## **Project:** Lake Mead Intervening Flows

**Goals:**

1. Compare and investigate more accurate ways to forecast and account for intervening flows into Lake Mead

2. Reconcile differences between intervening flows as calculated by the Bureau of Reclamation (BOR) and the Colorado Basin River Forecast Center (CBRFC)

3. Develop a methodology to forecast intervening flows that would be appropriate for potential use in Reclamation's modeling applications

**Status:**

The CBRFC has two methods to compute the side inflows into Lake Mead.

1) The official method uses a traditional mass balance approach similar to that of the BOR, though the CBRFC does not use or calculate an intervening flow term.

2) The backup (second) method utilizes gages from the Colorado River at Diamond Creek, Muddy River, Virgin River, and the Las Vegas Wash, along with Powell Releases and the Southern Nevada Water Authority.

The CBRFC is currently issuing a traditional forecast of intervening flows at Lake Mead that is based on the forecast of tributary inflow. The CBRFC is also issuing an "adjusted" BOR forecast.

The CBRFC has verified monthly and seasonal intervening flow forecasts from the CBRFC/BOR since December 2014 and will continue to archive/verify forecasts in the future.

**Method:**

The CBRFC mass balance method for calculating intervening flow into Lake Mead is the sum of Mead's release, change in storage, evaporation, and SNWA withdrawals, minus a *lagged* Powell release and return flows from the Las Vegas wasteway.
*CBRFC Observed Inflow = MeadRelease + MeadEvap(CBRFC) + ΔMeadStorage + SNWP Use - PowellRelease(lagged)*

The CBRFC tributary method for calculating intervening flow into Lake Mead is the sum of the flows at the Colorado River at Diamond Creek (CDCA3), the Virgin River (VLMN2), Muddy River

(MUDN2), and the average local flows below the Grand Canyon, minus a Powell *lagged* release.
*Inflow from Gages = CDCA3 + VLMN2 + MUDN2 + LocalC - PowellRelease(lagged)*

To develop an "adjusted" BOR forecast of intervening flows, the CBRFC intervening flow forecast is adjusted by the difference between the BOR/CBRFC forecast for Mead evaporation, and the BOR change in Mead bank storage. The calculation of the observed BOR intervening flow value is done similarly.
*Adjusted BOR Inflow = CBRFC Inflow + MeadEvap(BOR) - MeadEvap(CBRFC) + ΔBankStorage(BOR)*

**Outcomes, Findings:**

1) Over the 30 Year calibration period spanning water years 1981-2010, the adjusted intervening flows calculated by the CBRFC are similar to those calculated by BOR.

2) Monthly verification of intervening flow forecasts since December 2014 was performed. The different forecasts considered were: CBRFC ESP, BOR, and Climo (1980-2010). The following is a summary of the results:
   - The CBRFC ESP method does best in the spring, however it struggles compared to climo during the summer/fall season, with a large negative (underforecast) bias.
   - The BOR forecasts have the largest errors, except summer.
   - ★ *CBRFC New* uses the CBRFC ESP in the winter/spring and Climo during the summer/fall. Due to its superior stats, it will be the primary CBRFC forecasting method for intervening flows going forward.