

**Engineering Committee Report Republican
River Compact Administration
August 31st, 2023**

EXECUTIVE SUMMARY

This document reports the activities of the RRCA Engineering Committee from the August 31st, 2022 RRCA Annual Meeting to the August 31st, 2023 RRCA Annual Meeting. The Engineering Committee (EC) met four times since the August 31st, 2022, Republican River Compact Administration (RRCA) Annual Meeting. Over the past year, the EC completed these assignments: 1) hold quarterly meetings; 2) exchange information listed in Section V of the RRCA Accounting Procedures and Reporting Requirements, including all required data and documentation; 3) finalize 2022 accounting; 4) continue work on documenting historical changes to the RRCA Accounting Procedures; 5) provide updates on the progress of new and ongoing management strategies for maintaining compact compliance; 6) continue development and maintenance of the RRCA administrative website that serves as an informational page for the public and provide regular updates to the EC; 7) continue work and provide updates on improving accounting tools developed by the Engineering Committee; 8) work to prepare the 2022 RRCA annual meeting report; and 9) work to find a solution regarding the NCORPE pumping reporting error in the 2021 accounting.

Ongoing assignments include: 1) hold quarterly meetings; 2) continue work on documenting historical changes to the RRCA Accounting Procedures; 3) provide updates on the progress of new and ongoing management strategies for maintaining compact compliance; 4) work on maintaining and enhancing the RRCA public website; 5) continue work and provide future updates on improving accounting tools developed by the Engineering Committee.

The EC recommends discussion by the RRCA on the exchange of data, modeling results, and proposed accounting for 2022 incorporating the EC's proposed course of action for dealing with correction of 2021 NCORPE pumping; modeling and data tasks to be assigned to Principia Mathematica for 2023; the document summarizing historical changes to the RRCA Accounting Procedures; and recommended EC assignments and other potential assignments for the next year.

Details of the various EC tasks are described further in the remainder of this report, including:

- Attachment 1: Minutes of the quarterly meetings of the EC
- Attachment 2: Accounting Inputs and Accounting Tables from the RRCA Accounting for 2022 recommended by the EC for approval by the RRCA (Task 3)
- Attachment 3: Report on Error in the 2021 NCORPE augmentation project pumping data

COMMITTEE ASSIGNMENTS AND RELATED WORK ACTIVITIES

1. Meet quarterly to review the tasks assigned to the committee.
 - a. The EC met November 10, 2022; January 19, 2023; April 20, 2023; and July 13, 2023. See Attachment 1 for the approved minutes of these meetings.
 - b. The EC recommends that this task continue.

2. Exchange by April 15, 2023, the information listed in Section V of the RRCA Accounting Procedures and Reporting Requirements, and other data required by that document, including all necessary documentation. By July 15, 2023, the states will exchange any updates to these data.
 - a. Nebraska posted its data on April 14, 2023, and provided an update on July 14, 2023.
 - b. Kansas posted its data on April 14, 2022, and provided an update to the data on July 6, 2023.
 - c. Colorado posted its data on April 4, 2023, and added Crop Irrigation Requirement (CIR) data on July 1, 2023.
3. Finalize the 2022 accounting and recommend it for approval by the RRCA.
 - a. Colorado, Kansas, and Nebraska accounting data for 2022 are final and the EC hereby recommends approval of the accounting by the RRCA.
 - b. The applicable summary accounting tables are presented in Attachment 2.
4. Continue work on creating a document memorializing when RRCA Accounting Procedures have changed over the years and incorporate it into the Accounting Procedures (AP).
 - a. The EC will continue to maintain the AP tracking document and publish it on the website.
5. Provide updates on the progress of new and ongoing management strategies for maintaining compact compliance.
 - a. Nebraska provided updates on the current year forecasting and kept the other states abreast of the status of Water Short and Compact Call Year determinations. Nebraska discussed anticipated management actions for the 2023.
 - b. Kansas informed the EC that minimum desirable streamflows were being enforced in parts of the basin. The EC heard several updates on the status of automation efforts on the Courtland Canal along with preliminary information on the status of the NRCS-sponsored Regional Conservation Partnership Program in the Upper Republican River Basin, which will focus on phreatophyte removal along the river channel.
 - c. The EC continued to explore use of the climate-based analyses for projecting pumping by Kansas.
 - d. Colorado provided updates on deliveries by the Colorado Compliance Pipeline.
 - e. The EC recommends this task as a recurring assignment.
6. Continue efforts to develop and publish an administrative website that would be an informational page for the public.
 - a. State staff have maintained and updated the website, which is accessible to the public, and reported back to the EC.
 - b. The EC recommends this task as a recurring assignment.

7. Continue work and provide future updates on improving accounting tools developed by the Engineering Committee.
 - a. The EC continues to use the website accounting tool to validate the accounting spreadsheet results.
 - b. The EC discussed the overlap in the Courtland Canal above Lovewell and Attachment 7 inputs and calculations that when combined with varying data sources were causing inconsistencies in the accounting spreadsheet. The EC will address this issue by performing a quality control check upon receiving these data from the United States Bureau of Reclamation.
 - c. The EC recommends this task as a recurring assignment.
8. Prepare the 2022 RRCA annual meeting report for approval by the RRCA at the 2023 annual meeting.
 - a. The report has been finalized and approved by the EC and is hereby recommended for approval by the RRCA.
9. Make a recommendation on a course of action for dealing with the 2021 NCORPE data correction.
 - a. On January 12, 2023, Nebraska provided a memorandum (Attachment 3) describing an error in 2021 NCORPE augmentation pumping data and updated 2021 pumping data from the NCORPE augmentation project wells. Since 2021 accounting was approved at the 2022 annual meeting, the memorandum from Nebraska also provided the differences in pumping and concluded that the differences in pumping would not impact the results of the 2021 accounting. The EC discussed how to calculate the accounting for 2022.
 - b. The EC recommends that the approved accounting for 2021 be left as it is since correcting the 2021 groundwater model runs results in no change to the 2021 groundwater impacts to streamflow.
 - c. The EC recommends that the 2022 accounting use groundwater model runs with starting heads for 2022 that incorporate the correction for 2021, and documentation explaining the difference is included with the 2022 accounting.

ITEMS FOR RRCA DISCUSSION & ACTION

1. Data exchange and modeling results for 2022 incorporating the EC's proposed course of action for dealing with correction of 2021 NCORPE pumping. The EC recommends the proposed 2022 accounting presented in Attachment 2 and in the spreadsheet titled "RRCA Accounting 2022 Final.xlsx" for approval by the RRCA. Upon approval of the accounting, the above-mentioned spreadsheet file will be placed on the public website.
2. Modeling and data tasks to be assigned to Principia Mathematica for 2023. The EC recommends that Principia Mathematica continue to maintain the web-based accounting tool and perform periodic model and accounting updates at the same level of service as in 2022.

3. The document summarizing historical changes to the RRCA Accounting Procedures is current and being maintained by the EC. The EC recommends that the document continue to be maintained by the EC as an ongoing assignment.
4. Discussion of the recommended EC assignments and other potential assignments for the next year and agreement on a final set of assignments. The EC presents the following list of recommended assignments to report on at the 2024 annual meeting of the RRCA.

RECOMMENDED ASSIGNMENTS FOR THE COMING YEAR

The Engineering Committee recommends that the Republican River Compact Administration assign the following tasks:

1. Meet quarterly to review the tasks assigned to the committee.
2. Exchange by April 15, 2024, the information listed in Section V of the RRCA Accounting Procedures and Reporting Requirements, and other data required by that document, including all necessary documentation. By July 15, 2024, the states will exchange any updates to these data.
3. Finalize the 2023 accounting and recommend it for approval by the RRCA.
4. Maintain and publish updates to *Summary of Historical Changes to the RRCA's Accounting Procedures and Reporting Requirements* as necessary.
5. Provide updates on the progress of new and ongoing management strategies for maintaining compact compliance.
6. Continue development and maintenance of the RRCA administrative website that serves as an informational page for the public and provide regular updates to the EC.
7. Continue work and provide future updates on improving accounting tools developed by the Engineering Committee.
8. Prepare the 2023 RRCA annual meeting report for approval by the RRCA at the 2024 annual meeting.

The Engineering Committee Report and the exchanged data will be posted on the web at <http://republicanriver.org/>

SUBMITTED TO THE RRCA BY

Ivan Franco, Chair and Engineering Committee Member for Colorado

Christopher Beightel, Engineering Committee Member for Kansas

Kari Burgert, Engineering Committee Member for Nebraska

MINUTES for the
**QUARTERLY MEETING of the
ENGINEERING COMMITTEE of the
REPUBLICAN RIVER COMPACT ADMINISTRATION**
November 10, 2022 9:00 AM Mountain Time

Meeting was held via Google Meet.

Attendees:

Chris Beightel, KS

Kari Burgert, NE

Hongsheng Cao, KS

Jesse Bradley, NE

Chelsea Erickson, KS

Elizabeth Esseks, NE

Samantha Capps, NE

Brian Flynn, NE

Ivan Franco, CO

Sam Perkins, KS

Willem Schreüder CO

ENGINEERING COMMITTEE TASK LIST

1. Introductions
 - 1.1. The meeting started at approximately 9:00 a.m. MT
2. Review/Modify Agenda
 - 2.1. No revisions or modifications to the agenda.
3. Review and Update Progress on Engineering Committee Task List
 - 3.1. Meet quarterly to review the tasks assigned to the committee.
 - This is the first meeting of the year and the subsequent meetings have been scheduled.
 - 3.2. Exchange by April 15, 2023, the information listed in Section V of the RRCA Accounting Procedures and Reporting Requirements, and other data required by that document, including all necessary documentation. By July 15, 2023, the states will exchange any updates to these data.
 - Willem emailed all parties at the start of November with a CBCU update that included climate data updated thru October of 2022. The update also included a preliminary 2023 model run assuming the year would be water short.
 - 3.3. Finalize the 2022 accounting and recommend it for approval by the RRCA.
 - Courtland Canal Data is in two locations in the accounting.
 - Nebraska informed the group that they continue to work on an email detailing Courtland Canal Data improvements.
 - **Action Item: Kari will draft an email distilling down where we have seen issues with the data reporting in order to get a good sense of the issue and for the EC to be able to provide feedback to the USBR.**
 - 3.4. Maintain and publish updates to Summary of Historical Changes to the RRCA's Accounting Procedures and Reporting Requirements as necessary.
 - No discussion necessary
 - 3.5. Provide updates on the progress of new and ongoing management strategies for maintaining compact compliance.
 - Willem noted that the CCP forecast is out and that the pipeline is expected to run into April 2023 as the forecast is less than optimal. The original estimate put the pumping at 9,500 acre-feet and we expect a rise of perhaps 2,000 acre-feet to account for the water short year.
 - Kari noted that Nebraska has their early forecast meeting with the natural resources districts and the

irrigation districts coming up next week and the final forecast will be out by the end of the year. Her intuition is that 2023 would likely be a Compact Call Year.

- Chris informed the group that Kansas is enforcing minimum desirable stream flows in their part of the basin due to streamflow declines. Chris reminded the group of the automation taking place throughout the KBID/NBID system. Chelsea informed the group of the Upper Republican South Fork work being done. She noted that in the 2021 bid round there were more than 70 applicants for things like soil moisture probes, nozzle packages, pivot controls and so on. Chelsea noted that there is still about 1.2 million left to be awarded.

3.6. Continue development and maintenance of the RRCA administrative website that serves as an informational page for the public and provide regular updates to the EC.

- There have been no significant changes to the website. Chelsea noted that Kansas renewed the hosting and backup service for another three years.
- Sam Capps informed the group that Avery Dresser would now be the contact person for Nebraska on the website committee.

3.7. Continue work and provide future updates on improving accounting tools developed by the Engineering Committee.

- Continue evaluating usefulness/applicability of the climate pumping estimator proposed by Kansas.
- Willem informed the group that he is still thinking about how to best utilize Sam Perkins' precipitation estimate methodology. Willem noted that Sam provides a result in inches of application and Willem is still unsure of how to convert that into a useful pumping distribution. Willem noted that the CBCU is not terribly sensitive to this year's pumping based on a model run where he mistakenly entered zero pumping.
- Chris thought it would be interesting to understand when each year's pumping had the largest impact on the system. Willem noted that as the system is non-linear it would be difficult to pinpoint exactly but his intuition was that it was likely a decade, or so, out from the actual pumping year.

3.8. Prepare the 2022 RRCA annual meeting report for approval by the RRCA at the 2023 annual meeting.

- Kansas has performed an initial review and edit of the 2022 annual meeting transcript and has forwarded along the edited document to Nebraska for further edits. The plan moving forward is to collect everyone's final edits and return the draft document to the stenographer's office for production of a final copy.

4. Summary of Meeting Actions/Assignments (in bold)

- **Kari will send out an email summarizing the Courtland Canal issue.**
- **Sam Perkins will continue to work with Willem on how best to utilize the pumping estimate tool.**

5. Future Meetings

5.1. **The next meeting will be on January 19th, 2023 at 1 pm MST.**

6. Adjourn

6.1. The meeting adjourned at approximately 9:29 a.m.

MINUTES for the
**QUARTERLY MEETING of the
ENGINEERING COMMITTEE of the
REPUBLICAN RIVER COMPACT ADMINISTRATION**
January 19, 2023 1:00 PM Mountain Time

Meeting was held via Google Meet.

Attendees:

Chris Beightel, KS

Kari Burgert, NE

Hongsheng Cao, KS

Jesse Bradley, NE

Chelsea Erickson, KS

Lizzie Hickman, KS

Samantha Capps, NE

Brian Flynn, NE

Ivan Franco, CO

Sam Perkins, KS

Willem Schreüder CO

Elizabeth Esseks, NE

ENGINEERING COMMITTEE TASK LIST

1. Introductions

1.1. The meeting started at approximately 1:00 P.M. MT

2. Review/Modify Agenda

2.1. No revisions or modifications to the agenda.

3. Review and Update Progress on Engineering Committee Task List

3.1. Meet quarterly to review the tasks assigned to the committee.

- This is the second meeting of the year and the subsequent meetings have been scheduled.

3.2. Exchange by April 15, 2023, the information listed in Section V of the RRCA Accounting Procedures and Reporting Requirements, and other data required by that document, including all necessary documentation. By July 15, 2023, the states will exchange any updates to these data.

- Kari noted that Elizabeth has been working with Nebraska staff who will be copying everyone on data request emails to the Bureau of Reclamation.
- Willem noted that one last piece of data that he is waiting on is for the USGS to clean up the icing record on the gauges from November 2022.

3.3. Finalize the 2022 accounting and recommend it for approval by the RRCA.

- Courtland Canal Data is in two locations in the accounting.
 - Nebraska informed the group that they continue to work on an email detailing Courtland Canal Data improvements.
 - Chris asked if the BOR was providing two sets of data. Kari noted that Nebraska receives the monthly water distributions spreadsheet and a "Court wrk sht" spreadsheet and at times the data can differ.
 - **Action Item: Kari will draft an email distilling down where we have seen issues with the data reporting in order to get a good sense of the issue and for the EC to be able to provide feedback to the USBR.**

3.4. Maintain and publish updates to Summary of Historical Changes to the RRCA's Accounting Procedures and Reporting Requirements as necessary.

- No discussion necessary

3.5. Provide updates on the progress of new and ongoing management strategies for maintaining compact compliance.

Attachment 1 Engineering Committee Meeting Minutes

- Kari noted that Nebraska's forecast for 2023 was completed at the end of 2022 and has designated 2023 as a Compact Call Year. All states should have received this letter. In April, Nebraska will send a letter of proposed Water Short Year Administration (which is anticipated) measures for 2023 as required by the FSS.
 - Willem noted that the CCP pipeline is running. The pipeline should be running into April 2023. There are a number of CREP acres coming into retirement on the South Fork so that is looking promising.
 - Chris noted that Kansas was planning on contacting the Cheyenne County Conservation District to discuss the RCPP. Chelsea noted that she contacted Dani Holzwarth and she noted that this is no forward movement on this project. There appears to be a hang-up on the Federal level. The planned activities largely revolve around phreatophyte removal.
 - Chris further noted that Pete Gile had a useful presentation that the Engineering Committee may be interested in hearing. The presentation revolved around efficiency improvements that have been implemented in the District.
- 3.6. Continue development and maintenance of the RRCA administrative website that serves as an informational page for the public and provide regular updates to the EC.
- There have been no significant changes to the website. Chelsea noted that the updated version of the CCP agreement with the new dates was somewhat difficult to locate. In order to remedy this the document may be copied to a new location that makes more sense.
- 3.7. Continue work and provide future updates on improving accounting tools developed by the Engineering Committee.
- Continue evaluating usefulness/applicability of the climate pumping estimator proposed by Kansas.
 - Sam Perkins has no further discussion prepared for this. Chris noted that Kansas was not interested in pressing this issue further. If there was utility to be gained from it that is great. Chris noted it may be useful in scaling the previous year's pumping and if it's useful to Willem that is up to him.
 - Willem noted that he was developing a procedure where he took the estimated pumping from the previous three years and applied a scaling factor to each states pumping using the climate-based estimator methodology and compared it to the pumping that actually occurred in that year, as reported.
 - Willem noted that the state-by-state correlation was about 0.6 and the basin wide correlation was about 0.7. He is still trying to understand why looking at state-by-state precipitation would be less accurate than a basin wide precipitation analysis.
- 3.8. Prepare the 2022 RRCA annual meeting report for approval by the RRCA at the 2023 annual meeting.
- Samantha Capps noted that there was a lot of work done on the transcripts by Kansas and Nebraska. The transcriptionist had many areas where she was not able to make out what was being said and, in some places, appears to have paraphrased the discussions.
 - Chelsea noted that some areas were quite difficult to edit and that it required an extensive effort to get the current draft version. Chelsea believes that the final copy that includes everyone's edits will be very good.
 - Elizabeth Esseks noted that the original version of the transcripts were very poor.
 - Samantha noted that each state has focused on their individual sections and that Colorado should work thru everything putting an emphasis on Colorado's section.
 - Nebraska noted that they have a contact with a transcriptionist that is more familiar with water terminology and that may be an available option for the 2023 annual meeting.
 - Chris suggested including language in the Engineering Committee Report that staff had to make an

unusually high amount of edits the transcript or something to that effect, and this would be sufficient when approving the transcripts. The group generally felt that this would be a good idea.

- Chelsea noted that she had not posted any versions of the 2022 Annual Meeting video on the website and was not sure if we would or not. Ivan Franco noted that he would look into potentially producing a final version suitable for posting on the RRCA website.

4. Nebraska identified an issue with the NCORPE pumping date for 2021

- Kari explained that the discrepancy identified occurred because monthly summary data as received from the NCORPE data systems was not properly vetted/corrected. Nebraska is actively working to assure that a process is in place to assure this error does not happen again.
- Kari provided the group with a report describing the issue dated January 12, 2023.
- Willem asked if it was possible to pump up to 14,000 acre-feet per year in one cell as the report describes. Willem was wondering if there was a limit that could be inserted to that an upper bound check could be integrated into his analysis.
- Willem noted that there is no actual difference in the total approved accounting. Willem noted that in the past a new run is produced which addresses the error and a new starting head is ready for 2022. The alternative solution would be to change the pumping inputs to the model and change the model run that was used for 2021. The group noted that this second option has never been exercised and the EC has produced new starting heads for the upcoming years twice prior, this would potentially be the third time. The group decided to continue to think about how to move forward correcting the issue that Nebraska identified.

5. Summary of Meeting Actions/Assignments (in bold)

- **Kari will send out an email summarizing the Courtland Canal issue.**
- **Sam will continue to work with Willem on how best to utilize the pumping estimate tool.**
- **The group will consider how best to resolve the NCORPE over pumping issue identified by Nebraska.**

6. Future Meetings

6.1. **The next meeting will be on April 20th, 2023 at 9 am MST.**

7. Adjourn

7.1. The meeting adjourned at approximately 1:50 p.m.

MINUTES for the
**QUARTERLY MEETING of the
ENGINEERING COMMITTEE of the
REPUBLICAN RIVER COMPACT ADMINISTRATION**
April 20, 2023 9:00 AM Mountain Time

Meeting was held via Google Meet.

Attendees:

Chris Beightel, KS

Kari Burgert, NE

Hongsheng Cao, KS

Sam Perkins, KS

Chelsea Erickson, KS

David Engelhaupt, KS

Stefan Remund, NE

Samantha Capps, NE

Brian Flynn, NE

Ivan Franco, CO

Willem Schreüder, CO

Elizabeth Esseks, NE

ENGINEERING COMMITTEE TASK LIST

1. Introductions

1.1. The meeting started at approximately 9:00 A.M. MT

2. Review/Modify Agenda

2.1. No revisions or modifications to the agenda.

3. Review and Update Progress on Engineering Committee Task List

3.1. Meet quarterly to review the tasks assigned to the committee.

- This is the third meeting of the year and the Annual Meeting has been scheduled for August 31st, 2023.

3.2. Exchange by April 15, 2023, the information listed in Section V of the RRCA Accounting Procedures and Reporting Requirements, and other data required by that document, including all necessary documentation. By July 15, 2023, the states will exchange any updates to these data.

- Ivan noted that each state had distributed their preliminary data, and Willem had produced a preliminary run from said data. Each state explicitly stated when the data was distributed.
- Data for Kansas was made available on April 10th.
- Data for Nebraska was made available on April 14th.
- Data for Colorado was made available on April 4th.
- Kari noted that the USGS is in the process of finalizing any preliminary gage data that is left.
- Willem noted that the CIR data is coming soon from Randy Hendrix and there will likely not be any changes to Colorado data.
- Chris noted that he thought the Kansas data was about 95% complete with only slight updates coming in July.

3.3. Finalize the 2022 accounting and recommend it for approval by the RRCA.

- Courtland Canal Data is in two locations in the accounting.
 - Nebraska informed the group that they continue to work on an email detailing Courtland Canal Data improvements. Kari contacted the BOR by email on the 13th or 14th of April telling the BOR that the data they had provided was contradicting itself in the Attachment7 and Courtland Canal worksheet. Kari noted that this worked and this may just end up being a quality control issue each year when these are received.

Attachment 1 Engineering Committee Meeting Minutes

- Kari noted that in the coming weeks she would provide a preliminary accounting sheet for comparison to Willem's sheet.
 - **Action Item: Kari will draft an email distilling down where we have seen issues with the data reporting in order to get a good sense of the issue and for the EC to be able to provide feedback to the USBR.**
- 3.4. Maintain and publish updates to Summary of Historical Changes to the RRCA's Accounting Procedures and Reporting Requirements as necessary.
- No discussion necessary
- 3.5. Provide updates on the progress of new and ongoing management strategies for maintaining compact compliance.
- Samantha noted that Nebraska has distributed its annual letter to the states, earlier in the month, detailing the anticipated management actions. Conditions will continue to be monitored and updates will continue to be provided as the year progresses.
 - Willem noted that the CCP had pumped about 7,000 acre-feet and in the next 10 days another 500 acre-feet will likely be pumped. The current projection is for 12,500 acre-feet and we are still anticipating a water short year for 2023, but that may change.
 - Chelsea provided an update on Northwest Kansas activities. Dan Holzwerth with the Cheyenne County Conservation District provided Chelsea an update on the RCPP. A partnership agreement is getting closer to being finalized and there are still meetings with groups to figure out logistics. Applications may start to be accepted this summer. Originally, Kansas Water Office provided five-hundred thousand dollars and this was matched by other sources and is earmarked for a number of equipment improvements throughout the region.
- 3.6. Continue development and maintenance of the RRCA administrative website that serves as an informational page for the public and provide regular updates to the EC.
- There have been no significant changes to the website. When annual meeting data is made available those documents will be posted on the website.
 - Samantha noted that Stefan Remund will be the new Nebraska contact for the website committee.
- 3.7. Continue work and provide future updates on improving accounting tools developed by the Engineering Committee.
- Continue evaluating usefulness/applicability of the climate pumping estimator proposed by Kansas.
 - No further discussion on these topics.
- 3.8. Prepare the 2022 RRCA annual meeting report for approval by the RRCA at the 2023 annual meeting.
- Ivan noted that the transcripts are very close to being finalized and he had received final comments from Kansas and when Nebraska completes their review he would send them to the transcriptionist for production of a final copy.
4. Nebraska identified an issue with the NCORPE pumping data for 2021
- The group discussed the issue and the two proposed solutions. Ultimately, the group decided that either solution would work but that the decision should be left in the hands of the commissioners. The group agreed to speak with their respective commissioner so that they were abreast of the situation. At some point in the future the three commissioners should decide on a path forward on this issue.
5. Summary of Meeting Actions/Assignments (in bold)
- **Kari will send out an email summarizing the Courtland Canal issue.**
 - **Kari would send out a preliminary accounting run for comparison purposes.**
 - **Sam will continue to work with Willem on how best to utilize the pumping estimate tool.**

- **The group will consult their individual commissioners on how to resolve the NCORPE over pumping issue identified by Nebraska.**

6. Future Meetings

6.1. **The next meeting will be on July 12th, 2023 at 9 am MST.**

7. Adjourn

7.1. The meeting adjourned at approximately 9:33 a.m.

MINUTES for the
**QUARTERLY MEETING of the
ENGINEERING COMMITTEE of the
REPUBLICAN RIVER COMPACT ADMINISTRATION**
July 13, 2023 9:00 AM Mountain Time

Meeting was held via Google Meet.

Attendees:

Chris Beightel, KS

Kari Burgert, NE

Hongsheng Cao, KS

Sam Perkins, KS

Willem Schreüder, CO

Stefan Remund, NE

Samantha Capps, NE

Brian Flynn, NE

Ivan Franco, CO

Chelsea Erickson, KS

David Engelhaupt, KS

ENGINEERING COMMITTEE TASK LIST

1. Introductions

1.1. The meeting started at approximately 9:00 A.M. MT

2. Review/Modify Agenda

2.1. No revisions or modifications to the agenda.

3. Review and Update Progress on Engineering Committee Task List

3.1. Meet quarterly to review the tasks assigned to the committee.

- The Engineering Committee has now met four times and the next meeting will be the Annual Meeting on August 31st in Burlington.

3.2. Exchange by April 15, 2023, the information listed in Section V of the RRCA Accounting Procedures and Reporting Requirements, and other data required by that document, including all necessary documentation. By July 15, 2023, the states will exchange any updates to these data.

- Ivan noted that Kari has sent out Nebraska's most current accounting for comparison to Willem's accounting. There was only one very minor difference that needs addressing.
 - Willem sent out an email earlier in the week detailing one difference when he compared the two accounting calculations, which occurs for Table 3C. Willem has changed which output he uses for Nebraska Imported Water Supply Credit. He is now pulling row 28 from the Nebraska Mound impacts which sums the pre-rounded subbasin values instead of row 31, which sums the subbasin rounded values. This approach is slightly different and makes a 10-acre-foot difference only. However, it is something to consider if we want the exact same number. Kari will look into this and get back to group but would likely implement Willem's change.
 - Kari noted that a very slight change to 2022 data would be coming from Nebraska by the end of the week. The volume of water has not changed but the location will be changed to reflect the correct canal return flow location.
 - Colorado does not expect any additional changes to their data between now and July 15, 2023.

3.3. Finalize the 2022 accounting and recommend it for approval by the RRCA.

- Courtland Canal Data are in two locations in the accounting.
 - Previously, Kari contacted the BOR by email on the 14th of April telling the BOR that the data they had provided was contradicting itself in the Monthly Water Distribution for Courtland in Nebraska and Courtland Canal worksheet. Kari noted that this fixed the discrepancy and any

implications in the accounting. Kari suggested that, rather than pursuing any modifications to the locations of the data in the accounting spreadsheet, the EC continue this assignment to implement a quality control check on this data every year.

- **Action Item: Ivan Franco will change this item to continue forward as implementation of a quality control check that should be performed each year.**

3.4. Maintain and publish updates to Summary of Historical Changes to the RRCA's Accounting Procedures and Reporting Requirements as necessary.

- Ivan noted that the Commissioners unanimously decided during a three-states meeting on June 20, 2023 to proceed to amend Nebraska's 2021 NCORPE pumping in a manner similar to the PRISM data correction. Therefore, updates to this document will be necessary. He noted his uncertainty as to whether this should be updated at the Annual Meeting in 2023 or afterwards as a housekeeping task for the Engineering Committee.
- Prior to the meeting, Kari provided language for the suggested update. Ivan noted he would take another look at that document and incorporate/edit the suggested language and make sure other changes are not required.

3.5. Provide updates on the progress of new and ongoing management strategies for maintaining compact compliance.

- Ivan started by noting that Colorado had reached its goal of retiring more than 10,000 acres of land along the South Fork and that initial documents had been forwarded to each state. A response was received by Nebraska asking for a map and suggesting packaging all pertinent documentation for acceptance by the RRCA at the Annual Meeting in 2023. Colorado is working on putting together an overall package so that it may be included in the annual meeting data and the commissioners can make a motion for acceptance.
- Ivan noted that 2023 will not be a water short year and therefore this changes some early predictions for Colorado's pumping but other factors are at play as well and he asked Willem to elaborate.
- Willem informed the group that Colorado's predicted pumping for 2023 remains unchanged at 12,500 acre-feet due to the effects of the wet spring on the current year's consumptive use.
- Kari informed the group that while 2023 is officially not water short, it is still a compact call year and therefore pursuant to the resolution Nebraska is still required to send monthly updates by the 10th of each month. The other states can expect normal updates pursuant to a compact call year.
- Samantha noted that there are contracts in the works for telemetry meters in Lower Republican Natural Resources District in Nebraska and a Lower Republican augmentation project. Chris asked the group if there was a timeline for the augmentation project. Samantha noted the project is still in the consultation phase with some pump testing being performed.
- Chelsea provided an update on RCPP monies. Contracts or beginning to sign contracts for phreatophyte removal. Work on some of this removal may start as soon as this fall/winter.

3.6. Continue development and maintenance of the RRCA administrative website that serves as an informational page for the public and provide regular updates to the EC.

- There have been no significant changes to the website. When annual meeting data are made available those documents will be posted on the website.

3.7. Continue work and provide future updates on improving accounting tools developed by the Engineering Committee.

- Continue evaluating usefulness/applicability of the climate pumping estimator proposed by Kansas.
- Willem informed the group that he would like to continue this task and is looking forward to utilizing this tool to better estimate 2023's pumping impacts.
- Chris Beightel asked Willem a question about the preliminary accounting posted on the website and

what a page that shows differences was intended to delineate.

- Willem noted that when he runs the integrated accounting, he has a program that reads all of the fields in the spreadsheet and in the integrated accounting and if there's a difference, it just says, there's a difference between what's in the official accounting spreadsheet and what the integrated accounting would show.

3.8. Prepare the 2022 RRCA annual meeting report for approval by the RRCA at the 2023 annual meeting.

- Ivan noted that a couple of weeks ago he sent a copy of the draft annual meeting report that contained the final amended transcripts (this was not noted in the email) and that Kansas is taking a first stab at edits and will forward comments to Nebraska.
- Chelsea noted that she had sent edits to the April meeting minutes and had already commented on the previous two meeting minutes. Nebraska sent out an email, prior to the meeting, where they provided edits on the three previous meetings. Ivan noted that he had received all of these comments and would incorporate all of these changes in the final copies.

4. Nebraska identified an issue with the NCORPE pumping data for 2021

- As noted, the Commissioners unanimously decided to amend Nebraska's 2021 NCORPE pumping in a manner similar to the PRISM data correction. Prior to the meeting, Kari sent draft language that could be included in the EC report and with the 2022 accounting to note the revisions. Willem has already implemented the change in the groundwater model runs.

5. Summary of Meeting Actions/Assignments (in bold)

- **The group will continue to review/compare draft accounting for final approval at the annual meeting.**
- **The group will continue to review the draft 2022 Annual Meeting Report that is circulating.**
- **Ivan Franco will draft the Engineering Committee Report**
 - **The report will include language regarding QAQC for item 3.3 of this agenda.**
 - **Ivan will review Kari's draft language for the NCORPE pumping fix**
 - **Colorado will continue to work on producing an acceptable package showing acreage retirement in the South Fork.**
- **Sam will continue to work with Willem on how best to utilize the pumping estimate tool.**

6. Future Meetings

6.1. **The next meeting will be on August 31st in Burlington, Colorado.**

7. Adjourn

7.1. The meeting adjourned at approximately 9:38 a.m.

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Accounting Inputs

| Calendar Year | | 2022 |
|-------------------------|-----------------------------------|---------|
| Groundwater Data | | |
| North Fork Subbasin | GW CBCU Colorado | 17,903 |
| | GW CBCU Kansas | 0 |
| | GW CBCU Nebraska | 1,288 |
| Arikaree Subbasin | GW CBCU Colorado | 735 |
| | GW CBCU Kansas | 128 |
| | GW CBCU Nebraska | 105 |
| Buffalo Subbasin | GW CBCU Colorado | 394 |
| | GW CBCU Kansas | 0 |
| | GW CBCU Nebraska | 3,535 |
| Rock Subbasin | GW CBCU Colorado | 88 |
| | GW CBCU Kansas | 0 |
| | GW CBCU Nebraska | 5,015 |
| South Fork Subbasin | GW CBCU Colorado | 12,347 |
| | GW CBCU Kansas | 4,381 |
| | GW CBCU Nebraska | 820 |
| Frenchman Subbasin | GW CBCU Colorado | 192 |
| | GW CBCU Kansas | 0 |
| | GW CBCU Nebraska | 76,085 |
| Driftwood Subbasin | GW CBCU Colorado | 0 |
| | GW CBCU Kansas | 0 |
| | GW CBCU Nebraska | 866 |
| Red Willow Subbasin | GW CBCU Colorado | 0 |
| | GW CBCU Kansas | 0 |
| | GW CBCU Nebraska | 7,773 |
| Medicine Creek Subbasin | GW CBCU Colorado | 0 |
| | GW CBCU Kansas | 0 |
| | GW CBCU Nebraska | 19,933 |
| Beaver Subbasin | GW CBCU Colorado | 0 |
| | GW CBCU Kansas | 3,243 |
| | GW CBCU Nebraska | 1,840 |
| Sappa Subbasin | GW CBCU Colorado | 0 |
| | GW CBCU Kansas | 51 |
| | GW CBCU Nebraska | 1,011 |
| Prairie Dog Subbasin | GW CBCU Colorado | 0 |
| | GW CBCU Kansas | 1,450 |
| | GW CBCU Nebraska | 0 |
| Mainstem Subbasin | GW CBCU Colorado | (5,340) |
| | GW CBCU Kansas Above Guide Rock | (103) |
| | GW CBCU Kansas Below Guide Rock | 63 |
| | GW CBCU Nebraska Above Guide Rock | 43,723 |
| | GW CBCU Nebraska Below Guide Rock | 2,203 |

| | | |
|--------------------------|--|---------------|
| Import Water Data | | |
| North Fork Subbasin | Imported Water Nebraska | 0 |
| Arikaree Subbasin | Imported Water Nebraska | 0 |
| Buffalo Subbasin | Imported Water Nebraska | 0 |
| Rock Subbasin | Imported Water Nebraska | 0 |
| South Fork Subbasin | Imported Water Nebraska | 0 |
| Frenchman Subbasin | Imported Water Nebraska | 0 |
| Driftwood Subbasin | Imported Water Nebraska | 0 |
| Red Willow Subbasin | Imported Water Nebraska | 26 |
| Medicine Creek Subbasin | Imported Water Nebraska | 9,351 |
| Beaver Subbasin | Imported Water Nebraska | 0 |
| Sappa Subbasin | Imported Water Nebraska | 13 |
| Prairie Dog Subbasin | Imported Water Nebraska | 0 |
| Mainstem Subbasin | Imported Water Nebraska Above Guide Rock | 6,769 |
| | Imported Water Nebraska Below Guide Rock | (17) |
| | Total | 16,142 |

| | | |
|------------------------|--|-----|
| SW Pumping Data | | |
| North Fork Subbasin | SW Diversions - Irrigation -Non-Federal Canals- Colorado | 349 |
| | SW Diversions - Irrigation - Small Pumps - Colorado | 7 |
| | SW Diversions - M&I - Colorado | 0 |
| Arikaree Subbasin | SW Diversions - Irrigation -Non-Federal Canals- Colorado | 0 |
| | SW Diversions - Irrigation - Small Pumps - Colorado | 0 |
| | SW Diversions - M&I - Colorado | 0 |
| | SW Diversions - Irrigation - Non-Federal Canals- Kansas | 0 |
| | SW Diversions - Irrigation - Small Pumps - Kansas | 0 |
| | SW Diversions - M&I - Kansas | 0 |
| | SW Diversions - Irrigation - Non-Federal Canals - Nebraska | 0 |
| | SW Diversions - Irrigation - Small Pumps - Nebraska | 0 |
| | SW Diversions - M&I - Nebraska | 0 |

| Calendar Year | | 2022 |
|--|---|-------|
| Buffalo Subbasin | SW Diversions - Irrigation -Non-Federal Canals- Colorado | 0 |
| | SW Diversions - Irrigation - Small Pumps - Colorado | 0 |
| | SW Diversions - M&I - Colorado | 0 |
| | SW Diversions - Irrigation - Non-Federal Canals - Nebraska | 29 |
| | SW Diversions - Irrigation - Small Pumps - Nebraska | 0 |
| Rock Subbasin | SW Diversions - M&I - Nebraska | 0 |
| | SW Diversions - Irrigation - Non-Federal Canals - Nebraska | 0 |
| | SW Diversions - Irrigation - Small Pumps - Nebraska | 0 |
| South Fork Subbasin | SW Diversions - M&I - Nebraska | 0 |
| | SW Diversions - Irrigation -Non-Federal Canals- Colorado | 0 |
| | SW Diversions - Irrigation - Small Pumps - Colorado | 0 |
| | SW Diversions - M&I - Colorado | 0 |
| | SW Diversions - Irrigation - Non-Federal Canals- Kansas | 0 |
| | SW Diversions - Irrigation - Small Pumps - Kansas | 0 |
| | SW Diversions - M&I - Kansas | 0 |
| | SW Diversions - Irrigation - Non-Federal Canals - Nebraska | 0 |
| Frenchman Subbasin | SW Diversions - Irrigation - Small Pumps - Nebraska | 0 |
| | SW Diversions - M&I - Nebraska | 0 |
| | SW Diversions - Irrigation - Non-Federal Canals - Nebraska | 0 |
| Driftwood Subbasin | SW Diversions - M&I - Nebraska | 0 |
| | SW Diversions - Irrigation - Non-Federal Canals- Kansas | 0 |
| | SW Diversions - Irrigation - Small Pumps - Kansas | 0 |
| | SW Diversions - M&I - Kansas | 0 |
| | SW Diversions - Irrigation - Non-Federal Canals - Nebraska | 0 |
| Red Willow Subbasin | SW Diversions - Irrigation - Small Pumps - Nebraska | 0 |
| | SW Diversions - M&I - Nebraska | 0 |
| | SW Diversions - Irrigation - Non-Federal Canals - Nebraska | 0 |
| | SW Diversions - Irrigation - Small Pumps - Nebraska | 0 |
| Medicine Creek Subbasin | SW Diversions - M&I - Nebraska | 0 |
| | SW Diversions - Irrigation - Non-Federal Canals - Nebraska - Above Gage | 0 |
| | SW Diversions - Irrigation - Small Pumps - Nebraska - Above Gage | 68 |
| | SW Diversions - M&I - Nebraska - Above Gage | 0 |
| | SW Diversions - Irrigation - Non-Federal Canals - Nebraska -Below Gage | 0 |
| Beaver Subbasin | SW Diversions - Irrigation - Small Pumps -Nebraska - Below Gage | 62 |
| | SW Diversions - M&I - Nebraska - Below Gage | 0 |
| | SW Diversions - Irrigation - Non-Federal Canals - Nebraska - Above Gage | 0 |
| | SW Diversions - Irrigation - Small Pumps - Nebraska - Above Gage | 0 |
| | SW Diversions - M&I - Nebraska - Above Gage | 0 |
| | SW Diversions - Irrigation - Non-Federal Canals - Nebraska -Below Gage | 0 |
| | SW Diversions - Irrigation - Small Pumps -Nebraska - Below Gage | 0 |
| | SW Diversions - M&I - Nebraska - Below Gage | 0 |
| | SW Diversions - Irrigation - Non-Federal Canals- Colorado | 0 |
| | SW Diversions - Irrigation - Small Pumps - Colorado | 0 |
| Sappa Subbasin | SW Diversions - M&I - Colorado | 0 |
| | SW Diversions - Irrigation - Non-Federal Canals- Kansas | 0 |
| | SW Diversions - Irrigation - Small Pumps - Kansas | 14 |
| | SW Diversions - M&I - Kansas | 0 |
| | SW Diversions - Irrigation - Non-Federal Canals - Nebraska - Above Gage | 0 |
| | SW Diversions - Irrigation - Small Pumps - Nebraska - Above Gage | 0 |
| | SW Diversions - M&I - Nebraska - Above Gage | 0 |
| | SW Diversions - Irrigation - Non-Federal Canals - Nebraska -Below Gage | 0 |
| | SW Diversions - Irrigation - Small Pumps -Nebraska - Below Gage | 0 |
| | SW Diversions - M&I - Nebraska - Below Gage | 0 |
| Prairie Dog Subbasin | SW Diversions - Irrigation - Non-Federal Canals- Kansas | 0 |
| | SW Diversions - Irrigation - Small Pumps - Kansas | 531 |
| | SW Diversions - M&I - Kansas | 383 |
| | SW Diversions - Irrigation - Non-Federal Canals - Nebraska -Below Gage | 0 |
| | SW Diversions - Irrigation - Small Pumps -Nebraska - Below Gage | 63 |
| Mainstem Subbasin | SW Diversions - M&I - Nebraska - Below Gage | 0 |
| | SW Diversions - Irrigation - Non-Federal Canals- Kansas | 0 |
| | SW Diversions - Irrigation - Small Pumps - Kansas | 797 |
| | SW Diversions - M&I - Kansas | 0 |
| | SW Diversions - Irrigation - Non-Federal Canals - Nebraska | 3,332 |
| | SW Diversions - Irrigation - Small Pumps - Nebraska | 1,830 |
| | SW Diversions - M&I - Nebraska | 0 |
| | SW Diversions - Irrigation - Non-Federal Canals - Nebraska Below Guide Rock | 0 |
| SW Diversions - Irrigation - Small Pumps - Nebraska Below Guide Rock | 763 | |
| | SW Diversions - M&I - Nebraska - Below Guide Rock | 0 |

| Calendar Year | | 2022 |
|--|---|--------|
| Non-Federal SW Consumptive Use | | |
| | % Non-Federal Canal Diversion Consumed | 60% |
| | % Small Surface Water Pumps Consumed | 75% |
| | % Municipal And Industrial SW Consumed | 50% |
| Non-Federal Reservoir Evaporation Data | | |
| North Fork Subbasin | Non-Federal Reservoir Evaporation - Colorado | 44 |
| Arikaree Subbasin | Non-Federal Reservoir Evaporation - Colorado | 0 |
| | Non-Federal Reservoir Evaporation - Kansas | 21 |
| | Non-Federal Reservoir Evaporation - Nebraska | 0 |
| Buffalo Subbasin | Non-Federal Reservoir Evaporation - Colorado | 0 |
| | Non-Federal Reservoir Evaporation - Nebraska | 16 |
| Rock Subbasin | Non-Federal Reservoir Evaporation - Nebraska | 184 |
| South Fork Subbasin | Non-Federal Reservoir Evaporation - Colorado | 0 |
| | Non-Federal Reservoir Evaporation - Kansas | 180 |
| | Non-Federal Reservoir Evaporation - Nebraska | 0 |
| Frenchman Subbasin | Non-Federal Reservoir Evaporation - Nebraska | 154 |
| Driftwood Subbasin | Non-Federal Reservoir Evaporation - Kansas | 22 |
| | Non-Federal Reservoir Evaporation - Nebraska | 0 |
| Red Willow Subbasin | Non-Federal Reservoir Evaporation - Nebraska | 353 |
| Medicine Creek Subbasin | Non-Federal Reservoir Evaporation - Nebraska - Above Gage | 413 |
| | Non-Federal Reservoir Evaporation - Nebraska - Below Gage | 5 |
| Beaver Subbasin | Non-Federal Reservoir Evaporation - Colorado | 0 |
| | Non-Federal Reservoir Evaporation - Kansas | 522 |
| | Non-Federal Reservoir Evaporation - Nebraska - Above Gage | 226 |
| | Non-Federal Reservoir Evaporation - Nebraska - Below Gage | 0 |
| Sappa Subbasin | Non-Federal Reservoir Evaporation - Kansas | 561 |
| | Non-Federal Reservoir Evaporation - Nebraska - Above Gage | 99 |
| | Non-Federal Reservoir Evaporation - Nebraska - Below Gage | 6 |
| Prairie Dog Subbasin | Non-Federal Reservoir Evaporation - Kansas | 410 |
| | Non-Federal Reservoir Evaporation - Nebraska | 33 |
| Mainstem Subbasin | Non-Federal Reservoir Evaporation - Kansas | 135 |
| | Non-Federal Reservoir Evaporation - Nebraska - Above Guide Rock Gage - Whole Basin Value: | 1,934 |
| | Non-Federal Reservoir Evaporation - Nebraska - Below Guide Rock Gage - Whole Basin Value: | 95 |
| Stream Gage Data | | |
| North Fork Subbasin | North Fork Republican River At Colorado-Nebraska State Line | 21,129 |
| Arikaree Subbasin | Arikaree River At Haigler | 982 |
| Buffalo Subbasin | Buffalo Creek Near Haigler | 1,030 |
| Rock Subbasin | Rock Creek At Parks | 2,955 |
| South Fork Subbasin | South Fork Republican River Near Benkelman | 0 |
| Frenchman Subbasin | Frenchman Creek At Culbertson | 10,761 |
| Driftwood Subbasin | Driftwood Creek Near McCook | 992 |
| Red Willow Subbasin | Red Willow Creek Near Red Willow | 2,678 |
| Medicine Creek Subbasin | Medicine Creek Below Harry Strunk | 29,716 |
| Beaver Subbasin | Beaver Creek Near Beaver City | 484 |
| Sappa Subbasin | Sappa Creek Near Stamford | 5,718 |
| Prairie Dog Subbasin | Prairie Dog Creek Near Woodruff | 2,414 |
| Mainstem Subbasin | Republican River At Guide Rock | 32,213 |
| | Republican River Near Hardy | 69,608 |
| Hardy Gage Data | | |
| USGS Gage 06853500 Republican River Near Hardy, NE | | |
| Mainstem Subbasin | January | 8,005 |
| | February | 7,615 |
| | March | 9,074 |
| | April | 6,592 |
| | May | 4,958 |
| | June | 3,981 |
| | July | 18,172 |
| | August | 3,666 |
| | September | 2,326 |
| | October | 1,624 |
| | November | 1,775 |
| | December | 1,815 |
| | | ANNUAL |

Accounting Tables

Table 1: Annual Virgin and Computed Water Supply, Allocations, and Computed Beneficial Consumptive Uses by State, Main Stem, and Sub-Basin

| 2022 Basin | Virgin Water Supply | Computed Water Supply | Allocations | | | | Computed Beneficial Consumptive Use | | |
|------------------------------------|------------------------|--------------------------|-------------|---------|----------|-------------|-------------------------------------|--------|----------|
| | | | Colorado | Kansas | Nebraska | Unallocated | Colorado | Kansas | Nebraska |
| North Fork | 38,290 | 38,290 | 8,580 | 0 | 9,420 | 20,290 | 18,160 | 0 | 5,020 |
| Arikaree | 1,980 | 1,980 | 1,550 | 100 | 330 | 0 | 740 | 150 | 110 |
| Buffalo | 4,990 | 4,990 | 0 | 0 | 1,650 | 3,340 | 390 | 0 | 3,570 |
| Rock | 8,250 | 8,250 | 0 | 0 | 3,300 | 4,950 | 90 | 0 | 5,200 |
| South Fork | 17,730 | 17,730 | 7,870 | 7,130 | 250 | 2,480 | 12,350 | 4,560 | 820 |
| Frenchman | 89,090 | 90,530 | 0 | 0 | 48,520 | 42,010 | 190 | 0 | 79,050 |
| Driftwood | (1,390) | (1,390) | 0 | (100) | (230) | (1,060) | 0 | 20 | 870 |
| Red Willow | 15,220 | 20,050 | 0 | 0 | 3,850 | 16,200 | 0 | 0 | 8,730 |
| Medicine | 36,530 | 45,010 | 0 | 0 | 4,100 | 40,910 | 0 | 0 | 20,450 |
| Beaver | 6,330 | 6,330 | 1,270 | 2,460 | 2,570 | 30 | 0 | 3,780 | 2,070 |
| Sappa | 6,950 | 6,950 | 0 | 2,860 | 2,860 | 1,230 | 0 | 610 | 1,120 |
| Prairie Dog | 4,640 | 10,070 | 0 | 4,600 | 770 | 4,700 | 0 | 7,660 | 80 |
| Main Stem | 88,090 | 160,360 | 0 | 81,940 | 78,420 | 0 | (5,340) | 50,990 | 122,870 |
| Total All Basins | 316,700 | 409,150 | 19,270 | 98,990 | 155,810 | 135,080 | 26,580 | 67,770 | 249,960 |
| Main Stem Including Unallocated | | 295,440 | 0 | 150,970 | 144,470 | | | | |
| Total | 316,700 | 409,150 | 19,270 | 168,020 | 221,860 | 0 | 26,580 | 67,770 | 249,960 |

Table 2: Original Compact Virgin Water Supply and Allocations

| Basin | Virgin Water Supply | Colorado Allocation | % of Basin Supply | Kansas Allocation | % of Basin Supply | Nebraska Allocation | % of Basin Supply | Unallocated | % of Basin Supply |
|-------------------------|---------------------|---------------------|-------------------|-------------------|-------------------|---------------------|-------------------|-------------|-------------------|
| North Fork | 44,700 | 10,000 | 22.4% | | | 11,000 | 24.6% | 23,700 | 53.0% |
| Arikaree | 19,610 | 15,400 | 78.5% | 1,000 | 5.1% | 3,300 | 16.8% | (90) | -0.4% |
| Buffalo | 7,890 | | | | | 2,600 | 33.0% | 5,290 | 67.0% |
| Rock | 11,000 | | | | | 4,400 | 40.0% | 6,600 | 60.0% |
| South Fork | 57,200 | 25,400 | 44.4% | 23,000 | 40.2% | 800 | 1.4% | 8,000 | 14.0% |
| Frenchman | 98,500 | | | | | 52,800 | 53.6% | 45,700 | 46.4% |
| Driftwood | 7,300 | | | 500 | 6.9% | 1,200 | 16.4% | 5,600 | 76.7% |
| Red Willow | 21,900 | | | | | 4,200 | 19.2% | 17,700 | 80.8% |
| Medicine | 50,800 | | | | | 4,600 | 9.1% | 46,200 | 90.9% |
| Beaver | 16,500 | 3,300 | 20.0% | 6,400 | 38.8% | 6,700 | 40.6% | 100 | 0.6% |
| Sappa | 21,400 | | | 8,800 | 41.1% | 8,800 | 41.1% | 3,800 | 17.8% |
| Prairie Dog | 27,600 | | | 12,600 | 45.7% | 2,100 | 7.6% | 12,900 | 46.7% |
| Tributaries Sub-Total | 384,000 | | | | | | | 175,500 | |
| Main Stem | 94,500 | | | | | | | | |
| Main Stem + Unallocated | 270,000 | | | 138,000 | 51.1% | 132,000 | 48.9% | | |
| Total | 478,900 | 54,100 | | 190,300 | | 234,500 | | | |

Table 3A: Table to Be Used to Calculate Colorado's Five-Year Running Average Allocation and Computed Beneficial

| | Col. 1 | Col. 2 | Col. 3 | Col. 4 |
|---------------|------------|---------------------------------|--|---|
| Year | Allocation | Computed Beneficial Consumptive | Imported Water Supply Credit and CORWS | Difference between Allocation and the Computed Beneficial Consumptive Use offset by Imported Water Supply Credit and CORWS Credit Col 1 – (Col 2- Col 3) |
| 2018 | 25,630 | 35,130 | 13,578 | 4,078 |
| 2019 | 22,710 | 32,740 | 8,905 | (1,125) |
| 2020 | 24,200 | 26,910 | 6,218 | 3,508 |
| 2021 | 22,790 | 30,200 | 9,390 | 1,980 |
| 2022 | 19,270 | 26,580 | 8,501 | 1,191 |
| Avg 2018-2022 | 22,920 | 30,310 | 9,320 | 1,930 |

Table 3B: Table to Be Used to Calculate Kansas's Five-Year Running Average Allocation and Computed Beneficial

| | Col. 1 | Col. 2 | Col. 3 | Col. 4 |
|---------------|------------|---------------------------------|------------------------------|--|
| Year | Allocation | Computed Beneficial Consumptive | Imported Water Supply Credit | Difference between Allocation and the Computed Beneficial Consumptive Use offset by Imported Water Supply Credit Col 1 – (Col 2- Col 3) |
| 2018 | 179,780 | 51,450 | NA | 128,330 |
| 2019 | 333,300 | 47,910 | NA | 285,390 |
| 2020 | 247,750 | 53,810 | NA | 193,940 |
| 2021 | 201,890 | 57,130 | NA | 144,760 |
| 2022 | 168,020 | 67,770 | NA | 100,250 |
| Avg 2018-2022 | 226,150 | 55,610 | NA | 170,530 |

Table 3C: Table to Be Used to Calculate Nebraska's Five-Year Running Average Allocation and Computed Beneficial

| | Col. 1 | Col. 2 | Col. 3 | Col. 4 |
|---------------|------------|---------------------------------|--|---|
| Year | Allocation | Computed Beneficial Consumptive | Imported Water Supply Credit and NERWS | Difference between Allocation and the Computed Beneficial Consumptive Use offset by Imported Water Supply Credit and NERWS Credit Col 1 – (Col 2- Col 3) |
| 2018 | 241,680 | 266,080 | 25,943 | 1,543 |
| 2019 | 389,300 | 262,870 | 26,541 | 152,971 |
| 2020 | 303,070 | 252,400 | 18,995 | 69,665 |
| 2021 | 258,180 | 252,650 | 21,456 | 26,986 |
| 2022 | 221,860 | 249,960 | 16,157 | (11,943) |
| Avg 2018-2022 | 282,820 | 256,790 | 21,820 | 47,840 |

Table 4A: Colorado Compliance with the Sub-basin Non-impairment Requirement

Table 4A is left unpopulated pursuant to the August 24, 2016 “RESOLUTION BY THE REPUBLICAN RIVER COMPACT ADMINISTRATION APPROVING OPERATION AND ACCOUNTING FOR THE COLORADO COMPACT COMPLIANCE PIPELINE AND COLORADO’S COMPLIANCE EFFORTS IN THE SOUTH FORK REPUBLICAN RIVER BASIN”, paragraph E.

2022

| | Col 1 | Col 2 | Col 3 | Col 4 | Col 5 | Col 6 |
|------------|---|--|---|--|--|---|
| Sub-basin | Colorado Sub-basin Allocation (Five-year Running Average) | Unallocated Supply (Five-year Running Average) | Credits from Imported Water Supply and CORWS Credit (Five-year Running Average) | Total Available Supply (Five-year Running Average) | Colorado Computed Beneficial Consumptive Use (Five-year Running Average) | Difference Between Available Supply and Computed Beneficial Consumptive Use (Five-year Running Average) |
| North Fork | | | | | | |
| Arikaree | | | | | | |
| South Fork | | | | | | |
| Beaver | | | | | | |

Table 4B: Kansas's Sub-Basin Non-impairment Compliance**2022**

| | Col 1 | Col 2 | Col 3 | Col 4 | Col 5 | Col 6 | Col 7 |
|-------------|---|--|---|--|--|--|---|
| Sub-basin | Kansas Sub-basin Allocation (Five-year Running Average) | Unallocated Supply (Five-year Running Average) | Unused Allocation from Colorado (Five Year Running Average) | Credits from Imported Water Supply (Five-year Running Average) | Total Available Supply Col 1 + Col 2 + Col 3 + Col 4 (Five-year Running Average) | Kansas Computed Beneficial Consumptive Use (Five-year Running Average) | Difference Between Available Supply and Computed Beneficial Consumptive Use Col 5 - Col 6 (Five-year Running Average) |
| Arikaree | 162 | (10) | 790 | N/A | 942 | 138 | 804 |
| South Fork | 8,426 | 2,936 | 0 | N/A | 11,362 | 4,746 | 6,616 |
| Driftwood | 44 | 500 | 0 | N/A | 544 | 16 | 528 |
| Beaver | 4,034 | 60 | 2,080 | N/A | 6,174 | 5,856 | 318 |
| Sappa | 7,472 | 3,230 | 0 | N/A | 10,702 | 2,172 | 8,530 |
| Prairie Dog | 8,124 | 8,298 | 0 | N/A | 16,422 | 10,324 | 6,098 |

Table 5A: Colorado's Compliance During Water-Short Year Administration

| | Col. 1 | Col. 2 | Col. 3 | Col. 4 | Col. 5 | Col. 6 | Col. 7 |
|---------------|---|----------------------|---|--|--|--|--|
| Year | Is the year Water Short Pursuant to III.J?* (Yes or No) | Statewide Allocation | Beaver Creek Reduction Pursuant to Table 5F | Allocation - Beaver Creek Reduction (Col. 2 - Col.3) | Computed Beneficial Consumptive (excluding the Beaver Creek Sub-basin) | Imported Water Supply Credit - IWS Beaver Creek + CORWS Credit | Difference between Allocation and the Computed Beneficial Consumptive Use offset by Imported Water Supply Credit and CORWS Credit (Col. 4 - Col. 5 + Col. 6) |
| 2018 | Yes | 25,630 | 1,852 | 23,778 | 35,130 | 13,578 | 2,226 |
| 2019 | No | 22,710 | 0 | 22,710 | 32,740 | 8,905 | (1,125) |
| 2020 | No | 24,200 | 0 | 24,200 | 26,910 | 6,218 | 3,508 |
| 2021 | No | 22,790 | 0 | 22,790 | 30,200 | 9,390 | 1,980 |
| 2022 | No | 19,270 | 0 | 19,270 | 26,580 | 8,501 | 1,191 |
| Avg 2018-2022 | Yes | 22,920 | 370 | 22,550 | 30,310 | 9,320 | 1,560 |

Table 5F: Colorado's Beaver Creek Reduction During Water-Short Years

| Water Short Year (WSY) Pursuant to III.J | Beaver Creek Allocation | Reduction = Average of last five WSY Beaver Creek Allocations |
|--|-------------------------|---|
| | Col. 1 | Col. 2 |
| 2002 | 770 | N/A |
| 2003 | 260 | N/A |
| 2004 | 360 | N/A |
| 2005 | 910 | N/A |
| 2006 | 1,420 | N/A |
| 2007 | 2,320 | 744 |
| 2013 | 1,130 | 1,054 |
| 2014 | 1,250 | 1,228 |
| 2015 | 2,130 | 1,406 |
| 2016 | 2,430 | 1,650 |
| 2018 | 1,940 | 1,852 |

Table 5B: Kansas's Compliance During Water-Short Year Administration
Kansas

| Year | Allocation | | | | Computed Beneficial Consumptive Use | Imported Water Supply Credit | Difference Between Allocation and the Computed Beneficial Consumptive Use offset by Imported Water Supply Credit |
|---------------|----------------|-------------------------------------|---|-----------------------------|-------------------------------------|------------------------------|--|
| Column | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| | Sum Sub-basins | Kansas' Share of Unallocated Supply | Kansas' Share of the Unused Colorado Allocation | Total Col 1 + Col 2 + Col 3 | | | Col 4 - (Col 5 - Col 6) |
| 2021 | 25,860 | 6,607 | 1,589 | 34,056 | 20,650 | N/A | 13,406 |
| 2022 | 17,050 | 3,771 | 1,063 | 21,884 | 16,780 | N/A | 5,104 |
| Avg 2021-2022 | 21,455 | 5,189 | 1,326 | 27,970 | 18,715 | N/A | 9,255 |

Table 5E: Nebraska's Tributary Compliance During Water-Short Year Administration

| Year | Allocation | | | Computed Beneficial Consumptive Use | Imported Water Supply Credit and AWS | Allocation - (CBCU - IWS-AWS) |
|---------------|-----------------|-----------------------------|---------|-------------------------------------|--------------------------------------|-------------------------------|
| | Sub-Basin Total | Share of Unallocated Supply | Total | | | |
| 2020 | 95,240 | 78,440 | 173,680 | 132,980 | 10,716 | 51,416 |
| 2021 | 89,710 | 68,225 | 157,935 | 133,520 | 10,822 | 35,237 |
| 2022 | 77,390 | 66,054 | 143,444 | 127,090 | 9,442 | 25,796 |
| Avg 2021-2022 | 83,550 | 67,140 | 150,690 | 130,305 | 10,132 | 30,517 |

Table 5C: Nebraska's Compliance During Water-Short Year Administration

| Year | Allocation | | | | Computed Beneficial Consumptive Use | | | Imported Water Supply Credit and NERWS Credit | Difference Between Allocation and Computed Beneficial Consumptive Use offset by Imported Water Supply Credit Above Guide Rock and NERWS Credit |
|---------------|-----------------------|-----------------------------|-----------------------------|--|-------------------------------------|-----------------------|-----------------------|---|--|
| Column | Col 1 | Col 2 | Col 3 | Col 4 | Col 5 | Col 6 | Col 7 | Col 8 | Col 9 |
| | State-Wide Allocation | Allocation Below Guide Rock | Allocation Above Guide Rock | Nebraska's Share of Unused Colorado Allocation | State-Wide CBCU | CBCU Below Guide Rock | CBCU Above Guide Rock | Credits Above Guide Rock | Col 3 + Col 4 - (Col 7 - Col 8) |
| 2021 | 258,180 | 6,503 | 251,677 | 1,521 | 252,650 | 3,084 | 249,566 | 21,485 | 25,116 |
| 2022 | 221,860 | 9,277 | 212,583 | 1,017 | 249,960 | 2,870 | 247,090 | 16,174 | (17,316) |
| Avg 2021-2022 | 240,020 | 7,890 | 232,130 | 1,270 | 251,310 | 2,980 | 248,330 | 18,830 | 3,900 |

Table 5D: Nebraska's Compliance Under a Alternative Water-Short Year Administration Plan

| Year | Allocation | | | | Computed Beneficial Consumptive Use | | | Imported Water | Difference Between Allocation |
|---------------|-----------------------|-----------------------------|-----------------------------|-------------------------------------|-------------------------------------|-----------------------|-----------------------|--------------------------|---------------------------------|
| Column | Col 1 | Col 2 | Col 3 | Col 4 | Col 5 | Col 6 | Col 7 | Col 8 | Col 9 |
| | State-Wide Allocation | Allocation Below Guide Rock | Allocation Above Guide Rock | Share of Unused Colorado Allocation | State-Wide CBCU | CBCU Below Guide Rock | CBCU Above Guide Rock | Credits Above Guide Rock | Col 3 + Col 4 - (Col 7 - Col 8) |
| 2020 | 303,070 | 17,777 | 285,293 | 1,628 | 252,400 | 2,266 | 250,134 | 18,995 | 55,783 |
| 2021 | 258,180 | 6,503 | 251,677 | 1,521 | 252,650 | 3,084 | 249,566 | 21,485 | 25,116 |
| 2022 | 221,860 | 9,277 | 212,583 | 1,017 | 249,960 | 2,870 | 247,090 | 16,174 | (17,316) |
| Avg 2020-2022 | 261,040 | 11,190 | 249,850 | 1,390 | 251,670 | 2,740 | 248,930 | 18,880 | 21,190 |

Attachments

Attachment 1: Sub-basin Flood Flow Thresholds

| Sub-basin | Sub-basin Flood Flow Threshold Acre-feet per Year ³ |
|--------------------------------|---|
| Arikaree River | 16,400 |
| North Fork of Republican River | 33,900 |
| Buffalo Creek | 9,800 |
| Rock Creek | 9,800 |
| South Fork of Republican River | 30,400 |
| Frenchman Creek | 51,900 |
| Driftwood Creek | 9,400 |
| Red Willow Creek | 15,100 |
| Medicine Creek | 55,100 |
| Beaver Creek | 13,900 |
| Sappa Creek | 26,900 |
| Prairie Dog | 15,700 |

³ Flows considered to be Flood Flows are flows in excess of the 94% flow based on a flood frequency analysis for the years 1971-2000. The Gaged Flows are measured after depletions by Beneficial Consumptive Use and change in reservoir storage.

Attachment 6: Computing Water Supplies and Consumptive Use Above Guide Rock

Note: At its Annual Meeting on August 21, 2020, the RRCA agreed that the Accounting Procedures (Rev. May 25, 2017) do not properly implement the Flood Flows provisions at the Hardy gage with respect to the calculation of Computed Water Supply above and below Guide Rock. The current implementation could impact Nebraska's Table 5C compliance test, specifically the Allocation above Guide Rock. Nebraska and Kansas each offered proposals to resolve the issue but could not reach agreement on a solution. Due to the infrequent occurrence of Flood Flows, the RRCA deferred resolution of the matter to a future date necessitated by and preceding impact to Nebraska's Table 5C compliance. The states wish to acknowledge and memorialize the issue to encourage work towards its resolution. As it stands, Attachment 6 calculates Virgin Water Supply Guide Rock to Hardy rather than Computed Water Supply Guide Rock to Hardy which would reduce Virgin Water Supply by the relevant Flood Flows as described in Section II. Definitions and Section III. Basic Formulas.

| Year | Total Mainstem CWS | Hardy Gage | Superior Courtland Diversion Dam | Courtland Canal Diversions | Superior Canal Diversion | Courtland Canal Returns | Superior Canal Returns | Total Bostwick Returns Below Guide Rock | NE CBCU Below Guide Rock | KS CBCU Below Guide Rock | Total CBCU Below Guide Rock | Gain Guide Rock to Hardy | VWS Guide Rock to Hardy | Mainstem VWS Above Guide Rock | NE MS Allocation Above Guide Rock | KS MS Allocation Above Guide Rock | Nebraska Guide Rock to Hardy Allocation | Kansas Guide Rock to Hardy Allocation |
|------|--------------------|------------|----------------------------------|----------------------------|--------------------------|-------------------------|------------------------|---|--------------------------|--------------------------|-----------------------------|--------------------------|-------------------------|-------------------------------|-----------------------------------|-----------------------------------|---|---------------------------------------|
| 2022 | 160,360 | 69,608 | 32,213 | 73,224 | 9,827 | 15,494 | 6,460 | 21,954 | 2,870 | 661 | 3,531 | 15,441 | 18,972 | 141,388 | 69,139 | 72,249 | 9,277 | 9,695 |

| COURTLAND CANAL | | | | | |
|---|--------|--------|--------|--------|--------|
| | 2018 | 2019 | 2020 | 2021 | 2022 |
| Return Flow From Courtland Canal To Republican River Above Lovewell From Kansas | 608 | 761 | 536 | 912 | 835 |
| Return Flow From Courtland Canal To Republican River Above Hardy From Nebraska | 4,706 | 3,519 | 6,791 | 9,625 | 14,659 |
| Courtland Canal Diversions At Headgate | 46,704 | 55,120 | 44,380 | 73,224 | 74,964 |
| Courtland Canal At Kansas-Nebraska State Line | 40,559 | 50,721 | 35,756 | 60,776 | 55,667 |
| NE Courtland Canal CBCU (includes transportation loss) | 405 | 108 | 342 | 711 | 1,420 |
| Superior Canal CBCU | 2,744 | 1,433 | 2,046 | 3,076 | 3,367 |

| NEBRASKA | | | | | |
|--|-------|-------|-------|-------|-------|
| | 2018 | 2019 | 2020 | 2021 | 2022 |
| SW Diversions - Irrigation - Small Pumps - Nebraska Below Guide Rock | 1,177 | 84 | 552 | 665 | 763 |
| SW Diversions - M&I - Nebraska - Below Guide Rock | 0 | 0 | 0 | 0 | 0 |
| SW Non-Federal Reservoir Evaporation - Below Guide Rock | (9) | (6) | 84 | 51 | 95 |
| SW Return - Irrigation | 294 | 21 | 138 | 166 | 191 |
| SW Return - M&I | 0 | 0 | 0 | 0 | 0 |
| GW CBCU Nebraska Below Guide Rock | 2,440 | 1,723 | 1,769 | 2,534 | 2,203 |

| KANSAS | | | | | |
|------------------------------------|------|------|------|------|------|
| | 2018 | 2019 | 2020 | 2021 | 2022 |
| SW CBCU - Irrigation - Small Pumps | 518 | 148 | 565 | 667 | 598 |
| SW CBCU - M&I | 0 | 0 | 0 | 0 | 0 |
| GW CBCU Kansas Below Guide Rock | 47 | 49 | 51 | 56 | 63 |

2022

Attachment 7: Calculations of Return Flows from Bureau of Reclamation Canals

| Col 1 | Col 2 | Col 3 | Col 4 | Col 5 | Col 6 | Col 7 | Col 8 | Col 9 | Col 10 | Col 11 | Col 12 |
|-------------------------------------|--------------------|---------------------------------|---------------|--------------------------------|---------------|--|---------------|--------------------------|---|--|--------------------------------------|
| Canal | Canal Diversion | Spill to Waste-Way | Net Diversion | Field Deliveries | Canal Loss | Average Field Loss Factor | Field Loss | Total Loss from District | Percent Field and Canal Loss That Returns to the Stream | Total return to Stream from Canal and Field Loss | Return as Percent of Canal Diversion |
| Name Canal | Headgate Diversion | Sum of measured spills to river | Col 2 - Col 3 | Sum of Deliveries to the field | Col 4 - Col 5 | 1 -Weighted Average Efficiency of Application System for the District* | Col 5 x Col 7 | Col 6 + Col 8 | Estimated Percent Loss* | Col 9 x Col 10 + Col 3 | Col 11/Col 2 |
| Σ Irrigation Season | | | | | | | | | | | |
| Σ Non- Irrigation Season | | | | | | | | | | | |
| Culbertson | 3,575 | 0 | 3,575 | 23 | 3,552 | 30% | 7 | 3,559 | 82% | 2,918 | 82% |
| | 213 | 0 | 213 | 0 | 213 | 30% | 0 | 213 | 92% | 196 | 92.0% |
| Culbertson Extension | 0 | 0 | 0 | 0 | 0 | 30% | 0 | 0 | 82% | 0 | 100% |
| | 0 | 0 | 0 | 0 | 0 | 30% | 0 | 0 | 92% | 0 | 100.0% |
| Meeker - Driftwood | 21,898 | 2,740 | 19,158 | 8,381 | 10,777 | 30% | 2,514 | 13,291 | 82% | 13,639 | 62.3% |
| | 0 | 0 | 0 | 0 | 0 | 30% | 0 | 0 | 92% | 0 | 100.0% |
| Red Willow | 5,451 | 389 | 5,062 | 1,699 | 3,363 | 30% | 510 | 3,873 | 82% | 3,565 | 65.4% |
| | 0 | 0 | 0 | 0 | 0 | 30% | 0 | 0 | 92% | 0 | 100.0% |
| Bartley | 6,640 | 355 | 6,285 | 2,735 | 3,550 | 30% | 821 | 4,371 | 82% | 3,939 | 59.3% |
| | 0 | 0 | 0 | 0 | 0 | 30% | 0 | 0 | 92% | 0 | 100.0% |
| Cambridge | 26,873 | 1,188 | 25,685 | 12,715 | 12,970 | 30% | 3,815 | 16,785 | 82% | 14,951 | 55.6% |
| | 0 | 0 | 0 | 0 | 0 | 30% | 0 | 0 | 92% | 0 | 100.0% |
| Naponee | 1,288 | 355 | 933 | 383 | 550 | 35% | 134 | 684 | 82% | 916 | 71.1% |
| | 0 | 0 | 0 | 0 | 0 | 35% | 0 | 0 | 92% | 0 | 100.0% |
| Franklin | 24,542 | 2,299 | 22,243 | 7,468 | 14,775 | 35% | 2,614 | 17,389 | 82% | 16,558 | 67.5% |
| | 0 | 0 | 0 | 0 | 0 | 35% | 0 | 0 | 92% | 0 | 100.0% |
| Franklin Pump | 1,739 | 415 | 1,324 | 816 | 508 | 35% | 286 | 794 | 82% | 1,066 | 61.3% |
| | 0 | 0 | 0 | 0 | 0 | 35% | 0 | 0 | 92% | 0 | 100.0% |
| Almena | 2,542 | 0 | 2,542 | 915 | 1,627 | 30% | 275 | 1,902 | 82% | 1,559 | 61.3% |
| Superior | 9,827 | 1,224 | 8,603 | 3,214 | 5,389 | 31% | 996 | 6,385 | 82% | 6,460 | 65.7% |
| | 0 | 0 | 0 | 0 | 0 | 31% | 0 | 0 | 92% | 0 | 100.0% |
| Nebraska Courtland | 2,007 | 0 | 2,007 | 1,677 | 330 | 23% | 386 | 716 | 82% | 587 | 29.2% |
| Courtland Canal Above Lovewell (KS) | 22,667 | 1,453 | 21,214 | 10,725 | 10,489 | 23% | 2,467 | 12,956 | 82% | 12,077 | 53.3% |
| Courtland Canal Below Lovewell | 36,666 | 4,095 | 32,571 | 24,228 | 8,343 | 23% | 5,572 | 13,915 | 82% | 15,506 | 42.3% |

* The average field efficiencies for each district and percent loss that returns to the stream may be reviewed and, if necessary, changed by the RRCA to improve the accuracy of the estimates.

Attachment 8: Calculations of the Computed Water Supply Adjustment and Remaining Compact Compliance Volume for implementation of 2016 RRCA Resolution

| CCV and RCCV Tracking ^a | | | | | | | | | | | | | APV and RWS | | | | | RCCV Calc | |
|------------------------------------|---------------------------|-----------------|--------|---------------------|----------------------|------------------------------------|--|-------------------------------|--------------------------------------|--------------------------------------|-------------------------------------|--|---------------------------|--|---|--|--|--|---|
| Year | Col. 1 | Col. 2 | Col. 3 | Col. 4 | Col. 5 | Col. 6 | Col. 7 | Col. 8 | Col. 9 | Col. 10 | Col. 11 | Col. 12 | Colorado | | Nebraska | | | | |
| | Start of Year RCCV | RCCV Adjustment | CCV | CCV Inflow Into HCL | RCCV Inflow Into HCL | Total CCV and RCCV Inflow Into HCL | Total CCV and RCCV Available for Release | CCV Released from HCL as Flow | CCV Released from HCL as Evaporation | CCV Retained in HCL (at End of Year) | CWSA | End of Year RCCV | Aug. Pumping Volume (APV) | Resolution Water Supply Credit (CORWS) | Aug. Pumping Volume (APV) Rock Creek That Passed Sub-basin Gage in the Current Year | Aug. Pumping Volume (APV) N-CORPE That Passed Sub-basin Gage in the Current Year | Resolution Water Supply Credit (NERWS) | Extra CCV Efforts Above CCV (Use with RCCV Calc) | |
| | =Col. 12 of previous year | b | c | | | = Col. 4 + Col. 5 | =Col. 6 + Col. 10 of previous year | | | = Col. 7 – (Col. 8 + Col. 9) | =Col. 10 – Col. 10 of previous year | = Col. 1 – Col. 2 + Col. 3 - Col. 6 ^d | | | | | | | |
| 2007 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2010 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2011 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2012 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2013 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2014 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2015 | 0 | 0 | 0 | 8332 | 0 | 8332 | 8332 | 0 | 0 | 8332 | 8332 | 0 | 0 | 7,448 | 7,448 | 19,397 | 42,758 | 62,155 | 0 |
| 2016 | 0 | 0 | 41,935 | 24752 | 0 | 24752 | 33084 | 5084 | 4321 | 23679 | 15347 | 9,300 | 10,760 | 10,760 | 1,098 | 25,932 | 18,698 | 8332 | |
| 2017 | 9300 | 0 | 20,000 | 20,000 | 0 | 20000 | 43679 | 20000 | 2241 | 21438 | -2241 | 9,300 | 11,330 | 11,330 | 4,563 | 11,106 | 20,000 | 0 | |
| 2018 | 9300 | 0 | 0 | 0 | 0 | 0 | 21438 | 0 | 1339 | 20099 | -1339 | 9,300 | 13,578 | 13,578 | 0 | 0 | 0 | 0 | |
| 2019 | 9300 | 0 | 0 | 0 | 0 | 0 | 20099 | 0 | 2340 | 17759 | -2340 | 9,300 | 8,905 | 8,905 | 0 | 0 | 0 | 0 | |
| 2020 | 9300 | 1860 | 0 | 0 | 0 | 0 | 17759 | 0 | 3889 | 13870 | -3889 | 7,440 | 6,218 | 6,218 | 0 | 0 | 0 | 0 | |
| 2021 | 7,440 | 1860 | 0 | 0 | 0 | 0 | 13870 | 0 | 1550 | 12320 | -1550 | 5,580 | 9,390 | 9,390 | 0 | 0 | 0 | 0 | |
| 2022 | 5,580 | 1860 | 0 | 0 | 0 | 0 | 12320 | 0 | 4354 | 7966 | -4354 | 3,720 | 8,501 | 8,501 | 0 | 0 | 0 | 0 | |

a. Calculations for RCCV, CWSA, & RWS don't start until Oct. 1, 2015

b. See Provision 10 of the RRCA Resolution signed August 24, 2016, titled "Resolution Approving Long-Term Agreement Related to the Operation of Harlan County Lake for Compact Call Years" for the terms of assigning RCCV Adjustment. The RCCV Adjustment for each year is equal to 20% of the unadjusted portion of the RCCV, if it is a non-Compact Call Year, plus any remaining volumetric reductions from the previous four years.

c. In years when the contributions from Nebraska's water management activities, consistent with the 2016 CCY HCL Operations Resolution, are greater than CCV and the NERWS is equal to the greater contribution volume, CCV in Column 3 should also be set equal to the contribution.

d. The formula for calculation of RCCV is based on calendar year operations and will vary when operations occur in a different calendar year than NERWS Credit is applied.

Flood Flow Calculations Based on Accounting Procedures III.B.1 and Attachment 1.

| Hardy Gage Monthly Data (acre-feet) | | | | | |
|-------------------------------------|---------|---------|---------|---------|--------|
| | 2018 | 2019 | 2020 | 2021 | 2022 |
| January | 4,619 | 13,289 | 55,339 | 7,475 | 8,005 |
| February | 5,521 | 6,875 | 33,332 | 7,332 | 7,615 |
| March | 7,386 | 61,131 | 33,775 | 28,746 | 9,074 |
| April | 3,658 | 21,669 | 23,421 | 20,400 | 6,592 |
| May | 2,309 | 66,000 | 31,732 | 25,198 | 4,958 |
| June | 7,601 | 69,761 | 10,810 | 14,672 | 3,981 |
| July | 3,805 | 118,015 | 30,811 | 8,141 | 18,172 |
| August | 5,065 | 82,834 | 8,337 | 8,550 | 3,666 |
| September | 23,848 | 30,188 | 3,488 | 3,034 | 2,326 |
| October | 17,603 | 21,527 | 4,298 | 2,535 | 1,624 |
| November | 9,231 | 59,330 | 7,632 | 7,470 | 1,775 |
| December | 20,216 | 75,757 | 8,265 | 8,600 | 1,815 |
| ANNUAL | 110,862 | 626,376 | 251,239 | 142,153 | 69,603 |
| Over 400K | 0 | 226,376 | 0 | 0 | 0 |

| 5-month Consecutive Period Flows (acre-feet) | | | | | |
|--|--------|---------|---------|--------|--------|
| | 2018 | 2019 | 2020 | 2021 | 2022 |
| Jan-May | 23,494 | 168,964 | 177,598 | 89,151 | 36,244 |
| Feb-Jun | 26,475 | 225,436 | 133,069 | 96,348 | 32,220 |
| Mar-Jul | 24,760 | 336,576 | 130,548 | 97,157 | 42,777 |
| Apr-Aug | 22,438 | 358,279 | 105,110 | 76,961 | 37,369 |
| May-Sep | 42,628 | 366,798 | 85,177 | 59,595 | 33,103 |
| Jun-Oct | 57,922 | 322,325 | 57,743 | 36,932 | 29,769 |
| Jul-Nov | 59,552 | 311,894 | 54,566 | 29,730 | 27,563 |
| Aug-Dec | 75,962 | 269,636 | 32,020 | 30,189 | 11,206 |

| 2-month Consecutive Period Flows (acre-feet) | | | | | |
|--|--------|---------|--------|--------|--------|
| | 2018 | 2019 | 2020 | 2021 | 2022 |
| Jan-Feb | 10,140 | 20,164 | 88,671 | 14,807 | 15,620 |
| Feb-Mar | 12,907 | 68,006 | 67,107 | 36,078 | 16,689 |
| Mar-Apr | 11,045 | 82,800 | 57,195 | 49,146 | 15,666 |
| Apr-May | 5,967 | 87,669 | 55,152 | 45,598 | 11,550 |
| May-Jun | 9,910 | 135,761 | 42,541 | 39,870 | 8,939 |
| Jun-Jul | 11,406 | 187,776 | 41,621 | 22,813 | 22,153 |
| Jul-Aug | 8,870 | 200,849 | 39,148 | 16,691 | 21,838 |
| Aug-Sep | 28,912 | 113,022 | 11,825 | 11,584 | 5,992 |
| Sep-Oct | 41,451 | 51,715 | 7,786 | 5,569 | 3,950 |
| Oct-Nov | 26,834 | 80,857 | 11,930 | 10,005 | 3,399 |
| Nov-Dec | 29,447 | 135,087 | 15,898 | 16,070 | 3,590 |

| Final Sub-basin Flood Flows | | | | | |
|-----------------------------|------|--------|------|------|------|
| | 2018 | 2019 | 2020 | 2021 | 2022 |
| North Fork Flood Flow | 0 | 0 | 0 | 0 | 0 |
| Arikaree Flood Flow | 0 | 0 | 0 | 0 | 0 |
| Buffalo Flood Flow | 0 | 0 | 0 | 0 | 0 |
| Rock Flood Flow | 0 | 0 | 0 | 0 | 0 |
| Southfork Flood Flow | 0 | 0 | 0 | 0 | 0 |
| Frenchman Flood Flow | 0 | 0 | 0 | 0 | 0 |
| Driftwood Flood Flow | 0 | 0 | 0 | 0 | 0 |
| Red Willow Flood Flow | 0 | 0 | 0 | 0 | 0 |
| Medicine Creek Flood Flow | 0 | 0 | 0 | 0 | 0 |
| Beaver Flood Flow | 0 | 0 | 0 | 0 | 0 |
| Sappa Flood Flow | 0 | 15988 | 0 | 0 | 0 |
| Prairie Dog Flood Flow | 0 | 25260 | 0 | 0 | 0 |
| Mainstem Flood Flow | 0 | 185128 | 0 | 0 | 0 |

| Sub-basin Flows Above Attachment 1 Flood Flow Thresholds | | | | | |
|--|------|--------|------|------|------|
| | 2018 | 2019 | 2020 | 2021 | 2022 |
| North Fork | 0 | 0 | 0 | 0 | 0 |
| Arikaree | 0 | 0 | 0 | 0 | 0 |
| Buffalo | 0 | 0 | 0 | 0 | 0 |
| Rock | 0 | 0 | 0 | 0 | 0 |
| South Fork | 0 | 0 | 0 | 0 | 0 |
| Frenchman | 0 | 14,672 | 0 | 0 | 0 |
| Driftwood | 0 | 0 | 0 | 0 | 0 |
| Red Willow | 0 | 0 | 0 | 0 | 0 |
| Medicine Creek | 0 | 0 | 0 | 0 | 0 |
| Beaver | 0 | 0 | 0 | 0 | 0 |
| Sappa | 0 | 15,988 | 0 | 0 | 0 |
| Prairie Dog | 0 | 25,260 | 0 | 0 | 0 |
| Sub-basin Sum | 0 | 41,248 | 0 | 0 | 0 |

| 5-month Consecutive Period Test | | | | | |
|---------------------------------|------|------|------|------|------|
| | 2018 | 2019 | 2020 | 2021 | 2022 |
| Jan-May | 0 | 0 | 0 | 0 | 0 |
| Feb-Jun | 0 | 0 | 0 | 0 | 0 |
| Mar-Jul | 0 | 1 | 0 | 0 | 0 |
| Apr-Aug | 0 | 1 | 0 | 0 | 0 |
| May-Sep | 0 | 1 | 0 | 0 | 0 |
| Jun-Oct | 0 | 0 | 0 | 0 | 0 |
| Jul-Nov | 0 | 0 | 0 | 0 | 0 |
| Aug-Dec | 0 | 0 | 0 | 0 | 0 |
| TOTAL | 0 | 3 | 0 | 0 | 0 |

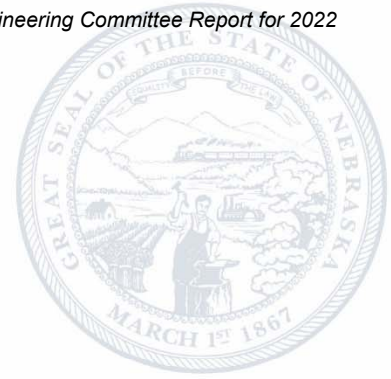
| 2-month Consecutive Period Test | | | | | |
|---------------------------------|------|------|------|------|------|
| | 2018 | 2019 | 2020 | 2021 | 2022 |
| Jan-Feb | 0 | 0 | 0 | 0 | 0 |
| Feb-Mar | 0 | 0 | 0 | 0 | 0 |
| Mar-Apr | 0 | 0 | 0 | 0 | 0 |
| Apr-May | 0 | 0 | 0 | 0 | 0 |
| May-Jun | 0 | 0 | 0 | 0 | 0 |
| Jun-Jul | 0 | 0 | 0 | 0 | 0 |
| Jul-Aug | 0 | 1 | 0 | 0 | 0 |
| Aug-Sep | 0 | 0 | 0 | 0 | 0 |
| Sep-Oct | 0 | 0 | 0 | 0 | 0 |
| Oct-Nov | 0 | 0 | 0 | 0 | 0 |
| Nov-Dec | 0 | 0 | 0 | 0 | 0 |
| TOTAL | 0 | 1 | 0 | 0 | 0 |

| Combined Test | | | | | |
|---------------|------|------|------|------|------|
| | 2018 | 2019 | 2020 | 2021 | 2022 |
| FINAL TOTAL | 0 | 4 | 0 | 0 | 0 |

NEBRASKA

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DEPT. OF NATURAL RESOURCES



Pete Ricketts, Governor

Date: 1/12/2023

To: RRCA EC Representatives - Ivan Franco, Colorado, and Chris Beightel, Kansas

From: Kari Burgert, Nebraska RRCA EC representative

Subject: Report on error in the 2021 NCORPE augmentation project pumping data

Summary

The purpose of this document is to inform the Engineering Committee of an issue in the 2021 NCORPE well pumping volumes that were included in the 2021 RRCA Groundwater Model and 2021 Accounting and to initiate correction. Over 36,000 acre-feet of NCORPE pumping were erroneously reported by Nebraska for 2021. The lagged impacts from this pumping error will continue to affect future CBCU calculations. Nebraska recommends the Engineering Committee discuss and propose a solution to the RRCA at the 2023 Annual Meeting.

2021 NCORPE Data Error and Impacts on Accounting

On December 16, 2022, Nebraska Department of Natural Resources (NeDNR) received confirmation that the NCORPE augmentation project pumping data reported to the RRCA for 2021 is incorrect. The following table displays originally reported and correct total 2021 pumping for each well. The spreadsheet titled *2021Aug_NcorpeCorrect.xlsx* has the correct 2021 monthly pumping for each well.

| Well | Model Row | Model Column | Original (acre-feet) | Correct (acre-feet) |
|------|-----------|--------------|----------------------|---------------------|
| W132 | 18 | 161 | 1.05 | 0.00 |
| W133 | 19 | 160 | 357.79 | 0.00 |
| W134 | 19 | 161 | 0.28 | 0.00 |
| W143 | 19 | 159 | 168.81 | 0.00 |
| W144 | 19 | 160 | 0.00 | 0.00 |
| W154 | 19 | 159 | 21.56 | 0.00 |
| W161 | 18 | 163 | 0.01 | 0.00 |
| W163 | 19 | 163 | 335.74 | 475.62 |

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1/12/2023

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| Well | Model Row | Model Column | Original (acre-feet) | Correct (acre-feet) |
|-------------------|-----------|--------------|----------------------|---------------------|
| W164 | 19 | 164 | 11.79 | 649.99 |
| W171 | 18 | 162 | 79.75 | 4.74 |
| W172 | 18 | 163 | 3.10 | 0.00 |
| W173 | 19 | 162 | 109.10 | 0.00 |
| W174 | 19 | 163 | 13.57 | 0.00 |
| W181 | 18 | 161 | 0.00 | 0.00 |
| W182 | 18 | 162 | 376.80 | 0.00 |
| W183 | 19 | 161 | 289.90 | 0.00 |
| W184 | 19 | 162 | 0.00 | 0.00 |
| W191 | 19 | 161 | 6,588.47 | 531.07 |
| W192 | 19 | 162 | 0.11 | 0.00 |
| W201 | 19 | 162 | 19.65 | 0.00 |
| W202 | 19 | 163 | 0.01 | 0.00 |
| W211 | 19 | 163 | 0.31 | 0.00 |
| W212 | 19 | 164 | 14,811.44 | 0.00 |
| W213 | 20 | 163 | 7,827.75 | 599.37 |
| W222 | 19 | 159 | 7,189.49 | 0.00 |
| W231 | 19 | 159 | 18.52 | 0.00 |
| W232 | 19 | 160 | 0.58 | 0.00 |
| W241 | 19 | 160 | 209.25 | 3.85 |
| W242 | 19 | 161 | 1.86 | 0.00 |
| W281 | 20 | 163 | 1.53 | 0.00 |
| 2021 Total | | | 38,438.22 | 2,264.63 |

In total, approximately 36,174 acre-feet of pumping was over-reported for the NCORPE wells for 2021.

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We corrected the 2021 NCORPE pumping and re-ran the RRCA Groundwater Model to obtain the 2021 Impacts in acre-feet shown in the following table. There were no differences in the 2021 Impacts with the corrected NCORPE pumping.

| 2021 Location | Colorado | | Kansas | | Nebraska | | Mound | |
|------------------------|---------------|---------------|---------------|---------------|----------------|----------------|---------------|---------------|
| | Original | Corrected | Original | Corrected | Original | Corrected | Original | Corrected |
| Arikaree | 1,443 | 1,443 | 115 | 115 | 110 | 110 | 0 | 0 |
| Beaver | 0 | 0 | 5,163 | 5,163 | 3,228 | 3,228 | 0 | 0 |
| Buffalo | 437 | 437 | 0 | 0 | 3,569 | 3,569 | 0 | 0 |
| Driftwood | 0 | 0 | 0 | 0 | 828 | 828 | 0 | 0 |
| Frenchman | 183 | 183 | 0 | 0 | 74,743 | 74,743 | 0 | 0 |
| North Fork | 17,951 | 17,951 | 0 | 0 | 1,272 | 1,272 | 0 | 0 |
| Above Swanson | -3,856 | -3,856 | 34 | 34 | 6,209 | 6,209 | 0 | 0 |
| Swanson - Harlan | 0 | 0 | -470 | -470 | 29,183 | 29,183 | 9,921 | 9,921 |
| Harlan - Guide Rock | 0 | 0 | 0 | 0 | 26,527 | 26,527 | 742 | 742 |
| Guide Rock - Hardy | 0 | 0 | 56 | 56 | 2,534 | 2,534 | -14 | -14 |
| Medicine | 0 | 0 | 0 | 0 | 20,219 | 20,219 | 10,693 | 10,693 |
| Prairie Dog | 0 | 0 | 2,164 | 2,164 | 0 | 0 | 0 | 0 |
| Red Willow | 0 | 0 | 0 | 0 | 6,670 | 6,670 | 49 | 49 |
| Rock | 82 | 82 | 0 | 0 | 5,113 | 5,113 | 0 | 0 |
| Sappa | 0 | 0 | 1,241 | 1,241 | 1,560 | 1,560 | 29 | 29 |
| South Fork | 12,250 | 12,250 | 5,155 | 5,155 | 774 | 774 | 0 | 0 |
| Hugh Butler | 0 | 0 | 0 | 0 | 2,192 | 2,192 | 0 | 0 |
| Bonny | 1,514 | 1,514 | 21 | 21 | 0 | 0 | 0 | 0 |
| Keith Sebelius | 0 | 0 | 560 | 560 | 0 | 0 | 0 | 0 |
| Enders | 17 | 17 | 0 | 0 | 5,179 | 5,179 | 0 | 0 |
| Harlan | 0 | 0 | 83 | 83 | 730 | 730 | 36 | 36 |
| Harry Strunk | 0 | 0 | 0 | 0 | 343 | 343 | 0 | 0 |
| Swanson | 17 | 17 | 0 | 0 | 302 | 302 | 0 | 0 |
| Mainstem | -3,866 | -3,866 | -371 | -371 | 64,452 | 64,452 | 10,649 | 10,649 |
| Total | 30,029 | 30,029 | 14,137 | 14,137 | 191,284 | 191,284 | 21,471 | 21,471 |

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Using Willem's January 2, 2023, groundwater model update and carrying the resulting 2021 heads from the corrected run forward to the 2022 and 2023 model projections, we obtain 2022 and 2023 CBCU shown in the following tables. Impact differences are in bold italics.

| 2022 Location | Colorado | | Kansas | | Nebraska | | Mound | |
|---------------------|---------------|---------------|--------------|--------------|----------------|----------------|---------------|---------------|
| | Original | Corrected | Original | Corrected | Original | Corrected | Original | Corrected |
| Arikaree | 728 | 728 | 128 | 128 | 122 | 122 | 0 | 0 |
| Beaver | 0 | 0 | 3,406 | 3,406 | 1,863 | 1,863 | 0 | 0 |
| Buffalo | 391 | 391 | 0 | 0 | 3,525 | 3,525 | 0 | 0 |
| Driftwood | 0 | 0 | 0 | 0 | 816 | 816 | 0 | 0 |
| Frenchman | 174 | 174 | 0 | 0 | 71,053 | 71,053 | 0 | 0 |
| North Fork | 17,977 | 17,977 | 0 | 0 | 1,288 | 1,288 | 0 | 0 |
| Above Swanson | -5,509 | -5,509 | 52 | 52 | 4,275 | 4,275 | 0 | 0 |
| Swanson - Harlan | 0 | 0 | -458 | -458 | 11,095 | 11,095 | 6,113 | 6,113 |
| Harlan - Guide Rock | 0 | 0 | 0 | 0 | 26,024 | 26,024 | 701 | 701 |
| Guide Rock - Hardy | 0 | 0 | 62 | 62 | 2,272 | 2,272 | -19 | -19 |
| Medicine | 0 | 0 | 0 | 0 | 19,248 | 19,247 | 9,490 | 9,492 |
| Prairie Dog | 0 | 0 | 872 | 872 | 0 | 0 | 0 | 0 |
| Red Willow | 0 | 0 | 0 | 0 | 5,429 | 5,429 | 26 | 26 |
| Rock | 88 | 88 | 0 | 0 | 5,012 | 5,012 | 0 | 0 |
| Sappa | 0 | 0 | 128 | 128 | 1,013 | 1,013 | 13 | 13 |
| South Fork | 10,755 | 10,755 | 4,369 | 4,369 | 811 | 811 | 0 | 0 |
| Hugh Butler | 0 | 0 | 0 | 0 | 2,270 | 2,270 | 0 | 0 |
| Bonny | 1,542 | 1,542 | 22 | 22 | 0 | 0 | 0 | 0 |
| Keith Sebelius | 0 | 0 | 580 | 580 | 0 | 0 | 0 | 0 |
| Enders | 18 | 18 | 0 | 0 | 5,265 | 5,265 | 0 | 0 |
| Harlan | 0 | 0 | 66 | 66 | 727 | 727 | 38 | 38 |
| Harry Strunk | 0 | 0 | 0 | 0 | 351 | 351 | 0 | 0 |
| Swanson | 16 | 16 | 0 | 0 | 296 | 296 | 0 | 0 |
| Mainstem | -5,516 | -5,516 | -335 | -335 | 43,666 | 43,666 | 6,795 | 6,795 |
| Total | 26,173 | 26,173 | 9,241 | 9,241 | 162,755 | 162,755 | 16,376 | 16,378 |

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| 2023 | Colorado | | Kansas | | Nebraska | | Mound | |
|---------------------|---------------|---------------|--------------|--------------|----------------|----------------|---------------|---------------|
| Location | Original | Corrected | Original | Corrected | Original | Corrected | Original | Corrected |
| Arikaree | 976 | 976 | 175 | 175 | 135 | 135 | 0 | 0 |
| Beaver | 0 | 0 | 3,131 | 3,131 | 1,455 | 1,455 | 0 | 0 |
| Buffalo | 386 | 386 | 0 | 0 | 3,559 | 3,559 | 0 | 0 |
| Driftwood | 0 | 0 | 0 | 0 | 817 | 817 | 0 | 0 |
| Frenchman | 164 | 164 | 0 | 0 | 76,768 | 76,768 | 0 | 0 |
| North Fork | 18,588 | 18,588 | 0 | 0 | 1,320 | 1,320 | 0 | 0 |
| Above Swanson | -2,102 | -2,102 | 0 | 0 | 8,324 | 8,324 | 0 | 0 |
| Swanson - Harlan | 0 | 0 | -1,350 | -1,350 | 21,565 | 21,565 | 6,697 | 6,697 |
| Harlan - Guide Rock | 0 | 0 | 0 | 0 | 26,563 | 26,563 | 745 | 745 |
| Guide Rock - Hardy | 0 | 0 | 66 | 66 | 2,522 | 2,522 | -16 | -16 |
| Medicine | 0 | 0 | 0 | 0 | 21,491 | 21,486 | 10,888 | 10,910 |
| Prairie Dog | 0 | 0 | 1,369 | 1,369 | 0 | 0 | 0 | 0 |
| Red Willow | 0 | 0 | 0 | 0 | 6,816 | 6,816 | 37 | 37 |
| Rock | 94 | 94 | 0 | 0 | 5,057 | 5,057 | 0 | 0 |
| Sappa | 0 | 0 | -350 | -350 | 872 | 872 | 0 | 0 |
| South Fork | 12,499 | 12,499 | 5,801 | 5,801 | 856 | 856 | 0 | 0 |
| Hugh Butler | 0 | 0 | 0 | 0 | 2,334 | 2,334 | 0 | 0 |
| Bonny | 1,568 | 1,568 | 23 | 23 | 0 | 0 | 0 | 0 |
| Keith Sebelius | 0 | 0 | 596 | 596 | 0 | 0 | 0 | 0 |
| Enders | 20 | 20 | 0 | 0 | 5,342 | 5,342 | 0 | 0 |
| Harlan | 0 | 0 | 60 | 60 | 728 | 728 | 40 | 40 |
| Harry Strunk | 0 | 0 | 0 | 0 | 351 | 351 | 0 | 0 |
| Swanson | 21 | 21 | 0 | 0 | 298 | 298 | 0 | 0 |
| Mainstem | -2,106 | -2,106 | -1,275 | -1,275 | 58,974 | 58,974 | 7,425 | 7,425 |
| Total | 32,210 | 32,210 | 9,537 | 9,537 | 187,173 | 187,169 | 18,405 | 18,427 |

Since Willem's January 2, 2023, groundwater model update used 2021 pumping files for 2022 and 2023 impacts runs, we ran additional 2022 and 2023 runs that have the 2021 heads from the corrected 2021 and the corrected 2021 pumping repeated. As expected, there was no difference in the 2022 Impacts and a 2 acre-feet difference in 2023 Mound Impacts with the corrected starting heads and approved or corrected 2021 pumping repeated.

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The following table summarizes the change in total CBCU by year in acre-feet from correcting the 2021 NCORPE pumping in the 2021 run and carrying the corrected heads forward to the 2022 and 2023 runs.

| Impact difference in acre-feet | 2021 | 2022 | 2023 |
|--------------------------------|------|------|------|
| Colorado | 0 | 0 | 0 |
| Kansas | 0 | 0 | 0 |
| Nebraska | 0 | 0 | -4 |
| Mound | 0 | 2 | 22 |

The two attached accounting spreadsheets are a draft 2023 Accounting spreadsheet with the original model impacts (from the uncorrected runs) and that accounting spreadsheet updated with the impacts from the corrected runs to show the difference in 2022 and 2023 Accounting balances that result from the correction.

Discussion

As shown above, the correction of NCORPE pumping has no effect on the Impacts from the RRCA Groundwater Model for 2021. Due to the location of the NCORPE wells, there is a lag from the time of pumping to the impacts to streamflow, which we expect to peak in future years. In addition, the pumping from these wells primarily impact the Medicine Creek subbasin. With the current model runs, the impacts to the Mound begin in 2022. Nebraska's CBCU begins to change in 2023. Since the CBCU decrease is to the Medicine Creek subbasin, allocation of that subbasin is reduced which does not affect Colorado's balances and slightly decreases Kansas's balance in 2023. Nebraska's allocation is also decreased but the reduction in Nebraska's CBCU and increase in Imported Water Supply credit increases Nebraska's balances.

Nebraska recommends that the Engineering Committee recognize this error and take action to correct it to continue to use the best available data. There are two general courses of action that Nebraska would propose:

1. Revise the 2021 Model with the correct data inputs
2. Establish a new 2022 starting head condition for the model based on the corrected model output (this approach would be similar to the approach used to correct erroneous PRISM data that was identified after the 2019 data was approved by the RRCA)

Since there are no changes to any approved Accounting, option 1 would allow for correction of the error while keeping the post-2020 runs continuous. Whereas, option 2 would allow correction of the error with no revisions to any approved 2021 datasets, but would create an additional discontinuity for the model starting heads.

Nebraska recommends the Engineering Committee discuss and propose a solution to the RRCA at the 2023 Annual Meeting.

Attachments: 2021Aug_NcorpeCorrect.xlsx,
20230103_RRCAAccounting_EarlyDraft2023_NoCorrection.xlsx,
20230103_RRCAAccounting_EarlyDraft2023_Correction.xlsx