LSCR Basin Study
Project Team Meeting #11 and Sub Teams
May 23, 2019
University of Arizona Water Resources Research Center
350 N Campbell Ave, Tucson, AZ 85719

NOTES

Attendees:

Eve Halper, Reclamation	Lindsey Bearup, Reclamation
Kathy Jacobs, University of Arizona	Kathy Chavez, Pima County
Chris Castro, University of Arizona	Neha Gupta, University of Arizona
Evan Canfield, Pima County/Regional Flood Control District	Hsin-I Chang, University of Arizona
Lee Comrie, Pima Association of Governments	Julia Fonseca, Pima County/Office of Sustainability and Conservation
Jaime Galayda, Tucson Water	Subhrendu Gangopadhyay, Reclamation
Dick Thompson, Tucson Water	Claire Zugmeyer, Sonoran Institute
Valerie Swick, Reclamation	Eylon Shamir, Hydrologic Research Center
Catlow Shipek, Watershed Management Group	Chris Magirl, United States Geologic Survey
Tom Meixner, University of Arizona	Jeff Odefey, American Rivers
Val Little, Water Conservation Alliance of Southern Arizona	Claire Zucker, U of Arizona/Water Resources Research Center
Marie Light (phone), Pima County /Department of Environmental Quality	Austin Carey (phone), Central Arizona Project
David Barnes (phone), Freeport McMoran	Kevin Lansey (phone), University of Arizona
Catherine Evilsizor, (phone) public	Luke Cole (phone), Sonoran Institute

1. Welcome and Introductions

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

2. Basin Study Update/Review of Completed Tasks (Eve Halper, Reclamation)

- Key decisions made in model development were reviewed:
  - Dynamically downscaling (DD) was used for RCP 8.5 climate projections (WRF-MPI). This method is not constrained by historical data, as it is a physical model that simulates the summer monsoon and other medium-scale atmospheric processes well.
  - Statistically downscaling (SD) was used for RCP 4.5 climate projections (LOCA-MPI). This method is based on statistics-derived historical data.
  - Key metrics: change in intensity of extreme events (precipitation and temperature), change in monsoon timing, change in dry period timing
  - Weather generator was chosen due to high variability of precipitation in the region; valuable to assess distribution of future precipitation patterns

- Progress review
  - The surface water model results are being presented today, while the CAP service area and groundwater pumping portion of the modeling remains in progress.
  - Budget increase and project extension has been granted, due to technical sophistication of project.
- The purpose of the study is to understand vulnerability and resilience of systems and to perform a “stress test”

3. Weather Generator & Surface Water Modeling Results (Lindsay Bearup and Subhrendu Gangopadhay, Reclamation)

- Spatially relevant (local) climate information (rainfall and temperature) provided by downscaling general circulation model grid
- Larger monsoon precipitation events were not well represented in LOCA MPI model. It captures average monsoon behavior but not upper tail of distribution
- Future Climate scenarios
  - 2020-2049 (“2030s”): near future
  - 2050-2079 (“2060s”): far future
- Three seasons were evaluated:
  - Dry season (“arid fore summer”) defined as two week dry spell
  - Monsoon season defined as first of thee days with mean daily dew point temperature greater than 55°F
  - Winter wet season
- Weather generator was calibrated using Colorado River Basin Forecast Center Sacramento Soil Moisture Accounting Model (SAC-SMA) dataset. This is the same model used by the National Weather Service for flood forecasting. The model was run with future climate scenarios to generate future time series of precipitation and temperature (P&T) as SAC-SMA surface water model inputs.
  - Input P&T by weighted elevation bands, aggregated by sub-basins, then basin averaged
  - 100 daily realizations (for 6 different versions)
  - Future basin-averaged values were disaggregated to preserve each day’s spatial relationships
  - No land cover change is included in surface water model due to the difficulty in modeling spatially explicit changes in population growth
- Going to get warmer, very high confidence in temperature predictions
  - Consistent warmer shift in extremes across seasons

- Precipitation predictions much more variable and uncertain
- SAC-SMA model was chosen due to operational use by National Forecasting Centers. It projects:
    - Basin runoff and soil moisture
    - Spatially lumped (average properties over sub basin: P, T, potential evapotranspiration (PET))
    - Daily and continuous
    - PET, as monthly factor, is important in considerations of "hot drought"
    - PET for the model was explicitly adjusted to account for higher temperatures through time.
- Projected Changes
    - Dry season: best case indicates slightly more streamflow in far future, changes are very small in the absolute sense
    - Monsoon: best case indicates more predicted streamflow in near future (varies by sub-basin), worse case indicates less streamflow
    - Winter season: similar story as monsoon, more aggressive drying in worse case
    - Changes driven by changes in P, T, and PET
    - More no-flow days predicted in streamflow in worse case (9-12 more days with no flow), partially due to more increased information available in DD model
    - Consistent with increases in temperature
    - Best case has relatively minimal change in precipitation, worse case has total precipitation decreases
    - Increase in no-flow days under worse case
- MPI climate model falls in hotter/drier space with respect to a large group of climate models
- Snow not as well represented but can be reviewed
- Next steps
    - Develop recharge scenarios for groundwater modeling
    - Prepare input for Environmental Sub-team's riparian vegetation assessment

Audience Comments:

- Tropical storms are not well represented in DD and SD models. They need to be well represented in global climate models to be well represented in boundary conditions of downscaled models

- Currently have historical record of last 40-50 years, with the last 20 years reflecting climate change influences. Can mine historical data a lot in addition to relying on climate projections.
- Changes in soil moisture can be used to help indicate health of riparian areas, by looking at relative changes, timing of available moisture.
- Thanks to the Reclamation's technical support team for their work and for distilling highly technical information for the project team and sub-teams.
- Question and answer session followed presentation of surface water modeling results.
    - Question: Will the surface water model include changes in rainwater run-off from impervious surfaces resulting from land use changes associated with urban growth? Response: Without additional time and resources, the model will not project changes in rainwater run-off.
    - Question: Is there a climate constraints layer that is part of the groundwater model? Response: Climate projections show that the best-case scenario is different that the worse-case scenario. It shows plausible futures at a finer scale
    - Question: Mike Crimmins early this week said there is a 50/50 chance of a dryer versus wetter future. Where does this model fall relative to other models predicting future precipitation? Response: The MPI model generally indicates a dryer future with dryer winters and wetter monsoons
    - Question: Why do water providers care about the monsoon season? Response: The summer peak demand ends with the first monsoon rain event, primarily due to landscape irrigation
    - Question: Does the SAC:SMA model look at snow closely? Response: It is not a key driver in the LSCR basin, because snowpack is not a major driver for water supply
    - Question: Do the models account for tropical storms? Response: They are not ignored, but are not well represented. The models do include historical data, so in that respect, tropical storms are represented.
    - Comment: Recharge is critical especially winter recharge. The surface water model will point to extreme events that affect infiltration and recharge
    - Comment: It is important to look at the impacts to upland vegetation, not just riparian vegetation

4. Next Steps

- Next steps include the evaluation of risks from supply/demand imbalances of six scenarios. These identified risks will be used to identify adaptation strategies that will be used to perform tradeoff analysis and create "menu" of adaptation strategies for the region.

- The next meeting will review the results of the groundwater model for six scenarios