4
OMedium High	4-6
●Very High	6+
Multi Family Density Class	Units/Acre
Low	5-10
Medium	10-15
High	15-50
⊖Very High	50+

Can vary densities in the model



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#### **Development and Redevelopment**



Phoenix metro area

Tucson metro area



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#### **Using Gridded Data**

- Allows for uniform unit of analysis
- Easier interpretation of results
- Reduces computing time
- Actual grid cell size is 1/4 mile X 1/4 mile



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#### **Sample Area: Carrying Capacity by Grid** Cell



Carrying Capacity

Suitability Analysis

Carrying Capacity by Grid Cell

- Α
- Buildable Area= 16.5 acres
- High SF density & High MF density
- Carrying Capacity: ~100 housing units
- B
- Buildable Area= 28 acres
- High MF density
- Carrying Capacity: ~560 housing units
- C
- Buildable Area= 40 acres
- Very High SF density
- Carrying Capacity: ~320 housing units
- D
- Buildable Area= 0 acres
- Carrying Capacity: 0 housing units





#### **Carrying Capacity Across** the Service Area

- Carrying capacity, or amount of housing units possible, by grid cell
- Function of both the amount of land in each grid cell and the density
- These are the areas where development can occur



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## **CAP CommunityViz Modeling Steps**



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- Transportation
  - Interstates and highways (current and future)
  - Arterial system
- Suitability Score by Grid Cell, 0-100
- Grid cells that are closest to the suitability factor (interstate) get the highest score



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- Employment (by # of employees)
  - Existing job centers
  - Future job centers
- Suitability based on number of job centers within a certain radius and weighted by number of employees at each site





- Combined suitability score
- Areas near freeways and job centers are the most suitable

Other suitability factors

- Utility infrastructure
- Traffic
- Urban amenities
- Municipal boundaries
- Water resource data



### **CAP CommunityViz Modeling Steps**







 Areas with high suitability score AND carrying capacity will get allocated housing units, up to the carrying capacity of the grid cell





#### Allocation

- Allocating county growth projections across each county
- Requires Carrying Capacity and Suitability Score for each grid cell
- Ability to customize where needed



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### **CAP CommunityViz Modeling Steps**



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# Key Planning Issues and Factors: Municipal Demand & Conservation



#### **Municipal Demand Calculations**

- CAP:SAM differentiates between new and existing demands, and both are converted into unique Gallons Per Housing Unit Per Day (GPHUD) values for each water provider (and on/off SRP lands)
  - Includes demand for the housing unit itself AND the fraction of all other demands (e.g., commercial, institutional, non-revenue, etc.)
  - Existing demands = total reported water use divided by the total existing housing units
  - New demands are tied to the housing unit projections from CommunityViz and dynamically adjusted based on the projected rate of growth
  - The fraction of demand associated with indoor use is estimated and tied to effluent production



#### **Municipal Conservation**

CAP:SAM allows annual and cumulative percent changes in GPHUD to be set for both new and existing uses







**Fulfill Requests** 

# **Imagery Classification of Vegetation and Other Exterior Uses**



**Goal**: Improve our understanding of exterior water use characteristics



**Data:** NAIP 2021, Phoenix-Pinal LiDAR 2020, Assessor Parcels, Building Footprints



**Output**: Classification of Vegetation (e.g., turf, shrub, tree), Non-vegetation, Pools, Artificial turf



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#### **Example Residential Parcel Classification**



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# Key Planning Issues and Factors: Supply Availability & Utilization



## **Supply Portfolios**

- CAP:SAM contains tabular data of the legal access each water provider (and all other entities) has to each of the water supply types
  - Based on entitlements, leases, information gleaned from DAWS and water resource plans, initial balances of LTSC and groundwater allowances, etc.
- These values represent the upper limit of what each water provider can "request" to satisfy projected demands



## **Supply Availability**

- The availability of most supply types is calculated based an aggregate volume, to which allocation rules are then applied
  - For example, the total CAP supply in a particular simulation year is based on output from JSAM and CRSS, but then made available within CAP:SAM to entities with CAP entitlements based on priority and ordering preferences
- Balances of long-term storage credits and groundwater allowances are calculated dynamically based on accrual or debiting behavior



#### **Supply/Demand Fulfillment**

# Each entity's projected demand is satisfied with supplies that are available to them in a sequence of preferred use





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#### **Example: Diverse vs. Uniform Portfolio**



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#### **Example: Large vs. Small Provider**





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#### **Example: Low vs High Growth**







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## **Effluent Production & Utilization**

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#### Sewer collection areas

- Effluent reuse (e.g., purple pipe, IPR, DPR) can have a large influence on how future demands are met
- CAP has compiled spatial and tabular data on effluent production and use, and incorporated additional functionality into CAP:SAM to better characterize future use
  - Includes a GIS layer of sewer collection areas
     by treatment plant
- Effluent availability can be estimated by aggregating the CommunityViz housing unit projections by the sewer collection areas, then applying production factors along with effluent ownership and current uses



# **Key Planning Issues and Factors: Member Land Considerations**



#### **Enrolled but Unconstructed Lots**

- CAGRD has a significant number of Member Land lots that are enrolled but not yet constructed
- At the same time, there are new Member Land enrollments (excluding Pinal AMA), some of which are proceeding quickly to construction





#### **Enrolled but Unconstructed Lots**

- CAP:SAM contains an initial inventory of unconstructed lots, differentiated by water provider and the Plan Period in which they were enrolled
  - Those lots are also assigned specific GPHUDs based on a statistical analysis of the demand ADWR used for the associated Certificates of AWS
- CAP:SAM uses a set of ratios, varied over time, to differentiate Member Land housing unit construction based on enrollment period
  - The ratio dynamically adjust as the "inventory" is exhausted
- The rate at which the inventory of previously enrolled lots are constructed can particularly affect the obligation projection in the outer decades



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#### ML Groundwater Allowance and Provider Reporting

- The volume and timing reported Excess Groundwater is influenced by the availability of groundwater allowance, the nature of the subdivision, when it was enrolled, and any non-groundwater supplies that the water provider delivers
- CAP:SAM tracks the groundwater allowances by ML water provider and Plan Period, and can account for differences in reporting percent and comingled supplies



Presentation, "CAGRD Operational Forecast," April 21, 2022



#### **Shameless Plug**

Want to do this type of work?

Know somebody who does?

#### **APPLY TODAY!**



SALARY: \$72,924.80 - \$87,484.80 Annually

OPENING DATE: 10/26/22

CLOSING DATE: 11/15/22 11:59 PM

**OVERVIEW & PURPOSE:** 

#### About the Pay

Target Starting Salary: \$72,924 - \$87,484 per year. This range does not represent the full pay range for employees in this position.

#### About Central Arizona Project

Central Arizona Project, a 336-mile system that brings Colorado River water to central and southern Arizona, delivers the state's single largest renewable water supply and serves 80% of the state's population.

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#### **Questions?**

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#### **Next Steps and Closing Comments**



# **2025 Plan of Operation Process Timeline**



