NOTES

Lower Santa Cruz River Basin Study Project Team Meeting #3
Friday, May 20th, 2016, 9:00 AM
Pima Association of Governments, 1 East Broadway Blvd. #401, Tucson, AZ,

Attendees

Attendee	Organization	Attendee	Organization
Peter Abraham	Oro Valley	Eylon Shamir	HRC (via phone)
Mike Block	Metro Water	Kevin Lansey	UA, Civil Engineering
Chris Castro	UA, Atmospheric Sciences	Bailey Kennett	UA, WRRC
Hsin-I Chang	UA, Atmospheric Sciences	John Kmeic	Marana Water
Kathy Chavez	Pima County	Mead Mier	PAG
Marcelino Flores	Pascua Yaqui Tribe	Robert Miller	Asarco
Subhrendu Gangopadhyay	Reclamation	Sue Montgomery	For Pascua Yaqui Tribe (via phone)
Bob Hedden	GVDWID	Asia Philbin	Marana Water
Eve Halper	Reclamation	Wally Wilson	Tucson Water
Kathy Jacobs	UA, CCASS	Brian Wong	BKW Farms
Tim Lahmers	UA, Atmospheric Sciences		

Purpose of Meeting
The purpose of this meeting was to discuss nationally-recognized climate science and projections (as presented in the Third National Climate Assessment), as well as the climate models and assumptions that have informed the Colorado River Basin Study. Additionally, UA Atmospheric Sciences research on dynamical downscaling of global climate models (as opposed to the statistical downscaling method used in the Colorado River Basin Study) was presented to illustrate the benefits and drawbacks of each downscaling option. The background presentations about climate projections, uncertainties, methods of regional modeling, and potential risks provided the Project Team with greater context to discuss and collectively agree on the climate models and assumptions that will be selected for the Lower Santa Cruz River Basin Study.

April 27 Meeting Notes
There were no changes or corrections to the notes from the April 27, 2016 Project Team meeting

Santa Cruz River Basin Study: Climate Change Impacts, Models and Scenarios for Managing Risk in the Southwest – presentation by Kathy Jacobs

Overview of the Third National Climate Assessment. Released in 2014, the goal of the Third National Climate Assessment is to enhance the ability of the US to anticipate, mitigate, and adapt to changes in the global environment. The Assessment is based on the conclusions of over 300 authors and an advisory committee of 60 members, and presents clear, recognized climatic trends.

With climate change, we will see increased variability and frequency of weather extremes – but in a continually warmer context, as is illustrated by decade to decade trends. Though the

severity of impacts will depend on future emission levels, anticipated risks for the US Southwest include fire, flood, drought, and impaired air quality. There is significant evidence supporting projections of drier winters and springs in the SW (due to reduced snowpack), though there is uncertainty about summer conditions.

Climate impacts to groundwater are not as well-known as those to surface water, though the rate and amount of recharge are expected to be affected. Specific impacts will depend on the depth to water, the geomorphology of the basin, and the type and quantity of riparian plants among other factors.

Approaching Uncertainties To approach human, scientific and natural uncertainties, the Project Team will develop scenarios to account for multiple possible futures. Determining which emissions scenarios to utilize and which method of global climate model downscaling to pursue will influence the results of the regional groundwater hydrology model, which will ultimately determine the level of risks to be assessed and the adaptation options to be developed. Analyzing extremes is a better risk management tool than preparing for average trends; further, there is no intrinsic reason that mid-range scenarios are more likely to occur than high-end or low-end scenarios.

Newly Available High Resolution Data Dynamically Downscaled for the Colorado River Basin – presentation by Hsin-I Chang and Chris Castro

UA Atmospheric Sciences researchers Chris Castro and Hsin-I Chang dynamically downscaled global IPCC climate model projections – with a particular emphasis on streamflow conditions in the Colorado River Basin. Dynamical downscaling provided regional climate simulations (at a 25-35 km resolution), which were then corrected for bias to create basin-scale simulations (at a 12.5 km resolution). As opposed to statistical downscaling, dynamical downscaling provides an improved physical representation at the finest scale (statistically significant at a 1-10 km resolution).

The dynamically downscaled model results for the period of 2011 – 2040 show an increase in intense rainfall events for the Southwest U.S. during monsoon season, while mean precipitation during the monsoon season decrease.

In addition to precipitation projections, dynamical downscaling provides a more accurate representation of historical streamflow than statistical downscaling. The greatest difference between dynamically and statistically downscaled streamflow projections occurs during periods of highest flows. If applied to the Colorado River, dynamical downscaling shows a 10-20% reduction in peak streamflow at Lee's Ferry than what is projected through statistical downscaling and is provided in the Colorado River Basin Study.

	Statistical Downscaling	**Dynamical Downscaling**
Pros	Simple and inexpensive	Represents physical processes
	Many realizations	Lots of variables available
	Relatively easy to apply	Characterize extremes
Cons	Stationarity problem	Lesser scenario simulations
	Underestimates extremes	Computationally expensive
	No physical process basis	Requires training, experience
Methodological Choice:	*Reduce statistical uncertainty*	*Reduce physical process uncertainty*

Lower Santa Cruz River Basin Study: Irrigation Demand – presentation by Subhrendu Gangopadhyay

The SECURE Water Act requires Bureau of Reclamation to look at risks to water supplies, including increases in water demand or reservoir evaporation as result of increasing temperature. Accordingly, Reclamation has researched impacts to agricultural water demand in response to climate change; the results of which can be found in the 2015 technical memorandum, *West-Wide Climate Risk Assessment: Irrigation Demand and Reservoir Evaporation Projections*. Agricultural impacts were evaluated in eight basins across the West, including the Colorado River Basin, by using five climate change scenarios to develop crop ET models. Reclamation's resources, including irrigation demand and reservoir evaporations projections for each HUC-8 area across the West is available for the LSCR Basin Study area.

Discussion

There are multiple choices to be made by the Project Team about which methods and assumptions will be used in the Basin Study. Key questions and Project Team discussion points are presented below.

1. Does the Project Team want to evaluate strictly the best and worst case climate scenarios?
    - Interest in looking at a high emissions / worst case climate scenario.

2. What is the appropriate number of climate scenarios to evaluate? Fewer scenarios make the analysis simpler, but a greater number of scenarios provide a more robust analysis.
    - The greater the number of scenarios, the more complex the decisions will be throughout the Basin Study process.
    - Focusing on fewer scenarios would make the overall project simpler and more focused, but would not encompass the full range of possible futures.
    - Other Reclamation Basin Studies have typically used 3 to 5 climate scenarios (warm/dry; warm/wet; hot/dry; hot/wet; and central tendency)
    - One view was that if this study is going to be a risk-management tool, there seems to be little point of evaluating "middle of the road"/central tendency scenarios.
    - With respect to environmental or agricultural considerations, it may be beneficial to focus on different climate scenarios to account for seasonality (different seasonal futures).
    - If water supply during monsoon season is a concern, dynamical downscaling may be the best method of regional modeling.

3. Does the Project Team want to evaluate climate impacts at a Colorado River Basin scale, a local scale, or both?
    - Both a local and a Colorado River Basin scale

4. How will impacts to water demands (municipal, agricultural, evapotranspiration) be influenced by the different climate modeling methods and assumptions?
    - If looking at municipal demand at a cursory level (change in gpcd, change in population, location of those demands), we could conduct a sensitivity analysis then look at how that aggregates across the basin.
    - There is flexibility in which demand assumptions are utilized by the Project Team.

5. Basin-wide balance vs. specific sub-basins: How will the Project Team account for the impact of climate change-induced water supply and demand changes in the larger Colorado River Basin? Will the Project Team assume the existing infrastructure and operations of over-arching entities (i.e., CAP, ADWR) or account for their expected operations under differing climatic conditions? How will varying assumptions be streamlined?
    - We can use the AMA model for the groundwater model.
    - There is interest in evaluating water supply and demand imbalances within sub-basins, not just the overall TAMA basin. It was noted that the Plan of Study specifies that the analysis will be aggregated by Water Accounting Areas defined by the TAMA Safe Yield Task Force.

After thorough discussion, the Project Team recommended the following course of action:

1. Explicitly consider a worst-case scenario
2. Evaluate climate change impacts on both Colorado River Basin and local water supplies
3. Explore the feasibility of using dynamical downscaling to model regional climate change impacts

Feasibility of Dynamical Downscaling

Reclamation will discuss internally and with the UA Atmospheric Sciences team to assess the feasibility of integrating dynamically downscaled climate projections into the Basin Study. These types of projections have not been used in a Reclamation Basin Study, so this presents an opportunity to incorporate a new generation of climate data into water resources planning.

Stakeholder Communications and Outreach Sub Team Report

Deferred to next meeting.

Next Meeting and Topics

Report on the development of climate modeling and launching of sub-teams. Doodle poll to be sent for next meeting date.