

Appendix K SJBHM PROGRESS REPORTS AND CHANGELOGS

FY2017 SJBHM PROGRESS REPORT AND CHANGELOG

The following is a summary of the progress, development, and modifications made to the SJBHM models and datasets during FY2017.

- **Input Data, StateMod, Hydrology, and Demands Work**
 - Data pathways from StateMod to RiverWare for model input flows and upper basin depletions were remade to be more user-friendly and transparent.
 - Errors were found and corrected both in the previous StateMod baseline model runs and the previous data pathways between StateMod and RiverWare.
 - Work was done in conjunction with Wilson Water Group (Colorado's SJ StateMod contractor) to correct and adjust aspects of StateMod to better meet the requirements of the SJRIP RiverWare model.
 - StateMod depletions were remapped to reporting categories to simplify the reporting and fix ambiguities.
 - Tribal depletion demands and reporting was adjusted and corrected.
 - "Current Condition" level demands were developed based on recently observed data to allow for model runs that analyze the performance of various flow recommendations under current demand levels as opposed to Baseline demand levels.
 - To support the "Current Conditions" demands, updated current condition StateMod runs were QA/QC'd, adjusted, and data pathways were developed.
- **RiverWare Model Improvements and Developments**
 - Run cycles were implemented in the model to provide more accurate model representation of San Juan Chama diversions, release requirements to meet Target Baseflows, and Total Available Water volume available for recovery program releases.
 - Additionally, the implementation of run cycles also allowed for accurate modeling of demand reductions due to shortage sharing.
 - Model representation of the ALP project was rebuilt to be more accurately represented and more user friendly and transparent.
 - Model water users representing "boundary" users in Colorado that are represented in both StateMod and RiverWare were rebuilt to be more accurately represented.
 - StateMod hydrology inputs (model inflows) were adjusted in the model to be more accurately represented.
 - Model structure and logic was developed to allow for efficient and transparent switching between Baseline and Current Condition demand levels.
- **RiverWare Logic (Rule) and Method Development**

- Model rules were developed to implement 3 versions of the “2016 Interim Flow Recommendations” (called “Run A”, “Run B”, and “Run C”). This included new rules and methods to determine the total Available Water, construct the recovery release hydrographs, and operate to these releases during model runs.
 - RiverWare model logic was developed and implemented to represent typical Shortage Sharing Agreements between applicable water users dynamically if shortage conditions arise within model runs. This replaced the previous “Supplemental Water” functionality that was used within the model and that caused issues and bias within the model depletion results during shortage years.
 - Many rules were rewritten as required to incorporate the addition of run cycles to the model, this included rules to operate San Juan Chama diversions, and to make and adjust target baseflow releases from Navajo, flood releases from Navajo, and recovery releases from Navajo.
 - Model logic and structures were developed to dynamically target NIIP annual average depletion requests to user-input levels within the model. Previously this process was completed outside of the model using various opaque and inconsistent methods.
 - Many previous rules and functions were rewritten for model efficiency purposes and for model transparency reasons.
- **General Model Maintenance and Cleanup**
 - RiverWare model output devices (DMI’s) were remade and previous no longer used DMIs were removed. No longer necessary post-processing rules and data objects in RiverWare were removed.
 - Many old and no longer used rules, functions, and objects were removed from the model. These are saved in previous versions of the model. The model rule and function sets were cleaned up and reorganized to be more transparent and user friendly.
 - The names of many water users and reaches were updated to be more user friendly and transparent as opposed to the previously used numeric station codes.
- **Analysis Model Runs Completed:**
 - Updated Flow Recommendations Analysis
 - Baseline Demands – Interim “Run A”, “Run B”, and “Run C” Flow Recommendations
 - Baseline Demands - “Run C” Flow Recommendations – Several iterations of model runs completed for further analysis of “Run C” Flow Recommendations
 - Current Condition vs Baseline Demand Level Analysis:
 - Current Condition Demands – 1999 Flow Recommendations
 - Current Condition Demands – “Run C” Flow Recommendations
 - Baseline Demands – 1999 Flow Recommendations
 - Baseline Demands – “Run C” Flow Recommendations

FY2018 SJBHM PROGRESS REPORT AND CHANGELOG

The following is a summary of the progress, development, and modifications made to the SJBHM models and datasets during FY2018.

- The October 2018 San Juan Basin Hydrology Model Documentation was developed, sent out for comments, and revised based on responses.
- Comments on SJBHM from NMISC (from 2017) were reviewed, considered, and acted upon as directed by the SJRIP.
- SJBHM Baseline Depletion Summary model result workbook was enhanced to allow for better viewing and understanding of model results by stakeholders. The workbook now facilitates viewing of summarized annual model results rather than strictly average annual results, while also distinguishing between water user *demands* (diversion requests and depletion requests) and model results (diversions and depletions), as well as presenting simulated shortages to water users.
- Model procedures for NIIP and Navajo Gallup demands and operations were reviewed and improved to be consistent with tribal settlements and planned project implementation.
- NIIP return flow locations (in both RiverWare models) were updated based on recent review of observed NIIP return flows by Keller-Bliesner Engineering, provided by Brian Westphal in August 2018.
- Historic NIIP return flow data was updated based on revised numbers. The SJRIP RiverWare Historic Model was updated with this data (and previous bullet adjustments), and local inflows were recalculated.
- NIIP groundwater interaction representation was improved to reflect more recent data and information and SJBHM Baseline scenario definition. Simulation during SJBHM Baseline scenario now assumes that NIIP groundwater interaction is at equilibrium with a constant outflow rate (through full model run inflows to groundwater equals outflows from groundwater).
- Simulation of tribal depletions and demands were reviewed and enhanced to be consistent with tribal settlements while also being consistent with representation methods of non-tribal water users. Previous “targeting” methods were eliminated and non-NIIP tribal demands were updated to max at the decreed numbers and acreages, and then to reduce acres below the max decreed acres in necessary years so that the total depletion demand maxes at the max decreed volume in those years. These users are now consistent with non-tribal irrigation users as they’re now using decreed acres and CIR rates, rather than targeting/adjusting the acres to get some specific depletion number
- Shortage sharing representation within the model continued to be developed and enhanced to reflect actual current procedures and agreements.
- Simulation of Navajo reservoir operations continued to be enhanced to better reflect actual reservoir operational procedures. Some minor adjustments to the way that Navajo releases are

set to meet the 3-gage average target baseflows to try and limit the “saw-toothing” releases where they get into this cycle of releasing lower than TBF values and then making up for it with higher releases about every 7th day, which isn’t the way they occur during real operations. These adjustments helped but did not completely eliminate the issue. Additionally, a minor issue where TBF releases were being calculated slightly differently between Run Cycles which ended up with the TBF releases changing a little bit between cycles was correct. The flood control rules were also adjusted slightly to be more consistent with actual procedures and requirements.

- Support was provided for SJBHM usage for altered climate scenario studies at Sandia National Labs (Vince Tidwell).
- General model maintenance and updates were performed with respect to RiverWare software versions and other support software improvements.

FY2019 SJBHM PROGRESS REPORT AND CHANGELOG

The following is a summary of the progress, development, and modifications made to the SJBHM models and datasets during FY2019.

- General model maintenance and updates were performed with respect to RiverWare software versions and other support software improvements.
- Shortage Sharing Simulation Procedure Updates: Adjustments made for consistency with 2017-2020 Shortage Sharing Agreement (2018 version). Method now handles much wider range of shortages as necessary in climate change modeling. Update has negligible impact on baseline results.
- Automation improvements made to increase modeling and analysis efficiency. Reduced need for manual intervention/calibration during model runs. Shortage Sharing Percentage calibration process. NIIP Groundwater calibration.
- Downstream Flood Control Limits Implemented, 12,000 cfs limit at Farmington and Shiprock.
- Navajo target baseflow release “sawtooth” issue improved.
- Many rule and method improvements/bugs fixed as identified through climate change hydrology modeling; now handles wide range of hydrology much better.
- CADSWES able to utilize USBR RW development funds (non-SJRIP-related funds) to work with on RiverWare software enhancements that will benefit SJRIP RW model (i.e., Run Cycle improvements)
- Continued support was provided for SJBHM usage for altered climate scenario studies at Sandia National Labs (Vince Tidwell).
- Navajo Gallup Depletion Guarantee Revision Request modeling. Request was analyzed in model tentatively. NMISC requested that DG be removed from SJRIP Baseline scenario. DG previously has been implemented by using an average annual NIIP depletion demand of 249,218 AF (= full NIIP depl demand of 270,000 AFY minus the DG requirement of 20,782 AFY) and full NGWSP depl demand of 35,893 AFY. This essentially assumes that the DG is in effect in each year of the model run. If removed, Baseline scenario demands will be Full NIIP (270,000 AFY) and NGWSP (35,893 AFY). Final decision was not made regarding this issue in FY2019. Please see/request separate summary report for more information.

FY2020 SJBHM PROGRESS REPORT AND CHANGELOG

The following is a summary of the progress, development, and modifications made to the SJBHM models and datasets during FY2020.

- General model maintenance and updates were performed with respect to RiverWare software versions and other support software improvements. Final FY2020 RiverWare version is 8.1.2.
- Model enhancements made to support maintenance release and climate change modeling, including new logic/rule development and enhancement to expand scope of some existing rules, as necessary. These model changes did not impact baseline results as they are applicable to maintenance release and climate change modeling scenarios only.
- Navajo-Gallup Depletion Guarantee (NGDG) Revision Request discussions were continued with relevant parties. Still no final decision made as of end of FY2020.
- Model and datasets were reviewed to determine that Ranchman-Terrell ditch depletions were already included in depletions (lumped into “NMAAnimasIrr” water user). Therefore, no specific modeling was required for Section 7 consultation.
- Hogback and Cudei depletions were corrected to SJBHM/SJRIP defined baseline values from 2006 Navajo Reservoir Operations FEIS (had previously been incorrectly adjusted to tribal decree values).
- SJRIP Hydrologic Modeling Technical Workgroup Meeting, January 28, 2020. Preliminary maintenance release modeling was presented and discussed. Climate change modeling background, crash course, similar studies, and recommendations for SJRIP Climate Change study was presented and discussed. Plans were made for continuation of both modeling efforts. Meeting materials are available upon request.
- Maintenance Releases: Modeling was conducted to support exploration of potential maintenance release procedures and analysis. See/request separate Maintenance Release modeling report for more information.
- SJRIP Climate Change Study: SJBHM modeling (using San Juan StateMod and SJRIP RiverWare) was conducted as part of SJRIP Climate Change Study. See/request separate SJRIP Climate Change Study report for more information.
- SJBHM Documentation was updated to reflect changes since last official version. Newest version now dated November 16, 2020.