NOTES
LSCR Basin Study
Meeting Project Team #9

May 8, 2018 9:30 to 11: 30 am
Pima Association of Governments

Attendees:

Lindsey Bearup, Reclamation	Kathy Jacobs, U of Arizona
Chris Castro, U of Arizona	Kevin Lansey, U of Arizona
Hsin-I Chang, U of Arizona	Marie Light, Pima County/DEQ
Kathy Chavez, Pima County/OSC	John McKinney, FICO/FWC
James DuBois, Pima County/RWRD	Mead Mier, PAG
Julia Fonseca, Pima County/OSC	Mike Milliken, Community Water Co. of GV
Lauren Furphy, Tucson Water	Asia Philbin, Town of Marana
Neha Gupta, U of Arizona	Margaret Snyder, Tucson Water
Eve Halper, Reclamation	Kip Volpe, Vail Water
Bob Hedden, USCPUG & GVWID	Wally Wilson, Metro Water District
Victoria Hermosillo, U of Arizona	Brian Wong, BKW Farms

1. **Review of April 2 draft minutes**
   - No comments changes from Project Team
2. **Evaluation of Climate Projections:** Presented by Dr. Hsin-I Chang, University of Arizona Department of Hydrology and Atmospheric Sciences
3. **Process of selecting climate data and narrowing down into recommendation for use in the LSCR Basin Study**
   - The Global Climate Model downscaling method used by the UofA group (the WRF Regional Climate Model) is physics-based (dynamical downscaling or DD), Reclamation's product (LOCA) is statistically downscaled (SD), based on observations.
   - IPCC data evaluated more than 20 global climate datasets. The Project Team chose lower-emission (RCP 4.5) and higher-emission (RCP 8.5) scenarios for this project
   - Before move into future climate, need to evaluate how climate models have performed in reproducing the past climate
   - Calculations will be performed for two future periods, the 2030's is considered the near future, the 2060's is considered the far future.
   - Sheffield et al. (2013)— includes a comprehensive evaluation of climate projection datasets' performance in North America
     - Highlights WNA: West North America (our region)
     - Evaluates "skill" of global climate datasets and ranks ability to perform to specific variables

    - Three stars on left are **global** climate datasets with higher rank for performance (MPI, HadGem2, GFDL)
    - These three models selected for physics-based (dynamically downscaled) climate projection approach, ranked in top 10 of 20 IPCC (Intergovernmental Panel on Climate Change) models
- Narrowed down physics-based (dynamically downscaled) model performance regionally for LSCR Basin Study by comparing to simulations of daily average precipitation for the historical period to observations
    - WRF-MPI and WRF-HadGem2 perform well, both are a little wetter
    - WRF-GFDL runs much "drier" than observations
    - All models will be bias-corrected before use

- Both dynamic (WRF) and statistically downscaled (LOCA) MPI and HadGEM2 models run "wetter" than observations. LOCA-GFDL runs much drier than other models & observations
- Discrepancies in monthly precipitation
    - MPI, HadGEM2 and GFDL have relatively good representation of summer rainfall
    - GFDL runs drier and monsoon peak is delayed
- **Future projection: 2001-2040**
    - Good representation of monsoonal rainfall variation is maintained
    - Magnitude not significantly changed
    - HadGem: earlier monsoon onset
    - Selected simulations vary in monsoon characteristics
- **Future Climate Assessment: August and December model performance, using worse (RCP 8.5) scenario**
    - **QQ Plots as graphical representation of performance of the entire distribution, rather than single performance metric**
        - q/q = plotting quantiles against quantiles
        - compare if data coming from same distributions, more robust than histograms
        - compare extremes & shapes of distributions
    - August historic daily precipitation: all models (SD/DD) have pretty large wet bias, this will be addressed in the bias correction process.
    - August 2030's future daily precipitation: models vary from "neutral" , slightly drier, slightly wetter, drier
        - LOCA:MPI and LOCA:HadGem2 show drier future

- August 2060's future daily precipitation: models vary from neutral to drier, none show have wetter
- December 2030's: some models show increasing precipitation, one shows significantly drier climate
- December 2060's: some are wetter (GFDL), multiple show significantly drier
- Remember: statistically downscaled uses observation as foundation, so models may bias wet due to observation record.
- Dynamically downscaled (DD) has warm bias
- **Box & whisker plots**: consistent warming pattern in August, December is a little more variable
    - *GFDL has cool far future, we may not want to give it as much weight, as this is inconsistent with most other models*

- Changes in daily extreme precipitation
    - Historical versus present day – extremes are getting more extreme (recent past has more extreme events)
    - Based on actual observational data, not models
    - Model projections (MPI & HadGem2) – see increase in the frequency of extreme event days, decrease of mild rainfall event days – for near and far future in August
    - Better representation of this trend in DD models
- Monsoon Onset Timing (end of dry spell)
    - Average on July 3 (modeling observations)
    - Question to the Project Team: How to define **end of dry spell**, looking into multiple definitions
        - CLIMAS definition: rainfall <0.1 inch over 2 weeks
        - Is it practical to use rainfall of 0.01 inch as threshold?
            - The Project Team was in consensus that a higher threshold, such as 0.1 inches averaged over the basin over 2 weeks, should be used to define the end of the pre-monsoon dry spell
        - Should we change the definition to a soil or ET metric? Feedback:
            - stick to less abstract parameters such as rainfall in inches
            - appears agricultural irrigation decisions not related to these considerations
            - ecological considerations also affected by antecedent moisture conditions

- water providers try to keep reservoirs full, entire year in case there's a break in the system – don't like to operate under full capacity… no real implications for utility daily management

- **Next steps:**
  1) UA Climate team will conduct dry spell calculation, 2) compare DD (worst case/high risk) projection to SD projection, 3) recommend best/worse case climate, 4) prepare climate datasets for weather generator to calculate surface flows and groundwater recharge. UA will deliver these datasets to Reclamation in their original form.

- **Discussion**
  Important messages on the climate projection analysis:
  - Team at UofA working hard to make sure we have right model for our region
  - Want to make sure have credible foundation and basis for next steps in supply/demand assessments
  - Want to look at implications of supply/demand imbalances in future

- Question: Are we leaning towards using MPI and HadGem2 and leaving out GFDL? Do you average out responses?
  - Yes, recommending MPI and HadGem2
  - Have not come up with conclusion of whether it is practical to use two models for weather generator, but projections are consistent. Average may be an option, we need to consider carefully
  - Counterpoint: lose understanding of behavior of system when average models
  - Taking metric approach, not necessarily averaging time-series, so not losing sub-model variability

- Comment: More extremes and variability will be challenging, longer time in between rains and extremes cause own issues.

- Question: Worse-case scenario runs drier, is it okay to evaluate the drier future?
  - Reason to do this is to prepare for future risk, and historically people have tended toward using average projections versus extremes. Water managers want to know how bad it could really get and be prepared
  - We know that our worse-case assumptions are not the *worst* possible assumptions
  - People not thinking about other implications of drier futures, and adjusting decisions
  - Okay to some to have drier projections, because we are seeing things we haven't seen before. Want to make wise decisions with forethought.

- As a water provider: seeing effects right now. Seeing increase in water use/demand (gpcd is rising) because of warmer temperatures, not because of growth. **Please reach out and ask questions!**

4. **Supply-Demand Scenarios Draft Proposal** Handout with details of scenarios, including assumptions. Included as attachments to meeting invite email.

Kathy Chavez reviewed the proposed supply (local climate) and demand (growth) scenario combinations. The biggest point of discussion has been assumptions (1) operation and timing of groundwater pumping for the Rosemont Mine in the Green Valley area and (2) how much replenishment will take place at Project Renews in Green Valley

Rosemont pumping site: Hudbay Minerals, the current owner of the Rosemont Mine, is proposing to pump 5,000 af per year from well fields located near Sahuarita. The Rosemont mine FEIS states that it is planning to replenish 105,000 AF over life of mine within the Tucson Active Management Area. This includes recharging Community Water Company (CWC) of Green Valley's CAP allocation (2,858 AFY) at Project Renews.

- Life of mine, based on the mining plan of operation, is 20 years. Experience shows mines can have a longer operational life
- Should the "worse case" include the Rosemont Mine continuing to pump throughout the study period, through 2060?
- Feedback: should we assume continued recharge at Project Renews assuming mine continues to operate past its expected life?
- Counterpoint: Should we assume Rosemont's owner will continue to replenish more groundwater if it continues to operate past its expected lifetime? Should we assume Rosemont's owner will have access to CWC's CAP allocation for recharge through the study period 2060?
- Not all of the groundwater Hudbay has committed to replenish for Rosemont Mine pumping is at the Project Renews site. Rosemont has replenished about 45,000 AF at a recharge site in Marana (far to the north, but within the Tucson Active Management Area).
- We don't know if (or when) Rosemont's 404 permit will be granted—how much do we want to speculate given how complex it can be?
- Should we assume mine operations and Project Renews recharge continue through period of study? We could revisit this in a feasibility study to test sensitivity of assumptions, including CWC water CAP allocations, water cutbacks, market pricing
- Assuming CWC would have their CAP allocation available for Rosemont to replenish the groundwater pumped from Sahuarita well fields, several permits would also have to be extended beyond the 20-year mine life in order for the mine to continue operating.

- Consensus on Industrial Demand-Mining: Scenario C will assume the Rosemont mine will operate for 20 years per their Mining Plan of Operation. Scenario F will assume that the Rosemont mine operation will extend through the study planning period, 2060.
- Consensus on Replenishment of Mining Demand: In Scenario C Rosemont will replenish its remaining commitment of 55,000 AF at Project Renews. After that, Project Renews would be available for recharge by other entities. In Scenario F, Rosemont will not replenish additional groundwater pumped beyond its original commitment of 105,000 AF (45,000 AF in Marana and 55,000 AF at Project Renews).
- CWC will recharge its CAP allocation at Project Renews throughout the study period, unless there are CAP shortages affecting Municipal and Industrial entitlements. Other entities may recharge at Project Renews.
- Consensus was reached by ensuring that the same standards applied to the Rosemont Mine as have been applied to other water demand sectors. The "without adaptation" scenarios assume that future water demands include existing demands and proposed projects whose plans have been approved, either by adoption of policies, regulatory permit approval and investment of substantial financial resources.

- Summary of Scenario matrix
  - Included "medium growth" and worse case climate
  - Assumed slow growth will be compact
  - Assumed rapid growth will be outward (sprawl)
  - Running six scenarios for groundwater models
  - The six scenarios may be grouped into "families of futures" depending on the results of the groundwater model runs
  - Creating model inputs, calibration, and interpreting model results for significant differences will be time consumptive

5. Updates from other sub-teams

- Environmental sub-team meeting monthly, defining objectives from adaptation, looking at social and ecological values
- Outreach: rescheduling this month's meeting
- Demand Sub-team work ongoing and obtaining input from agencies

6. Next Meeting Date and Topics

- Will focus on CAP:SAM projections and Climate Assessment
- Will consider webinar
- Date to be determined