LSCR Basin Study
All Teams and Stakeholder Advisors Meeting
October 22, 2019 1:30 pm – 3:30 pm

Pima Association of Governments

1 East Broadway Boulevard, Tucson, Arizona 85701

Attendees (in person)

Eve Halper, Reclamation	Jim Leenhouts, US Geological Survey
Kathy Chavez, Pima County	Fred Tillman, US Geological Survey
Marie Light, Pima County /Department of Environmental Quality	Chris Magirl, US Geological Survey
Mead Mier, Pima Association of Governments	Michael Guymon, Tucson Chamber of Commerce
Lee Comrie, Pima Association of Governments	James Brown, Pima County Wastewater Dept.
Melanie Alvarez, Pima Association of Governments	Tres English, Sustainable Tucson
Julie Jamarta, Pima Association of Governments	Colleen Whitaker, Southwest Decision Resources
Neha Gupta, U of Arizona	W. Mark Day, Stakeholder
Monica Pickenpaugh, U of Arizona	Juliet McKenna, Montgomery & Associates
Colin Wogenstahl, U of Arizona	Brittney Bates, Montgomery & Associates
Wally Wilson, Metro Water	Rosanna Gabaldon, AZ State Representative
Jaimie Galayda, Tucson Water	Arturo Gabaldon, President, Community Water Company of Green Valley
Beth Scully, Tucson Water	Ken Seasholes, Central Arizona Project
James MacAdam, Tucson Water	Austin Carey, Central Arizona Project
Margaret Snyder, Tucson Water	

Via Webinar Link

Lindsay Bearup, Reclamation	Kevin Lansey, U of Arizona
Brandon House, Reclamation	Thomas Meixner, U of Arizona
Susan Montgomery, Pascua Yaqui Tribe	Kathy Jacobs, U of Arizona
Ryan Jackisch, ADWR	Christopher Castro, U of Arizona
Irene Ogata, City of Tucson	Kip Volpe, Vail Water
Heide Kocsis, AZ State Land Department	Asia Philbin, Marana Water
Frank Holler, Stakeholder	Eylon Shamir, Hydrologic Research Center
Doug Greenland, Cortaro-Marana Irrigation District	Evan Canfield, Pima County Regional Flood Control District
Amanda Smith, Sonoran Institute	C'iena Schlaefli, San Xavier District, Tohono O'odham Nation
Ben Hickson, Pima Association of Governments	

1. Welcome and Introductions

- Kathy Chavez, Pima County, welcomed meeting attendees, Project Team members, sub-team members, stakeholder advisors, and additional meeting attendees. Introductions were made.

2. Basin Study Overview (Eve Halper, Reclamation)

- Recap of study area and objectives of LSCR Basin Study. Boundaries are the Tucson Active Management Area (AMA). Statutory goal of this region under the 1980 Groundwater Management Act is to get to safe yield, but there are supply-demand imbalances that still exist even under the conditions of safe yield.
- Groundwater levels have recovered since Central Arizona Project (CAP) water has been used to recharge groundwater in the study region. However, there are still areas where groundwater is declining.
- Future water management challenges include climate change and population growth, which need to be incorporated into planning efforts.
- Basin studies must address impacts of changing climate and population demands on water resources. This study addresses the above as well as impacts to water supply managers and riparian areas.
- This study uses two climate/emissions scenarios developed by the IPCC, surface water models (SAC: SMA), and population scenarios from the demographic information supplied by the Arizona Department of Administration. This demographic information is used for input into the developed via the CAP Service Area Model (CAP:SAM)
    - Two representative concentration pathways (RCP) were used as emission scenarios: RCP 4.5 (best case) and RCP 8.5 (worse case)
    - CAP: Service Area Model (CAP:SAM) estimates water demand by provider, based on rate and type of population growth, matches water provider supplies with preferred supplies in order of preference.
    - Worse case, versus worst case, is used to present a higher level of risk via RCP 8.5.
- Use a non-climate scenario in order to compare with Arizona Department of Water Resources (ADWR) projections, which do not incorporate climate change considerations.
- This area is unique due to the seasonal and annual variability of precipitation. We have distinct rainfall seasons that can vary widely from year to year. This variability must be incorporated into future climate projections, which is done via the use of a weather generator.

- The weather generator is used to introduce the expected amount of variability into our projections (100 possible realizations from one daily climate model projection). This is done to develop probabilistic projections.
- The weather generator outputs serve as an input to the surface water model.

3. CAP:SAM Summary (Ken Seasholes, CAP)

- Modeling conducted by the CAP includes many other water supplies in addition to CAP water.
- Supply and demand modeling start with simple identifications of factors that would cause change to supply or demand (e.g. population growth, changes in agricultural growth, etc.) These factors are collectively referred to as "driving forces."
- CAP:SAM model also accounts for the complex legal and physical characteristics of both users and supplies/suppliers (e.g. Assured Water Supply rules, CAGRD replenishment, etc.)
- CAP:SAM can be used to make forecasts, but is best suited for use with scenarios. Scenarios can include multiple factors or assumptions, including urban growth patterns.
- One of the most uncertain factors of the future is population growth. Growth is described in this study via "housing units" which is expected to increase by 30,000 to 60,000 in Pima and Maricopa County.
- The location of growth is also important, and can occur in multiple density patterns. Growth can occur via redevelopment (concentration in urban areas) as well as those that expand outward more widely.
- CAP:SAM can differentiate between new and existing demand, and be used to reflect effects of conservation and climate change (e.g. increased outdoor water use due to temperature increase).
- Scenario B: low growth combined with lower emission scenario.
- Scenario F: rapid growth with high emission scenario. Total demand exceeds CAP demand, combined with shortage. This scenario incorporates the use of long-term storage credits (LTSCs).
- Impacts of Scenario F are much more pronounced in Marana versus Tucson, as the impact of increased growth is more pronounced in Marana.
- Scenarios do account for the retirement of farmland. Higher growth scenarios account for the conversion of actively-irrigated farm land.
- CAP:SAM accounts for the accrual and debit of stored water. Once the stored water is fully "debited," then the water supply shifts to additional water supplies. By doing so, the model is attempting to simulate the behavior of multiple water districts. However, it is complicated to account for behavior via the use and prioritization of various water supplies.

- Overall, this model demonstrates how the various growth scenarios can be represented in terms of water supply provisions.
- The model demonstrates a close link between total demand and overall growth rate. Additionally, the location of growth is closely tied to the types of supplies available to meet demand.
- A summary report with additional details will be coming soon.

4. Inputs to Groundwater Model (Wally Wilson, Metro Water District)

- Inputs to groundwater model primarily considered in terms of potable water supplied by water providers. Some providers have a service area that is completely built out and therefore are not expecting increases in use. Others providers are experiencing or expecting to experience significant growth. Small water providers are represented via a 5-year average.
- Storage and recovery of CAP water are represented within pumping files, but groundwater recharge is not included in pumping files.
- Pumping was distributed across each of the providers, and considered on a year-by-year basis.
- Wheeling is represented in select water providers' pumping files where deemed appropriate and likely to meet demand imbalances.
- The scenario discussed today represents a worse possible case as a bookend for comparison to other scenarios.
- Assumptions had to be made in demand calculations that are expected to skew pumpage in some areas that are considered unlikely (e.g. rapid growth in Metro Water is not considered highly likely).
- "Results from this scenario could trigger deeper and more serious thought to adaptation strategies such as land use planning, reused in dispersed treatment infrastructure, sizing of renewable supply infrastructure..."

5. Surface Water Modeling Results (Lindsay Bearup, Reclamation)

- Lindsay Bearup started with an overview of the modeling process that included a description of climate projection downscaling, weather generator development, and surface water modeling that generated results serving as input to the groundwater model described in today's meeting.
    - These processes are summarized in a robust manner in previous meetings, including All Teams Meeting #12 held in May 2019. (Note: this meeting did not include the Stakeholder Advisors).
    - Key periods of interest are historical periods (1970-1999), "near" future ("2030s" [2020 to 2049]) and "far" future ("2060s" [2050 to 2079]).
    - Two climate scenarios described above (Representative Concentation Pathway [RCP] 4.5 and RCP 8.5) were used with different downscaling

methods, but an identical climate model (MPI). Since a dynamically downscaled version of the MPI climate projections under the RCP 4.5 emissions scenario was not available, a statistically downscaled using LOCA method was used. The projections from the MPI climate model under the RCP 8.5 emission scenario was dynamically downscaled using WRF model.

- A weather generator was used to develop projections that incorporated the variability and seasonality of temperature and precipitation of the study area.
- Overall, we expect to see warmer temperatures. The results of precipitation analyses are highly variable and must be compared within scenarios instead of between scenarios. In other words, it is important to concentrate on the changes predicted by the models, rather than the absolute values of temperature and precipitation.
- Soil moisture decreases were predicted, notably in months preceding the dry season (winter season). Evapotranspiration was projected to decrease as well due to soil moisture limitations.
- A summary report with additional details will be coming soon.

Responses to comments on the PowerPoint presentation submitted by Kathy Chavez:

1) *On slide 6, why are there differences in the historical distributions of monsoon season onset between the "Best" and "Worse" climate scenarios?* – The "historical" distribution depicted on slide 6 is the model simulation of the historical period, not the actual historical data. The simulation of the historic period was provided so that the audience could see the changes between the model simulations at various points in time.
2) On slide 7, the two boxes on the right, the dry season historical best case is different and shorter than the historical worse case. If it is historical, why wouldn't they be the same?

6. Groundwater Modeling Results (Brandon House, Reclamation)

- Brandon House, Reclamation, presented results for the scenario titled Scenario F, which includes rapid outward growth and the high emission scenario (RCP 8.5). He started with a brief overview of groundwater modeling, describing the model used (USGS MODLOW).
- Overall, the model is used to "keep track of the water and where it goes." The Tucson AMA model (TAMA) model developed by ADWR was used for groundwater modeling efforts.

- Intricacies of scenario development within the groundwater model were described, including the nature of boundaries and sources of recharge included in the model.
- Streamflow futures were included as recharge within the groundwater model. Additional sources of recharge included artificial recharge facilities distributed throughout the TAMA that were considered as constant recharge sources over a 3-year average throughout projections.
- Note: We have shortened this section to eliminate the dissemination of results that were later found to be in error.

7. Question & Discussion

- Question: How do we use 100 climate futures across the years? Response: Weather generator produces 100 different, equally plausible temperature and precipitation scenarios. Those 100 different scenarios are put into surface water model, to generate 100 different streamflow scenarios at each gage.

- Reservations were expressed about certain aspects of model development, including the treatment of recharge and use of groundwater supplies.
    - This reservation will be addressed in the very near future via a small group comprised of demand sub-team members and technical service experts.

8. Next Steps

- Workshop to discuss adaptation strategies coming up on November 21