

**Second Annual Report for the
Republican River Basin-Wide Plan**
Data and Progress Updates, 2019

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Jointly prepared by

Upper Republican Natural Resources District

Middle Republican Natural Resources District

Lower Republican Natural Resources District

Tri-Basin Natural Resources District

&

Nebraska Department of Natural Resources

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Introduction

The *Republican River Basin-Wide Plan* (basin-wide plan) was developed by the Nebraska Department of Natural Resources (NeDNR) and the Upper Republican, Middle Republican, Lower Republican, and Tri-Basin Natural Resources Districts (NRDs), in consultation and collaboration with a Stakeholder Advisory Committee. The time frame to implement the basin-wide plan is approximately 25 years, spanning from the effective date of the basin-wide plan (March 1, 2019) to April 17, 2044, which is 30 years after the operative date of LB 1098 (2014), as specified in *Neb. Rev. Stat. § 46-755*.

Action Item 3.2.2 of the basin-wide plan specifies that NeDNR and the NRDs will annually exchange reports containing data and information about water supplies and uses in the Republican River Basin, management activities, and progress toward the goals and objectives of the basin-wide plan. This report contains the data and information about plan implementation progress for the 2019 calendar year, to be exchanged by NeDNR and the NRDs at the following year's annual meeting.

Progress toward Goals, Objectives, and Action Items

Progress toward the basin-wide plan’s goals, objectives, and action items is described below, in two subsections. The “Management Activities” subsection summarizes progress toward the plan’s goals, objectives, and action items. The “Assessment of Measurable Hydrologic Objectives (MHOs)” subsection contains the results of the MHO assessments used to evaluate overall plan progress. Specific progress report details can be found on the following pages:

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Management Activities

Under *Neb. Rev. Stat. § 46-755 (4)*, the basin-wide plan was required to include a timeline of up to 30 years after April 17, 2014, to meet the plan’s goals and objectives. The basin-wide plan took effect on March 1, 2019. This section summarizes progress toward the basin-wide plan’s goals, objectives, and action items during the 2019 calendar year, first as a visual snapshot of overall plan progress (beginning on page 6) followed by summaries describing progress on individual action items (beginning on page 15).

Two icons are displayed beside each action item in both the visual progress snapshot and the progress summaries. One symbol indicates when the action item is to be completed, according to the implementation schedule in the basin-wide plan. The other symbol indicates progress

made on that action item during 2019. Figure 1 is a key describing the meanings of the symbols used throughout the “Management Activities” section.

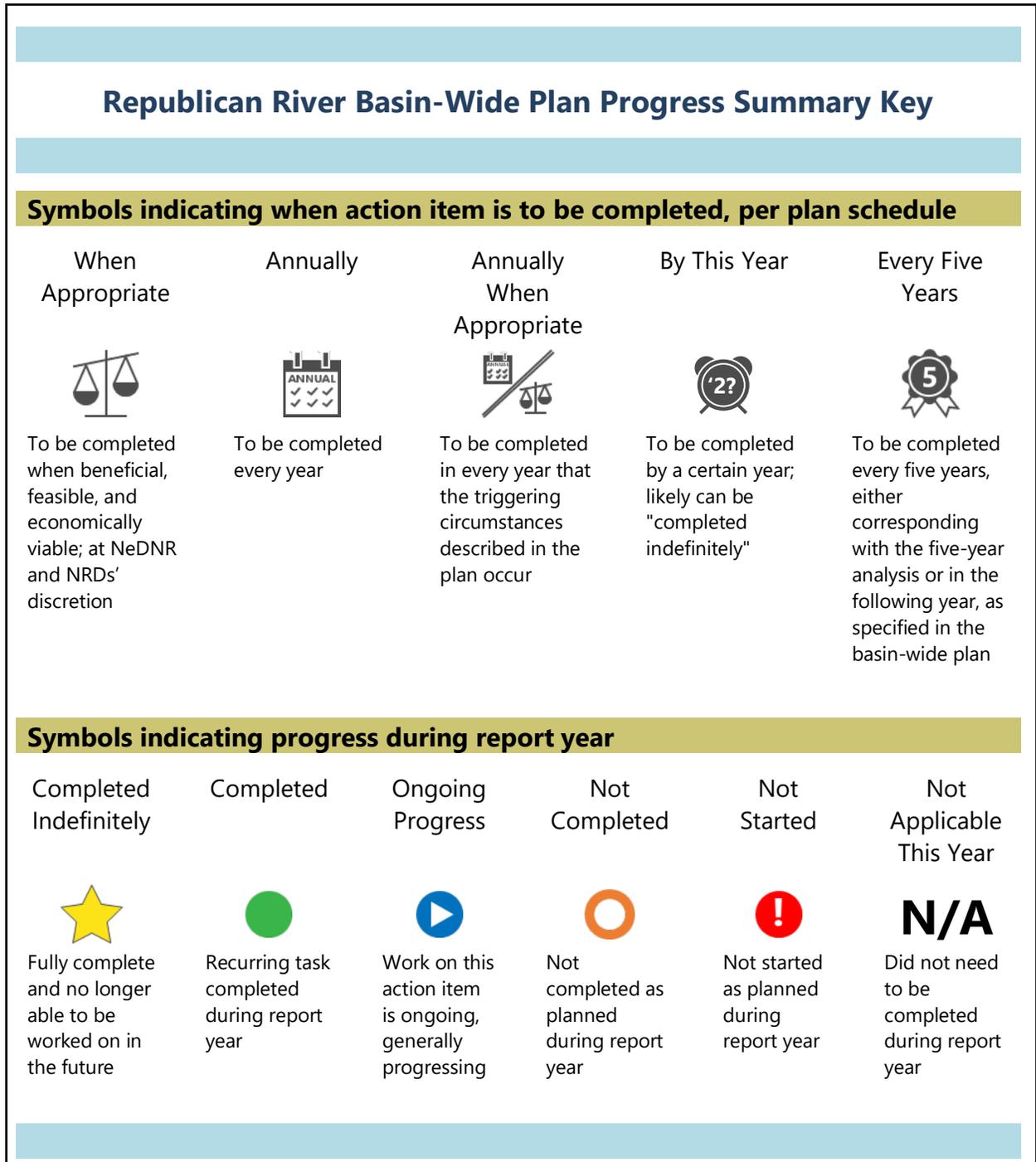


Figure 1. Key to symbols used throughout the “Management Activities” section. The report year for this report is 2019.

Progress Snapshot

This section contains a snapshot of overall progress on the basin-wide plan’s goals and objectives. Visual summaries of progress on each goal can be found in the following locations:

- Goal 1 visual summary: Table 1, beginning on page 6;
- Goal 2 visual summary: Table 2, beginning on page 9;
- Goal 3 visual summary: Table 3, beginning on page 13; and
- Goal 4 visual summary: Table 4, beginning on page 14.

Each of these four tables spans multiple pages.

Table 1. Visual summary of progress on Goal 1 during 2019. The “Time-Frame” column indicates the expected timeframe for each action item, as indicated in the basin-wide plan. The “Action Taken” column refers to whether the action item was worked on in 2019, and the “Progress” column contains more information about progress during 2019. For details about the progress on each action item, see the page number indicated in the rightmost column.

Action Item	Description	Time Frame	Action Taken	Progress	Page
Goal 1	Maintain Nebraska’s compliance with the Republican River Compact and applicable laws				
Obj. 1.1	Coordinate basin-wide management actions with Compact compliance efforts and adherence to state laws				
1.1.1	<i>Review each basin-wide plan management action prior to implementation to ensure it does not negatively impact efforts to achieve Compact compliance in the most efficient and cost-effective way practicable while adhering to state laws.</i>		Yes		15
1.1.2	<i>Implement appropriate offsets for any basin-wide plan action that would exceed Nebraska’s allocation under the Compact</i>		No	N/A	15

Legend

Per basin-wide plan, this action item is to be completed:					
When Appropriate	Annually	Annually When Appropriate	By This Year	Every Five Years	
					
Progress during report year:					
Completed Indefinitely	Completed	Ongoing Progress	Not Completed	Not Started	Not Applicable This Year
					N/A

(see Figure 1 on page 5 for more detailed descriptions of each symbol)

Action Item	Description	Time Frame	Action Taken	Progress	Page
Obj. 1.2	Understand effects of management actions for compact compliance on water supplies for State's water users				
1.2.1	Qualitatively evaluate the net effect on water supplies of any management actions that are taken for Compact compliance		Yes		16
Obj. 1.3	Assess progress toward meeting the goals and objectives of the Plan, and share the results of this assessment with the Public and the Nebraska Legislature				
1.3.1	Within five years after the adoption of this Plan, and every five years thereafter, conduct a technical analysis of the actions taken to determine the progress toward meeting the goals and objectives of the Plan		No	N/A	17
1.3.2	Evaluate progress toward each of the Plan's measurable hydrologic objectives at the intermediate dates specified in the Plan for each one.				
MHO A:	Maintain each NRD's net groundwater depletions to streamflow within its portion of Nebraska's allowable groundwater depletions to streamflow.		No	N/A	17
MHO B:	Limit groundwater depletions to streamflow to a relatively constant level over the long-term both across the basin as a whole and within each NRD		Yes		17
MHO C:	Ensure there is always enough groundwater for all groundwater uses within the timeframe of this plan, either by stabilizing groundwater levels or managing declining groundwater levels		Yes		18
MHO D:	Continue existing and initiate new actions that reduce the need for special regulations in the Rapid Response Area for Compact compliance		No	N/A	19

Legend

Per basin-wide plan, this action item is to be completed:					
When Appropriate	Annually	Annually When Appropriate	By This Year	Every Five Years	
					
Progress during report year:					
Completed Indefinitely	Completed	Ongoing Progress	Not Completed	Not Started	Not Applicable This Year
					N/A

(see Figure 1 on page 5 for more detailed descriptions of each symbol)

Action Item	Description	Time Frame	Action Taken	Progress	Page
MHO E:	Continue existing and initiate new actions that reduce the need for administration of surface water use for Compact compliance		No	N/A	19
1.3.3	Following each five-year technical analysis (Action Item 1.3.1), share the results of the analysis and any recommended Plan modifications with the public		No	N/A	20
1.3.4	Following each five-year technical analysis (Action Item 1.3.1) and any resulting modifications to the Plan, submit a report to the Legislature of the results of the analysis and progress made under the Plan		No	N/A	20

Legend

Per basin-wide plan, this action item is to be completed:					
When Appropriate	Annually	Annually When Appropriate	By This Year	Every Five Years	
					
Progress during report year:					
Completed Indefinitely	Completed	Ongoing Progress	Not Completed	Not Started	Not Applicable This Year
					N/A

(see Figure 1 on page 5 for more detailed descriptions of each symbol)

Table 2. Visual summary of progress on Goal 2 during 2019. The “Time-Frame” column indicates the expected timeframe for each action item, as indicated in the basin-wide plan. The “Action Taken” column refers to whether the action item was worked on in 2019, and the “Progress” column contains more information about progress during 2019. For details about the progress on each action item, see the page number indicated in the rightmost column.

Action Item	Description	Time Frame	Action Taken	Progress	Page
Goal 2 Maximize Nebraska’s efficient and beneficial consumptive use of its water, increase certainty for long-range planning of water supplies to reduce the need for regulatory actions, and increase collaborative efforts among water management entities and stakeholders across the Basin					
Obj. 2.1 Understand potential impacts of actions and establish standard procedure for projects					
2.1.1	<i>For each planned new water management project in the Plan, evaluate hydrologic and regulatory feasibility and potential economic and environmental impacts</i>		Yes		21
2.1.2	<i>For each project evaluated in accordance with Action Item 2.1.1 in a given year, include a summary of the evaluation in the annual report of that year’s activities</i>		Yes		21
2.1.3	<i>For projects that are feasible and beneficial, apply for necessary permits, establish new or utilize existing infrastructure, then begin operations</i>		Yes		22
Obj. 2.2 Improve the efficiency of use, availability, and reliability of water supplies for current irrigators					
2.2.1	<i>Work with irrigation districts and individual groundwater and surface water irrigators to improve the efficiency of the Basin’s surface water delivery systems and irrigation water use, when it is both feasible and beneficial to Nebraska’s Compact accounting balance</i>		Yes		22

Legend

Per basin-wide plan, this action item is to be completed:					
When Appropriate	Annually	Annually When Appropriate	By This Year	Every Five Years	
					
Progress during report year:					
Completed Indefinitely	Completed	Ongoing Progress	Not Completed	Not Started	Not Applicable This Year
					N/A

(see Figure 1 on page 5 for more detailed descriptions of each symbol)

Action Item	Description	Time Frame	Action Taken	Progress	Page
2.2.2	Participate in projects to improve the reliability, availability, and sustainability of water supplies in the Basin, which may include but are not limited to <ul style="list-style-type: none"> • Voluntary reduction of irrigated acres (temporary or permanent) • Interbasin transfers • Conjunctive management projects such as aquifer recharge or streamflow augmentation 		Yes		24
Obj. 2.3 Provide opportunities for collaboration among Basin’s water users					
2.3.1	Hold an annual public meeting to discuss Plan implementation and exchange information about the Basin		Yes		25
2.3.2	Work cooperatively to investigate and address conflicts between water users resulting from implementation of this Plan by following the procedures for addressing conflicts that are outlined in this Plan		No	N/A	26
Obj. 2.4 Promote conservation programs available to the water users in the Basin					
2.4.1	Work together to identify, investigate, and discuss existing and potential new water conservation programs		Yes		26
2.4.2	Collaborate to promote conservation program opportunities to the Basin’s water users		No	N/A	27
Obj. 2.5 Understand how management activities of independent decision-makers affect water supplies					
2.5.1	Study the effects of conservation practices on streamflow, if feasible		No	N/A	27

Legend

Per basin-wide plan, this action item is to be completed:					
When Appropriate	Annually	Annually When Appropriate	By This Year	Every Five Years	
					
Progress during report year:					
Completed Indefinitely	Completed	Ongoing Progress	Not Completed	Not Started	Not Applicable This Year
					N/A

(see Figure 1 on page 5 for more detailed descriptions of each symbol)

Action Item	Description	Time Frame	Action Taken	Progress	Page
2.5.2	As part of each five-year technical analysis, analyze the future impacts to streamflow of past pumping to determine the lag time of these residual impacts		No	N/A	28
2.5.3	Examine and attempt to estimate the quantity of all inputs and outputs affecting the water supply balance in a small watershed, and consider using the results of this pilot study to create water use and land use guidelines for producers and other land managers, incentivize participation in recommended practices, and determine the value of completing similar studies across the Basin		Yes		28
Obj. 2.6 Evaluate the feasibility and potential outcomes of establishing water markets in the Basin					
2.6.1	Cooperate in determining the feasibility of water markets in the Basin		No	N/A	29
2.6.2	Following the water markets feasibility analysis (Action Item 2.6.1), test conclusions through implementation of a water market program in a pilot area, if feasible		No	N/A	29
Obj. 2.7 Support the NRDs in management of allocations for irrigation purposes and surface water irrigation districts in management of the allotment of their water supply					
2.7.1	Periodically evaluate, as part of each five-year technical analysis, the impact of the groundwater allocation and surface water allotment systems as a whole		No	N/A	29
2.7.2	As needed, based on the evaluation described in Action Item 2.7.1, recommend changes or improvements to the groundwater allocation and/or surface water allotment systems		No	N/A	30

Legend

Per basin-wide plan, this action item is to be completed:					
When Appropriate	Annually	Annually When Appropriate	By This Year	Every Five Years	
					
Progress during report year:					
Completed Indefinitely	Completed	Ongoing Progress	Not Completed	Not Started	Not Applicable This Year
					N/A

(see Figure 1 on page 5 for more detailed descriptions of each symbol)

Action Item	Description	Time Frame	Action Taken	Progress	Page
Obj. 2.8 Conserve water for future use during a drought					
2.8.1	Organize and participate in a Basin-wide drought planning exercise		Yes		30
2.8.2	Following the drought planning exercise (Action Item 2.8.1) evaluate whether to recommend any changes to the IMPs or this Plan related to conservation of water for future use during a drought		No	N/A	31

Legend

Per basin-wide plan, this action item is to be completed:					
When Appropriate	Annually	Annually When Appropriate	By This Year	Every Five Years	
					
Progress during report year:					
Completed Indefinitely	Completed	Ongoing Progress	Not Completed	Not Started	Not Applicable This Year
					N/A

(see Figure 1 on page 5 for more detailed descriptions of each symbol)

Table 3. Visual summary of progress on Goal 3 during 2019. The “Time-Frame” column indicates the expected timeframe for each action item, as indicated in the basin-wide plan. The “Action Taken” column refers to whether the action item was worked on in 2019, and the “Progress” column contains more information about progress during 2019. For details about the progress on each action item, see the page number indicated in the rightmost column.

Action Item	Description	Time Frame	Action Taken	Progress	Page
Goal 3 Positive public relations, including information sharing, within and outside the Basin					
Obj. 3.1 Improve information sharing with decision-makers and public about solutions within the Basin					
3.1.1	Use existing resources to share information about Basin progress and activities with outside entities		Yes		32
3.1.2	Educate civic leaders and the public on implementation efforts within the Basin		Yes		32
3.1.3	Educate civic leaders and the public about the policies and institutional infrastructure that contribute to the development and implementation of solutions		Yes		33
3.1.4	Propose and support changes to laws, policies, and rules that would incentivize reduced water consumption		No	N/A	35
Obj. 3.2 Improve information sharing with water users who are reliant on the Basin’s water supplies					
3.2.1	Share data and information related to the Republican River Compact with the public in an easily accessible, user-friendly format		Yes		35
3.2.2	Annually prepare and exchange reports containing data and information about water supplies and uses in the Basin, and make these reports publicly known		Yes		36
3.2.3	Regularly communicate with the Plan’s former Stakeholder Advisory Committee about implementation progress and potential Plan revisions		Yes		36

Legend

Per basin-wide plan, this action item is to be completed:					
When Appropriate	Annually	Annually When Appropriate	By This Year	Every Five Years	
					
Progress during report year:					
Completed Indefinitely	Completed	Ongoing Progress	Not Completed	Not Started	Not Applicable This Year
					N/A

(see Figure 1 on page 5 for more detailed descriptions of each symbol)

Table 4. Visual summary of progress on Goal 4 during 2019. The “Time-Frame” column indicates the expected timeframe for each action item, as indicated in the basin-wide plan. The “Action Taken” column refers to whether the action item was worked on in 2019, and the “Progress” column contains more information about progress during 2019. For details about the progress on each action item, see the page number indicated in the rightmost column.

Action Item	Description	Time Frame	Action Taken	Progress	Page
Goal 4	When possible, pursue projects that not only benefit water supplies and uses, but also create benefits for fish, wildlife, recreation and conveyance within the Republican River Basin				
Obj. 4.1	Protect and enhance fish and wildlife habitat and recreational opportunities				
4.1.1	Partner with wildlife-focused organizations on projects that benefit the organizations’ habitat and wildlife interests while also helping to fulfill other goals of the Plan		Yes		38
4.1.2	Promote public recreation on the river, when doing so can also help to fulfill other goals of the Plan		Yes		38
4.1.3	Cooperate in projects to assess and restore riparian wetlands while also helping to fulfill other goals of the Plan		Yes		39
Obj. 4.2	Where feasible and beneficial, reduce the effects of undesirable vegetation on water conveyance				
4.2.1	Cooperate in removing undesirable vegetation impacting water conveyance and managing reinfestation		Yes		39

Legend

Per basin-wide plan, this action item is to be completed:					
When Appropriate	Annually	Annually When Appropriate	By This Year	Every Five Years	
					
Progress during report year:					
Completed Indefinitely	Completed	Ongoing Progress	Not Completed	Not Started	Not Applicable This Year
					N/A

(see Figure 1 on page 5 for more detailed descriptions of each symbol)

Progress Summaries

This section contains descriptions summarizing 2019 progress on each action item. For actions marked as not applicable (“N/A”) the summaries include explanations of why progress did not need to be taken on those action items in 2019. For a copy of any reference materials mentioned in these summaries, please contact NeDNR or one of the Republican Basin NRDs.

Goal 1 Maintain Nebraska’s compliance with the Republican River Compact and applicable laws

Obj. 1.1 Coordinate basin-wide plan management actions with Nebraska’s Compact compliance efforts and adherence to applicable state laws

1.1.1 Review each basin-wide plan management action prior to implementation to ensure it does not negatively impact efforts to achieve Compact compliance in the most efficient and cost-effective way practicable while adhering to state laws.



In 2019, all basin-wide plan management actions were reviewed in accordance with Action Item 1.1.1. The Republican Basin NRDs and NeDNR do not expect any 2019 basin-wide plan management actions to negatively impact efforts to achieve Compact compliance in the most efficient and cost-effective way under state law.

Based on our review of the potential future basin-wide plan management actions outlined in the basin-wide plan, we do not expect any will negatively impact Compact compliance efforts or adherence to state laws. As new management actions are proposed, we will thoroughly analyze them at that time.

1.1.2 Implement appropriate offsets for any basin-wide plan action that would exceed Nebraska’s allocation under the Compact



For this action item, the basin-wide plan defines offsets as actions that either reduce water use or increase water supply for the purpose of staying within Nebraska’s Compact allocation. Nebraska complied with the Compact in 2019 without the need for any offsets

Legend

Per basin-wide plan, this action item is to be completed:					
When Appropriate	Annually	Annually When Appropriate	By This Year	Every Five Years	
Progress during report year:					
Completed Indefinitely	Completed	Ongoing Progress	Not Completed	Not Started	Not Applicable This Year
					N/A

(see Figure 1 on page 5 for more detailed descriptions of each symbol)

by NeDNR or the Republican Basin NRDs. Because no offsets were necessary, this action item is not applicable for 2019.

In years when offsets are required, the volume of water that each NRD needs to make up through management actions is determined through procedures described in the IMPs. The IMPs for Upper Republican, Middle Republican, and Lower Republican NRDs require each district’s computed beneficial consumptive water use to remain within its share of Nebraska’s Compact allocation. The IMP for the Republican Basin portions of Tri-Basin NRD states that the district will incrementally achieve and sustain a hydrologically balanced condition so that, in combination with imported water contributions from the Platte Basin, streamflow augmentation, and other management actions, Tri-Basin NRD water users will not cause a net depletion to streamflow. Through implementation of the IMPs, NeDNR and the Republican Basin NRDs will take any necessary offsetting actions to ensure that Nebraska remains in compliance with the Compact.

Obj. 1.2 Understand the effects of management actions for Compact compliance on water supplies for Nebraska’s water users

1.2.1 *Qualitatively evaluate the net effect on water supplies of any management actions that are taken for Compact compliance*



This action item was completed during the first year of plan implementation. A qualitative evaluation of the net effect on water supplies of any management actions that were taken for Compact compliance during 2014–2018 was presented at the first annual meeting to review progress on the basin-wide plan, which took place in February 2020. It can be found in the PowerPoint presentation from the annual meeting, which is entitled *Republican River Basin-Wide Plan First Annual Meeting* (February 20, 2020) and can be downloaded from the basin-wide plan website, <http://rrbwp.nebraska.gov>.

The current year’s qualitative evaluation of the net effect of 2019 management actions for Compact compliance on water supplies can be found under “Qualitative Evaluation of Net Effect of Management Actions for Compact Compliance” on page 72 of this report.

Legend

Per basin-wide plan, this action item is to be completed:					
When Appropriate	Annually	Annually When Appropriate	By This Year	Every Five Years	
Progress during report year:					
Completed Indefinitely	Completed	Ongoing Progress	Not Completed	Not Started	Not Applicable This Year
					N/A

(see Figure 1 on page 5 for more detailed descriptions of each symbol)

Obj. 1.3 Assess progress toward meeting the goals and objectives of the Plan, and share the results of this assessment with the Public and the Nebraska Legislature

1.3.1 *Within five years after the adoption of this Plan, and every five years thereafter, conduct a technical analysis of the actions taken to determine the progress toward meeting the goals and objectives of the Plan*



N/A

A five-year technical analysis of actions taken is not necessary at this time. Following the schedule in the basin-wide plan, NeDNR and the Republican Basin NRDs will carry out the first five-year technical analysis in 2023 and repeat it every five years thereafter for the duration of the plan implementation time frame.

1.3.2 *Evaluate progress toward each of the Plan's measurable hydrologic objectives at the intermediate dates specified in the Plan for each one.*

MHO A: *Maintain each NRD's net groundwater depletions to streamflow within its portion of Nebraska's allowable groundwater depletions to streamflow.*



N/A

Because 2019 was the first year of plan implementation, there was no plan implementation progress to assess for the prior year; therefore, MHO A was not evaluated in 2019. This MHO will be evaluated annually for the remainder of the basin-wide plan implementation period.

The current year's evaluation of MHO A can be found under "MHO A Evaluation" on page 40 of this report.

MHO B: *Limit groundwater depletions to streamflow to a relatively constant level over the long-term both across the basin as a whole and within each NRD*



Legend

Per basin-wide plan, this action item is to be completed:

When Appropriate Annually Annually When Appropriate By This Year Every Five Years



Progress during report year:

Completed Indefinitely Completed Ongoing Progress Not Completed Not Started Not Applicable This Year



N/A

(see Figure 1 on page 5 for more detailed descriptions of each symbol)

An assessment of MHO B is not necessary at this time. Following the schedule laid out in the basin-wide plan, MHO B will be assessed in 2023, and every five years thereafter for the duration of the plan implementation time frame, as part of the five-year technical analysis.

In addition to requiring analysis of MHO B every five years, the basin-wide plan included a requirement to develop methodology for MHO B within the first year of plan implementation. In 2019, NeDNR and the Republican Basin NRDs worked together to develop methodology for this test. This methodology was presented at the first annual meeting in February 2020, and a final draft of the methods was included as an appendix to *First Annual Report for the Republican River Basin-Wide Plan: Data and Progress Updates, 2014–2018* (February 2020). The final methods are also available as a standalone document, *Supplement to the Republican River Basin-Wide Plan: Methodology for MHO B* (February 20, 2020). This task was completed within the first year of plan implementation, as specified in the basin-wide plan.

MHO C: *Ensure there is always enough groundwater for all groundwater uses within the timeframe of this plan, either by stabilizing groundwater levels or managing declining groundwater levels*



An assessment of MHO C is not necessary at this time. Following the schedule laid out in the basin-wide plan, MHO C will be assessed in 2023, and every five years thereafter for the duration of the plan implementation time frame, as part of the five-year technical analysis.

In addition to requiring analysis of MHO C every five years, the basin-wide plan included a requirement to develop methodology for MHO C within the first year of plan implementation. In 2019, NeDNR and the Republican Basin NRDs worked together to develop methodology for this test. This methodology was presented at the first annual meeting in February 2020, and a final draft of the methods was included as an appendix to *First Annual Report for the Republican River Basin-Wide Plan: Data and Progress Updates, 2014–2018* (February 2020). The final methods are also available as a standalone document, *Supplement to the Republican River Basin-Wide Plan: Methodology for MHO C*

Legend

Per basin-wide plan, this action item is to be completed:					
When Appropriate	Annually	Annually When Appropriate	By This Year	Every Five Years	
Progress during report year:					
Completed Indefinitely	Completed	Ongoing Progress	Not Completed	Not Started	Not Applicable This Year
					N/A

(see Figure 1 on page 5 for more detailed descriptions of each symbol)

(February 20, 2020). This task was completed within the first year of plan implementation, as specified in the basin-wide plan.

MHO D: *Continue existing and initiate new actions that reduce the need for special regulations in the Rapid Response Area for Compact compliance*



N/A

MHO D assesses whether groundwater pumping within the Rapid Response Area of Upper Republican, Middle Republican, or Lower Republican NRD was curtailed to ensure Compact compliance during the previous year. There is no Rapid Response Area designated within Tri-Basin NRD.

Because 2019 was the first year of plan implementation, there was no plan implementation progress to assess for the prior year; therefore, MHO D was not evaluated in 2019. This MHO will be evaluated annually for the remainder of the basin-wide plan implementation period.

The current year’s evaluation of MHO D can be found under “MHO D Evaluation” on page 45 of this report.

The Republican Basin NRDs and NeDNR have undertaken many projects that reduce the potential future need for special regulations in the Rapid Response Area for Compact compliance. Examples of new and existing projects can be found in this report, within the summaries of progress on other plan action items.

MHO E: *Continue existing and initiate new actions that reduce the need for administration of surface water use for Compact compliance*



N/A

MHO E assesses whether surface water administration was needed during the previous year to ensure Compact compliance. Note that any administration that is automatically triggered under terms of the Final Settlement Stipulation is not evaluated as part of MHO E.

Legend

Per basin-wide plan, this action item is to be completed:

When Appropriate	Annually	Annually When Appropriate	By This Year	Every Five Years

Progress during report year:

Completed Indefinitely	Completed	Ongoing Progress	Not Completed	Not Started	Not Applicable This Year
					N/A

(see Figure 1 on page 5 for more detailed descriptions of each symbol)

Because 2019 was the first year of plan implementation, there was no plan implementation progress to assess for the prior year; therefore, MHO E was not evaluated in 2019. This MHO will be evaluated annually for the remainder of the basin-wide plan implementation period.

The current year’s evaluation of MHO E can be found under “MHO E Evaluation” on page 46 of this report.

NeDNR and the Republican Basin NRDs have undertaken many projects that reduce the potential future need for surface water administration for Compact compliance. Some examples are included in this report, within the summaries of progress on other plan action items.

1.3.3 *Following each five-year technical analysis (Action Item 1.3.1), share the results of the analysis and any recommended Plan modifications with the public*



N/A

As explained under action item 1.3.1 above, the five-year technical analysis was not necessary in 2019; therefore, there were also no results to share with the public in 2019. As laid out in the basin-wide plan, NeDNR and the Republican Basin NRDs will carry out the five-year technical analysis and share the results with the public every five years throughout the plan implementation period, beginning in 2023.

1.3.4 *Following each five-year technical analysis (Action Item 1.3.1) and any resulting modifications to the Plan, submit a report to the Legislature of the results of the analysis and progress made under the Plan*



N/A

A report to the legislature summarizing the results of the analysis of a five-year technical analysis is not necessary at this time. As laid out in the basin-wide plan, NeDNR and the Republican Basin NRDs will carry out the five-year technical analysis every five years throughout the plan implementation period, beginning in 2023. A report to the Legislature will be submitted following each five-year technical analysis, beginning in 2024.

Legend

Per basin-wide plan, this action item is to be completed:					
When Appropriate	Annually	Annually When Appropriate	By This Year	Every Five Years	
Progress during report year:					
Completed Indefinitely	Completed	Ongoing Progress	Not Completed	Not Started	Not Applicable This Year
					N/A

(see Figure 1 on page 5 for more detailed descriptions of each symbol)

Goal 2 Maximize Nebraska’s efficient and beneficial consumptive use of its water, increase certainty for long-range planning of water supplies to reduce the need for regulatory actions, and increase collaborative efforts among water management entities and stakeholders across the Basin

Obj. 2.1 Understand the feasibility and potential impacts of Plan actions and establish a standard procedure for projects

2.1.1 *For each planned new water management project in the Plan, evaluate hydrologic and regulatory feasibility and potential economic and environmental impacts*



In 2019, Lower Republican NRD began evaluating three proposed locations for potential water storage. These efforts will initiate the National Environmental Policy Act (NEPA), which will require analyzing all components addressed in Action Item 2.1.1.

The Republican River Basin NRDs and NeDNR will continue to support the development and maintenance of digital water management models, databases, streamgages, observation wells, and other tools and facilities needed to accurately measure and clearly depict the current state of groundwater and surface water resources and potential future resource trends and conditions. These tools are essential for decision makers as they consider whether and how to regulate and manage water resources. As new water management actions are proposed, NeDNR and the NRDs will thoroughly review them in accordance with Action Item 2.1.1.

2.1.2 *For each project evaluated in accordance with Action Item 2.1.1 in a given year, include a summary of the evaluation in the annual report of that year’s activities*



The Lower Republican NRD NEPA analysis described under Action Item 2.1.1, above, may take up to 18 months. A hyperlink to the report can be provided in a future annual report, after conclusion of the analysis.

Legend

Per basin-wide plan, this action item is to be completed:					
When Appropriate	Annually	Annually When Appropriate	By This Year	Every Five Years	
Progress during report year:					
Completed Indefinitely	Completed	Ongoing Progress	Not Completed	Not Started	Not Applicable This Year
					N/A

(see Figure 1 on page 5 for more detailed descriptions of each symbol)

2.1.3 *For projects that are feasible and beneficial, apply for necessary permits, establish new or utilize existing infrastructure, then begin operations*



The Lower Republican and Tri-Basin NRDs (as partners in an Interlocal Cooperative Agreement), together with the Central Nebraska Public Power and Irrigation District, filed an application with NeDNR for a surface water appropriation for the proposed Platte to Republican Basin High Flow Diversion (PRD) project (application A-19594) in 2018. In June 2019, a hearing was held on procedural aspects of the application, and briefs were filed by the applicants and objectors after the hearing. Also in 2019, the PRD interlocal agreement requested that objectors be dismissed, arguing that the objectors will not have injury since the PRD interbasin transfer permit application requested to always be junior to existing and future Platte appropriations. As of the end of 2019, the applicants were still awaiting a decision from the Director of NeDNR on the matters raised at the hearing. This project is also mentioned under action item 2.2.2.

All ongoing and future projects will be developed in compliance with local, state, and federal permitting requirements.

Obj. 2.2 Improve the efficiency of use, availability, and reliability of water supplies for current irrigators

2.2.1 *Work with irrigation districts and individual groundwater and surface water irrigators to improve the efficiency of the Basin’s surface water delivery systems and irrigation water use, when it is both feasible and beneficial to Nebraska’s Compact accounting balance*



The Upper Republican NRD, Middle Republican NRD, Lower Republican NRD, Tri-Basin NRD and NeDNR each made progress on this action item in 2019.

The Upper Republican NRD is facilitating the installation of telemetry units on flow meters throughout the district. These units will make farmers aware of their water usage in near real time. The data will help farmers align their water applications more closely with crop-water demands that are indicated by tools including soil-moisture probes and

Legend

Per basin-wide plan, this action item is to be completed:

When Appropriate	Annually	Annually When Appropriate	By This Year	Every Five Years

Progress during report year:

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					N/A

(see Figure 1 on page 5 for more detailed descriptions of each symbol)

evapotranspiration estimates. Upper Republican NRD also continues to work with the University of Nebraska and Nebraska Water Balance Alliance to acquire grant funding to pursue developing a mobile app that provides location-specific evapotranspiration data and forecasts based on satellite imagery, research-grade evaporation calculation tools, and weather forecasts. In addition, the NRD and the Water Sustainability Fund provided cost share for 110 soil moisture probes on approximately 14,000 acres in 2019.

The Middle Republican NRD has a telemetry meter project targeting the high depletion areas of the NRD. NeDNR supports this effort in the Rapid Response Area by reimbursing a portion of project costs via the Water Resources Cash Fund. The NRD is also continuing its High Tech Irrigation program that uses telemetry that includes soil moisture probes. The Middle Republican NRD also works with the Frenchman-Cambridge Irrigation District (FCID) on potential surface water management projects. Middle Republican NRD has also provided support for an FCID telemetry gate project.

The Lower Republican NRD has an agreement with Bostwick Irrigation District in Nebraska (NBID) that establishes water savings through the placement of automated gates in the Franklin Canal. This project is funded by NBID, the Lower Republican NRD, and the Water Sustainability Fund. The NRD has also provided a letter of support to the NeDNR to support an NBID project to increase the efficiency of water delivery to the Superior Canal.

Tri-Basin NRD’s Water Conservation Incentive Program (WCIP) incentivizes landowners to reduce irrigation water use through enrollment in a voluntary five-year allocation program. Additional details, including an overview of the program and the number of acres enrolled in 2019, can be found in Table 23 under “Conservation/Retirement Programs” on page 62. This project is also described under action item 2.2.2.

In 2019, NeDNR provided financial support for several of the NRDs’ projects, as noted in the preceding paragraphs. Also noted above, NeDNR worked with Lower Republican NRD and NBID in 2019 to develop ideas for a project to increase the efficiency of water delivery in the Superior Canal. NeDNR also provided a letter of support for the project. In addition, in 2019 NeDNR and the basin’s irrigation districts discussed potential projects that might be eligible to utilize funds from a 2018 settlement with Colorado. Negotiations were ongoing in 2019 on a contract with FCID that includes financial support for a gate

Legend

Per basin-wide plan, this action item is to be completed:					
When Appropriate	Annually	Annually When Appropriate	By This Year	Every Five Years	
					
Progress during report year:					
Completed Indefinitely	Completed	Ongoing Progress	Not Completed	Not Started	Not Applicable This Year
					N/A

(see Figure 1 on page 5 for more detailed descriptions of each symbol)

automation project in the Meeker-Driftwood canal system as well as conjunctive management aspects; the contract was finalized in early 2020.

2.2.2 *Participate in projects to improve the reliability, availability, and sustainability of water supplies in the Basin, which may include but are not limited to:*

- *Voluntary reduction of irrigated acres (temporary or permanent)*
- *Interbasin transfers*
- *Conjunctive management projects such as aquifer recharge or streamflow augmentation*



All four Republican River Basin NRDs participate in the Conservation Reserve Enhancement Program (CREP), which provides federal funding for the temporary removal of environmentally sensitive land from production. Three of the districts also have acres enrolled in the Agricultural Water Enhancement Program (AWEP). Summaries of acres enrolled in CREP and AWEP within each NRD can be found on pages 52, (Upper Republican NRD), page 56 (Middle Republican NRD), page 59 (Lower Republican NRD), and page 61 (Tri-Basin NRD).

The Upper Republican NRD has initiated a program to permanently retire irrigation on cropland where pumping has high impacts on streamflow. This program is expected to result in the retirement of approximately 3500 acres, with an average 50-year streamflow depletion factor of approximately 60%, and an average annual irrigation usage of 12" per acre. This program is funded by the Upper Republican NRD and the Water Resources Cash Fund, which is administered by NeDNR. Specific details about the number of contracts entered into with landowners and the number of acres retired in 2019 are reported under "Conservation/Retirement Programs" on page 55.

The Middle Republican NRD has a program to permanently retire irrigation on cropland. This program is funded by the Middle Republican NRD and the Water Resources Cash Fund, which is administered by NeDNR. Specific details about the number of contracts

Legend

Per basin-wide plan, this action item is to be completed:					
When Appropriate	Annually	Annually When Appropriate	By This Year	Every Five Years	
Progress during report year:					
Completed Indefinitely	Completed	Ongoing Progress	Not Completed	Not Started	Not Applicable This Year
					N/A

(see Figure 1 on page 5 for more detailed descriptions of each symbol)

entered into with landowners and the number of acres retired in 2019 are reported under “Conservation/Retirement Programs” on page 51.

The Lower Republican NRD established a retirement program through the Regional Conservation Partnership Program (RCPP) and the Water Resources Cash Fund, which is administered by NeDNR.

The Lower Republican NRD and Tri-Basin NRD have submitted an application to NeDNR for an interbasin transfer permit to divert excess flows from the Platte Basin to the Republican Basin as the Platte to Republican Basin High Flow Diversion (PRD) project. As filed it was proposed to always be junior in priority to existing and future Platte River water uses. The permitting process for this project is ongoing. Permitting aspects of this project are described under action item 2.1.3.

The Lower Republican NRD has agreements with NBID to use water stored in Harlan County Lake for Compact compliance. The stored water is a result of water savings derived from automated gates, which received a million dollars from the Lower Republican NRD. Additionally, the NRD provided a letter of support for the Superior Canal WaterSMART grant.

Some additional potential conjunctive management projects NeDNR and the NRDs were involved in with the basin’s irrigation districts are described under action item 2.2.1.

Obj. 2.3 Provide opportunities for collaboration among Basin’s water users

2.3.1 *Hold an annual public meeting to discuss Plan implementation and exchange information about the Basin*



Coordination efforts to prepare for the first basin-wide plan annual meeting were underway in 2019. That meeting was held in February 2020, which was within the first year of plan implementation.

Legend

Per basin-wide plan, this action item is to be completed:

When Appropriate	Annually	Annually When Appropriate	By This Year	Every Five Years

Progress during report year:

Completed Indefinitely	Completed	Ongoing Progress	Not Completed	Not Started	Not Applicable This Year
					N/A

(see Figure 1 on page 5 for more detailed descriptions of each symbol)

Another opportunity to exchange information about the Basin occurred during a basin-wide meeting that was held in November 2019, in fulfillment of the IMPs for the Upper Republican, Middle Republican, and Lower Republican NRDs.

2.3.2 *Work cooperatively to investigate and address conflicts between water users resulting from implementation of this Plan by following the procedures for addressing conflicts that are outlined in this Plan*



N/A

The Republican River NRDs and NeDNR intend to work cooperatively to investigate and address conflicts between water users resulting from implementation of the Basin-Wide Plan by following the procedures for addressing conflicts that are outlined in the Plan. In 2019, no conflicts resulting from implementation of the basin-wide plan were brought to the attention of NeDNR or the NRDs to address.

Obj. 2.4 Promote conservation programs available to the water users in the Basin

2.4.1 *Work together to identify, investigate, and discuss existing and potential new water conservation programs*



Throughout 2019, the Republican Basin NRDs and NeDNR discussed and shared information with each other about existing and potential new water conservation programs as new information became available or new questions were raised by one of the parties. For example, they discussed changes to the Conservation Reserve Enhancement Program (CREP) that resulted from the 2018 Farm Bill.

The Tri-Basin NRD launched its Water Conservation Incentive Program in 2018. The program has options for groundwater users (voluntary allocation) and commingled users (incentive to use canal water). Nearly 5000 acres were enrolled in the program and additional sign-up opportunities are planned. For additional information about this program, see "Conservation/Retirement Programs", page 61. In 2019, Tri-Basin NRD shared information about this program with the other NRDs and NeDNR.

Legend

Per basin-wide plan, this action item is to be completed:

When Appropriate	Annually	Annually When Appropriate	By This Year	Every Five Years
				

Progress during report year:

Completed Indefinitely	Completed	Ongoing Progress	Not Completed	Not Started	Not Applicable This Year
					N/A

(see Figure 1 on page 5 for more detailed descriptions of each symbol)

2.4.2 *Collaborate to promote conservation program opportunities to the Basin’s water users*



N/A

The Republican River Basin NRDs and NeDNR are open to opportunities to collaborate with neighboring NRDs, state and federal government agencies and constituents on programs and projects that promote and incentivize water conservation. The NRDs and NeDNR did not collaborate with each other to jointly promote conservation program opportunities in 2019.

Obj. 2.5 Understand how various water management activities of independent decision-makers affect water supplies

2.5.1 *Study the effects of conservation practices on streamflow, if feasible*



N/A

This action item is to be completed by 2028, when and if funding and staff resources allow. NeDNR and the NRDs have some analytical tools available to them to assist with studies of the effects of conservation practices on streamflow, as described below.

The Lower Republican NRD will study the effects of conservation practices on streamflow through the Lower Republican NRD Management Action Opportunity (MAO) model. The RRCA model is run to determine the quantitative effect of a proposed land use change through the MAO model.

The Tri-Basin NRD has the most extensive groundwater level monitoring network in Nebraska. Groundwater level data is critical to accurately determining impacts of groundwater pumping on streamflows. Data are shared with state and federal agencies and made available to the public.

NeDNR uses the Republican River Compact Administration model to estimate stream depletions resulting from groundwater pumping, stream accretions resulting from recharge projects, and other parameters.

Legend

Per basin-wide plan, this action item is to be completed:

When Appropriate	Annually	Annually When Appropriate	By This Year	Every Five Years

Progress during report year:

Completed Indefinitely	Completed	Ongoing Progress	Not Completed	Not Started	Not Applicable This Year
					N/A

(see Figure 1 on page 5 for more detailed descriptions of each symbol)

2.5.2 *As part of each five-year technical analysis, analyze the future impacts to streamflow of past pumping to determine the lag time of these residual impacts*



N/A

Following the schedule in the basin-wide plan, NeDNR and the Republican Basin NRDs will carry out the first five-year technical analysis in 2023 and repeat it every five years thereafter for the duration of the plan implementation time frame.

2.5.3 *Examine and attempt to estimate the quantity of all inputs and outputs affecting the water supply balance in a small watershed, and consider using the results of this pilot study to create water use and land use guidelines for producers and other land managers, incentivize participation in recommended practices, and determine the value of completing similar studies across the Basin*



This action item is to be completed by 2028.

In 2019, the Upper Republican NRD partnered with the University of Nebraska Water for Food Institute and Nebraska Water Balance Alliance on a grant application to the USDA's Natural Resources Conservation Service to conduct a water balance study within the HUC-12 watershed of Perkins County. The 2019 grant was not approved; however, the partner groups plan to pursue other grant funding in the future. NeDNR also participated in informational discussions with the research team for this project.

The Middle Republican NRD has a Water Sustainability Grant looking at using airborne electromagnetic (AEM) technology to model water supply balance in the western portion of the Middle Republican NRD.

The Lower Republican NRD will examine the effort required to complete action item 2.5.3 in the coming years. Tri-Basin NRD is willing to consider opportunities to examine water use within sub-watersheds that originate within or flow through the district.

Legend

Per basin-wide plan, this action item is to be completed:					
When Appropriate	Annually	Annually When Appropriate	By This Year	Every Five Years	
Progress during report year:					
Completed Indefinitely	Completed	Ongoing Progress	Not Completed	Not Started	Not Applicable This Year
					N/A

(see Figure 1 on page 5 for more detailed descriptions of each symbol)

Obj. 2.6 Evaluate the feasibility and potential outcomes of establishing water markets in the Basin

2.6.1 *Cooperate in determining the feasibility of water markets in the Basin*



N/A

This action item is to be completed by 2023. Two large action items from the plan are scheduled to be completed by 2023: this feasibility study and the drought planning exercise described in Action Item 2.8.1, and it was not feasible in 2019 to begin both projects. At this time, NeDNR and the NRDs have been focusing efforts on the drought planning exercise.

2.6.2 *Following the water markets feasibility analysis (Action Item 2.6.1), test conclusions through implementation of a water market program in a pilot area, if feasible*



N/A

As stated in the basin-wide plan, this action item is contingent upon the findings from the feasibility study in Action Item 2.6.1. If the evaluation in Action Item 2.6.1 indicates that water markets in the Basin would be feasible, and if sufficient funding and staff resources are available to do so, then NeDNR and the NRDs will work cooperatively with the US Bureau of Reclamation, the Basin’s irrigation districts, and water users in the Basin to conduct a water market pilot program within a portion of the Basin by 2028.

Obj. 2.7 Support the NRDs in management of allocations for irrigation purposes and surface water irrigation districts in management of the allotment of their water supply

2.7.1 *Periodically evaluate, as part of each five-year technical analysis, the impact of the groundwater allocation and surface water allotment systems as a whole*



N/A

Legend

Per basin-wide plan, this action item is to be completed:

When Appropriate



Annually



Annually When Appropriate



By This Year



Every Five Years



Progress during report year:

Completed Indefinitely



Completed



Ongoing Progress



Not Completed



Not Started



Not Applicable This Year

N/A

(see Figure 1 on page 5 for more detailed descriptions of each symbol)

Following the schedule in the basin-wide plan, NeDNR and the Republican Basin NRDs will carry out the first five-year technical analysis in 2023 and repeat it every five years thereafter for the duration of the plan implementation time frame.

The NRDs individually review pumping and allocations on a regular basis to comply with the IMPs and groundwater management plans while balancing the allocations so as not to restrict the economic vitality of the NRD or the region, as is consistent with the mission of the *Republican River Basin-Wide Plan*.

Tri-Basin NRD has only one township in the Republican Basin that is subject to allocation. This allocation was imposed to protect groundwater levels in the local area from diminishment. The allocation requirement is tied to local groundwater levels. If a three-year average of groundwater levels rises above the 1981–1985 average springtime levels for that township, the allocation will be suspended. The other three NRDs have allocations district-wide.

2.7.2 *As needed, based on the evaluation described in Action Item 2.7.1, recommend changes or improvements to the groundwater allocation and/or surface water allotment systems*



N/A

Following the schedule in the basin-wide plan, NeDNR and the Republican Basin NRDs will carry out this action item by the year following each iteration of Action Item 2.7.1. Therefore, this action will be completed for the first time by 2024 and then repeated every five years thereafter for the duration of the plan implementation timeframe.

Obj. 2.8 Conserve water for future use during a drought

2.8.1 *Organize and participate in a Basin-wide drought planning exercise*



This action item is to be completed by 2023.

Legend

Per basin-wide plan, this action item is to be completed:

When Appropriate	Annually	Annually When Appropriate	By This Year	Every Five Years
				

Progress during report year:

Completed Indefinitely	Completed	Ongoing Progress	Not Completed	Not Started	Not Applicable This Year
					N/A

(see Figure 1 on page 5 for more detailed descriptions of each symbol)

In 2019 the four NRDs and NeDNR agreed to partner with the University of Nebraska-Lincoln to hire a Graduate Research Assistant to conduct a basin-wide drought planning exercise. The NRDs and NeDNR have agreed to share the cost of hiring the graduate student, with NeDNR responsible for 50% and the NRDs collectively responsible for the other 50%. The assistantship is expected to continue through May 2022.

In addition to participating in the basin-wide drought planning exercise, the Lower Republican NRD is interested in pursuing a plan to reserve flood water for irrigation use within existing structures, which would be beneficial for water supplies during drought periods. Many reservoirs in the US Army Corps of Engineers Kansas City District have Lake management plans that allow additional water to be held back above conservation pools. Additionally, regulatory changes that allow for the modification or change in a reservoir operating plan allowing flood water retention above current levels would conserve water for future use.

Tri-Basin NRD and Central Nebraska Public Power and Irrigation District are also in the early stages of developing a drought management and mitigation plan for the entire NRD.

2.8.2 *Following the drought planning exercise (Action Item 2.8.1) evaluate whether to recommend any changes to the IMPs or this Plan related to conservation of water for future use during a drought*



N/A

This action item will be completed by the year following completion of the drought planning exercise, and no later than 2024.

In addition to participating in the basin-wide drought plan, the Tri-Basin NRD and Central Nebraska Public Power and Irrigation District are in the early stages of developing a drought management and mitigation plan for the entire NRD. Once these efforts are complete an evaluation of recommended changes to Tri-Basin NRD's IMP or the basin-wide plan will be considered.

Legend

Per basin-wide plan, this action item is to be completed:					
When Appropriate	Annually	Annually When Appropriate	By This Year	Every Five Years	
Progress during report year:					
Completed Indefinitely	Completed	Ongoing Progress	Not Completed	Not Started	Not Applicable This Year
					N/A

(see Figure 1 on page 5 for more detailed descriptions of each symbol)

Goal 3 Positive public relations, including information sharing, within and outside the Basin

Obj. 3.1 Improve information sharing with decision-makers and public about solutions within the Basin

3.1.1 *Use existing resources to share information about Basin progress and activities with outside entities*



The Republican River Basin NRDs and NeDNR use existing information dissemination resources such as newsletters, radio programs, public meetings, websites, social media, and education/outreach events. Some of these resources were used in 2019 to share information about Basin progress and activities with outside entities. Examples are described under Action Item 3.1.2 and 3.1.3.

3.1.2 *Educate civic leaders and the public on implementation efforts within the Basin*



NeDNR and the Republican Basin NRDs participated in education and outreach about plan implementation efforts in 2019. The basin-wide plan identifies some examples of potential outreach topics related to this objective as efficiency improvements, the NRDs' allocation systems and resulting successes, other management activities and successes, factors that have contributed to streamflow reduction in the Basin, variations in groundwater management that reflect natural wet/dry cycles, realistic expectations for outcomes of projects and policy changes. The following paragraphs provide specific examples of 2019 education and outreach activities related to implementation efforts within the basin.

NeDNR hosts a website about the Republican River Basin-Wide Plan that was originally used to convey information about plan development (<http://rrbwp.nebraska.gov>). In 2019, NeDNR and the Republican Basin NRDs redesigned and redeveloped the website as a tool for conveying information about basin-wide plan implementation. The redesigned website includes background information about the plan and plan implementation resources such as data, annual meeting materials, and annual reports. Plan development meeting materials are still available on the website, too.

Legend

Per basin-wide plan, this action item is to be completed:					
When Appropriate	Annually	Annually When Appropriate	By This Year	Every Five Years	
Progress during report year:					
Completed Indefinitely	Completed	Ongoing Progress	Not Completed	Not Started	Not Applicable This Year
					N/A

(see Figure 1 on page 5 for more detailed descriptions of each symbol)

The Upper Republican NRD shared information about water management and progress within the Republican Basin with outside entities including the University of Washington, an association of irrigation-related organizations and individuals in New Zealand, and the University of Nebraska Water for Food Institute, among others.

Lower Republican NRD and Tri-Basin NRD co-hosted the South-Central Nebraska Water Conference with the Central Nebraska Public Power and Irrigation District (CNPPID) to inform the public on the happenings of the water world within South Central Nebraska. Middle Republican NRD participated in the McCook Farm and Ranch Show in November.

All four NRDs produce newsletters for the public containing information about their activities, including water management activities in the Republican Basin. NeDNR also produces a newsletter, but NeDNR’s newsletter did not include any Republican Basin-specific articles in 2019. The Lower Republican NRD also provides articles and radio publications on a regular basis to keep constituents informed.

3.1.3 *Educate civic leaders and the public about the policies and institutional infrastructure that contribute to the development and implementation of solutions*



NeDNR and the Republican Basin NRDs participated in education and outreach about policies and institutional infrastructure in 2019. The basin-wide plan identifies some examples of potential outreach topics related to this objective as correlative groundwater rights; integrated management plans; the Republican River Basin-Wide Plan; the Republican River Compact; other aspects of Nebraska’s surface water and groundwater statutes; and other NRD rules, regulations, and plans. The following paragraphs provide specific examples of 2019 education and outreach activities related to the policies and institutional infrastructure that contribute to the development and implementation of solutions.

The NRDs and NeDNR communicate regularly with their legislative representatives and other state senators, as needed. They work to educate civic leaders and the public about the policies and institutional infrastructure that contribute to the development and implementation of solutions, through public outreach such as articles, conferences, and radio news briefs. All four NRDs and NeDNR produce newsletters for the public containing

Legend

Per basin-wide plan, this action item is to be completed:					
When Appropriate	Annually	Annually When Appropriate	By This Year	Every Five Years	
Progress during report year:					
Completed Indefinitely	Completed	Ongoing Progress	Not Completed	Not Started	Not Applicable This Year
					N/A

(see Figure 1 on page 5 for more detailed descriptions of each symbol)

information about their activities, some of which included articles about policies and institutional infrastructure in 2019.

NeDNR hosted an American Water Resources Association specialty conference in Omaha in 2019 entitled *Setting Conditions for Success in Integrated Water Resources Management*. One of the presentations given by NeDNR staff at the conference was “From Litigation to Cooperation: The Changing World of the Republican River Basin.” This presentation highlighted examples of projects resulting from efforts in recent years by the basin’s interstate and intrastate partners to work collaboratively toward shared water management objectives, including the Republican River Compact and basin-wide plan development and implementation.

At the same conference, NeDNR staff gave multiple presentations about various aspects of the integrated management planning processes and legislation. Following the conference, NeDNR staff were invited to publish an article entitled “Legislation Supporting IWRM in Nebraska” in the American Water Resource Association’s magazine, *Impact*. NeDNR also shared information about the integrated management planning process at several other events in the state throughout the year, including at the Nebraska Women in Agriculture Conference, the South-Central Nebraska Water Conference, a seminar at the University of Nebraska-Lincoln, and multiple water conferences hosted by the Nebraska Association of Resources Districts.

NeDNR and colleagues from Kansas and Colorado maintain a website with information about the Republican River Compact (<http://republicanriver.org/>), which includes background information about the Republican River Compact Administration (RRCA), annual reports, and other RRCA meeting materials. The Upper Republican NRD website is updated with Compact developments and provides a layman’s explanation of the Compact and compliance efforts. Both Upper Republican NRD and NeDNR’s websites include links to the Compact, the Final Settlement Stipulation, and other important Compact-related documents.

NeDNR and the NRDs also addressed these topics in 2019 at some of the other outreach events described under action item 3.1.2.

Legend

Per basin-wide plan, this action item is to be completed:					
When Appropriate	Annually	Annually When Appropriate	By This Year	Every Five Years	
					
Progress during report year:					
Completed Indefinitely	Completed	Ongoing Progress	Not Completed	Not Started	Not Applicable This Year
					N/A

(see Figure 1 on page 5 for more detailed descriptions of each symbol)

3.1.4 *Propose and support changes to laws, policies, and rules that would incentivize reduced water consumption*



N/A

In 2019 there were no proposed changes to laws, policies, and rules that would incentivize reduced water consumption within the Basin. NeDNR and the Republican River Basin NRDs are committed to evaluating all proposals that offer incentives to reduce groundwater use, with the intention of supporting any changes that do not reduce the economic vitality of the region in accordance with the mission of the Basin-Wide Plan.

Obj. 3.2 Improve information sharing with water users who are reliant on the Basin’s water supplies

3.2.1 *Share data and information related to the Republican River Compact with the public in an easily accessible, user-friendly format*



All four NRDs and NeDNR exchange water use and groundwater level data annually for Republican River Compact Administration (RRCA) accounting purposes. RRCA annual reports and final RRCA accounting data are available at <http://republicanriver.org/>, and RRCA groundwater model information is available at the RRCA’s data site, <https://www.republicanrivercompact.org/>. Information about the Republican River Compact is also available on NeDNR’s website and the Upper Republican NRD’s website.

In the first year of basin-wide plan implementation, NeDNR and the NRDs worked to make some data from the RRCA annual accounting and groundwater model more easily accessible and user-friendly by including some data from these sources in *First Annual Report for the Republican River Basin-Wide Plan: Data and Progress Updates, 2014–2018*, which was developed beginning in 2019 and published in February 2020. In this current report, RRCA data can be found in several of the tables and charts throughout the “Water Supplies and Uses in the Basin” section, which begins on page 48.

Legend

Per basin-wide plan, this action item is to be completed:

When Appropriate	Annually	Annually When Appropriate	By This Year	Every Five Years

Progress during report year:

Completed Indefinitely	Completed	Ongoing Progress	Not Completed	Not Started	Not Applicable This Year
					N/A

(see Figure 1 on page 5 for more detailed descriptions of each symbol)

3.2.2 *Annually prepare and exchange reports containing data and information about water supplies and uses in the Basin, and make these reports publicly accessible*



All four NRDs and NeDNR share data and information about water supplies and uses in the basin as part of the annual report for the basin-wide plan. This information is shared with the public at the basin-wide plan’s annual meeting and through the *Republican River Basin-Wide Plan* website (<http://rrbwp.nebraska.gov>). In 2019, NeDNR and the NRDs worked to develop the first annual report, which was published in February 2020.

Tri-Basin NRD and NeDNR also exchange information about water supplies in uses annually in fulfillment of the IMP for the Republican Basin portions of Tri-Basin NRD. These reports can be downloaded from the NeDNR website (<https://dnr.nebraska.gov>).

3.2.3 *Regularly communicate with the Plan’s former Stakeholder Advisory Committee about implementation progress and potential Plan revisions*



All four NRDs and NeDNR work to keep former Stakeholder Advisory Committee members informed about implementation progress and potential plan revisions. This information is primarily shared at the annual meeting for the basin-wide plan.

Information about plan implementation is also shared via email through a GovDelivery contact list for people interested in receiving updates about the basin-wide plan. NeDNR created this contact list in 2019. All stakeholders from the plan development process were added to the list in 2019. One former stakeholder does not have an email account, so printed copies of updates posted to the GovDelivery list are mailed to that individual.

3.2.4 *Encourage and support water users to share information about their management practice improvements with other water users and the public*



All four NRDs and NeDNR encourage and support water users to share information about their management practice improvements with other water users and the public. In 2019, Tri-Basin NRD worked with researchers from the University of Nebraska-Lincoln (UNL) to

Legend

Per basin-wide plan, this action item is to be completed:					
When Appropriate	Annually	Annually When Appropriate	By This Year	Every Five Years	
Progress during report year:					
Completed Indefinitely	Completed	Ongoing Progress	Not Completed	Not Started	Not Applicable This Year
					N/A

(see Figure 1 on page 5 for more detailed descriptions of each symbol)

help irrigators improve water use efficiency. Middle Republican NRD held meetings with water users to introduce high tech irrigation programs. NeDNR and the NRDs also supported and participated in UNL’s TAPS program, which is an annual competition that provides teams from all over the state with an opportunity to learn from each other about irrigation water management practices and other aspects of crop production. A substantial portion of past TAPS award winners has been from the Republican River Basin.

Legend

Per basin-wide plan, this action item is to be completed:					
When Appropriate	Annually	Annually When Appropriate	By This Year	Every Five Years	
					
Progress during report year:					
Completed Indefinitely	Completed	Ongoing Progress	Not Completed	Not Started	Not Applicable This Year
					N/A

(see Figure 1 on page 5 for more detailed descriptions of each symbol)

Goal 4 When possible, pursue projects that not only benefit water supplies and uses, but also create benefits for fish, wildlife, recreation and conveyance within the Republican River Basin

Obj. 4.1 Where feasible and beneficial, protect and enhance fish and wildlife habitat and public outdoor recreational opportunities

4.1.1 *Partner with wildlife-focused organizations on projects that benefit the organizations' habitat and wildlife interests while also helping to fulfill other goals of this Plan*



The Republican Basin NRDs continued to partner with wildlife-focused organizations on projects to benefit habitat and wildlife interests in the Basin in 2019. Middle Republican NRD partnered with Pheasants Forever to promote habitat restoration through wildlife plantings, Lower Republican NRD continues to support the Nebraska Game and Parks Commission (NGPC) through the lease of office space, and Tri-Basin NRD worked with the Central Nebraska Public Power and Irrigation District (CNPPID) to deliver excess Platte River flows to USFWS wetlands to enhance habitat for migratory waterfowl and other wildlife and provide groundwater recharge that benefits both the Platte and Republican basins. The NRDs also provide support to the Twin Valley Weed Management and Southwest Weed Management Districts for the removal of invasive vegetation throughout the Basin, as described under Action Items 4.1.3 and 4.2.1.

4.1.2 *Promote public recreation on the river, when doing so can also help to fulfill other goals of the Plan*



Lower Republican NRD supports NGPC through lease of office space. Through the Lower Republican NRD office, the NGPC provides public information regarding public recreation on the River and open lands within the Basin.

Legend

Per basin-wide plan, this action item is to be completed:					
When Appropriate	Annually	Annually When Appropriate	By This Year	Every Five Years	
Progress during report year:					
Completed Indefinitely	Completed	Ongoing Progress	Not Completed	Not Started	Not Applicable This Year
					N/A

(see Figure 1 on page 5 for more detailed descriptions of each symbol)

4.1.3 *Cooperate in projects to assess and restore riparian wetlands while also helping to fulfill other goals of the Plan*



The NRDs provide financial support to weed management districts for the removal of invasive vegetation and noxious weeds throughout the Basin, including for restoration of riparian wetlands. Upper Republican NRD and Middle Republican NRD financially support the Southwest Weed Management District. Lower Republican NRD and Tri-Basin NRD financially support the Twin Valley Weed Management District. The NRDs have also worked with the weed management districts on projects across the basin to restore riparian areas.

In 2019, Upper Republican NRD and Middle Republican NRD helped in the reorganization of Southwest Weed Management District to improve oversight of the group and assure that it was achieving its mission. The district is on solid financial footing, has good board oversight, and has worked on projects across the basin to restore riparian areas.

Obj. 4.2 Where feasible and beneficial, reduce the effects of undesirable vegetation on water conveyance

4.2.1 *Cooperate in removing undesirable vegetation impacting water conveyance and managing reinfestation*



As described under Action Item 4.1.3, the NRDs provide financial support to the Southwest and Twin Valley Weed management districts for the removal of invasive vegetation and noxious weeds throughout the Basin. Upper Republican NRD also made landowners in the district aware of vegetation removal services the weed management districts provide and helped established plans for future vegetation removal.

Legend

Per basin-wide plan, this action item is to be completed:

When Appropriate	Annually	Annually When Appropriate	By This Year	Every Five Years

Progress during report year:

Completed Indefinitely	Completed	Ongoing Progress	Not Completed	Not Started	Not Applicable This Year
					N/A

(see Figure 1 on page 5 for more detailed descriptions of each symbol)

Assessment of Measurable Hydrologic Objectives (MHOs)

Under *Neb. Rev. Stat. § 46-755 (4)(b)*, this basin-wide plan is required to include measurable hydrologic objectives (MHOs) to ensure that reasonable progress is being made toward achieving the goals and objectives of the plan. The basin-wide plan includes five MHOs, which will each be evaluated either annually or every five years, as specified in the basin-wide plan. The MHOs and their assessment schedules are summarized in Table 5. Results of the MHO evaluations are described beginning on page 40.

In the table summarizing the results of each MHO, possible results of the assessment are described, including whether the results indicate that further discussion is required or not. If a result indicates that discussion of next steps is required, this means that NeDNR and the NRDs will discuss the test results and determine what actions will be taken to achieve the MHO in the future, as described in the basin-wide plan.

Table 5. Measurable Hydrologic Objectives (MHOs) agreed to during plan development and adoption. During plan implementation, each MHO is to be evaluated either annually or every 5 years, as specified in the basin-wide plan.

Measurable Hydrologic Objective (MHO)	Evaluation Frequency
MHO A: Maintain each NRD’s net groundwater depletions to streamflow within its portion of Nebraska’s allowable groundwater depletions to streamflow	Annually
MHO B: Limit groundwater depletions to streamflow to a relatively constant level over the long-term both across the basin as a whole and within each NRD	Every 5 years, beginning in 2023
MHO C: Ensure there is always enough groundwater for all groundwater uses within the timeframe of this plan, either by stabilizing groundwater levels or managing declining groundwater levels	Every 5 years, beginning in 2023
MHO D: Continue existing and initiate new actions that reduce the need for special regulations in the Rapid Response Area for Compact compliance	Annually
MHO E: Continue existing and initiate new actions that reduce the need for administration of surface water use for Compact compliance	Annually

MHO A Evaluation

MHO A Assessment Criteria

MHO A is to maintain each NRD’s net groundwater depletions to streamflow within its portion of Nebraska’s allowable depletions to streamflow. For the purposes of MHO A, “net groundwater depletions to streamflow” includes augmentation and other management actions.

The basin-wide plan defines the MHO A assessment as follows: for the previous Compact averaging period (2 or 5 years, as determined by Compact accounting procedures), has each NRD’s net groundwater depletions to streamflow for the RRCA model area remained within its portion of Nebraska’s allowable groundwater depletions to streamflow, as specified in the IMPs? This MHO is being achieved if the answer to that question is yes for each NRD. The results of this assessment are described in the next subsection.

Note the MHO A assessment as described above applies only to the Upper Republican, Middle Republican, and Lower Republican NRDs, because these are the three NRDs that receive a portion of Nebraska’s allowable groundwater depletions to streamflow under the terms of their IMPs. The equivalent test from the IMP for the Republican Basin portion of Tri-Basin NRD is the hydrologically balanced assessment, which evaluates whether Tri-Basin NRD’s depletions from groundwater pumping exceeded accretions from the groundwater mound caused by seepage from Platte River canals within in the district, when calculated on a three-year rolling average basis. The results from that analysis are included below, beginning on page 41.

MHO A Evaluation Results for 2019

MHO A evaluation results are summarized in Table 6. For 2019, MHO A is being achieved for Upper Republican, Middle Republican, and Lower Republican NRDs. Each NRD’s groundwater net depletions to streamflow remained within its portion of Nebraska’s allowable depletions to streamflow, as specified in the IMPs. The evaluation and results for each NRD are described below the summary table.

Table 6. Summary of MHO A results for 2019.

Key to Possible Test Results	 MHO is being achieved. NRD’s actual depletions were within its allowable depletions. No further discussion is needed.		
	 MHO is not being achieved. NRD’s actual depletions exceeded its allowable depletions. Discussion of next steps is required.		
NRD	Upper Republican	Middle Republican	Lower Republican
NRD’s Results for 2019			

According to the Compact accounting procedures, the averaging period applicable to 2019 is five-year averaging corresponding to a “Normal Year” in the integrated management plans.

Allowable groundwater depletions to streamflow for each NRD are defined in the current integrated management plans between each NRD and NeDNR, Section VII.B.2.c, as:

*(Nebraska Allocation + IWS – SWCBCU_{NE} – Other NRD CBCU) * NRD's Normal-Year Baseline Depletion Percentage*

where

Nebraska Allocation = Nebraska's available water supply under the Compact

IWS = Imported Water Supply credit

SWCBCU_{NE} = The surface water consumptive use by Nebraska, includes net evaporative losses

Other NRD CBCU = The groundwater consumptive use of streamflow calculated for the South Platte NRD, Twin Platte NRD, Tri-Basin NRD, Central Platte NRD, and Little Blue NRD

To include all NRD management actions in the analysis, allowable groundwater depletions were adjusted by the difference between Nebraska Resolution Water Supply (NERWS) Credit under the Compact and the NRD's management actions, which may be different in instances such as annual crediting for permanent surface water retirements and the timing of the calculations outlined in RRCA procedures.

Each NRD's groundwater depletions to streamflow is calculated using the RRCA ground water model. An NRD's net depletions are the sum of groundwater depletions and the impacts to Nebraska's Compact balance from management actions taken.

Altogether, the difference between an NRD's allowable groundwater depletions to streamflow and the NRD's groundwater net depletions to streamflow is calculated as:

*(Nebraska Allocation + IWS – SWCBCU_{NE} – Other NRD CBCU – All NRD management Actions + NERWS Credit) * NRD's Normal-Year Baseline Depletion Percentage – NRD Actual Groundwater Depletions + NRD Management Actions*

The results of the five-year average evaluation for MHO A for 2019 for each NRD are shown in Table 7. Two-year averaging was not evaluated this year as part of MHO A because, under RRCA Accounting Procedures, two-year averaging does not apply for 2019.

Table 7. MHO A evaluation results for 2019, with five-year averaging. Positive values indicate that allowable groundwater depletions to streamflow exceeded actual groundwater net depletions to streamflow. The five-year averaging period for MHO A is evaluated based on the average of the evaluation year (2019) and the previous four years, in conformance with RRCA Accounting Procedures.

Year	Difference between allowable depletions an actual groundwater net depletions (acre-feet)		
	Lower Republican NRD	Middle Republican NRD	Upper Republican NRD
2015	-4,926	6,470	14,956
2016	8,676	9,724	5,175
2017	3,862	14,687	17,291
2018	540	-1,919	2,922
2019	40,262	46,951	65,758
5-year average (2015–2019)	9,683	15,183	21,220
5-year average positive?	Yes	Yes	Yes

Tri-Basin NRD Hydrologically Balanced Assessment Results for 2019

The hydrologically balanced assessment from the IMP for the Republican Basin portion of Tri-Basin NRD evaluates whether Tri-Basin NRD’s depletions from groundwater pumping and accretions from the mound are hydrologically balanced when calculated on a three-year rolling average basis. This assessment is performed by NeDNR each fall, following finalization of RRCA data for the prior calendar year.

Hydrologically balanced assessment results for 2019 are summarized in Table 8. The analysis and results are explained below the summary table.

Table 8. Summary of results of hydrologically balanced assessment for Tri-Basin NRD for 2019.

<p>Key to Possible Test Results</p>	<p> In compliance with IMP. On a three-year rolling average basis, depletions from groundwater pumping did not exceed accretions from the mound. Also, sufficient management actions were taken in 2019 to offset net depletions from previous year’s test, if any. No further discussion is needed.</p> <p> Caution. On a three-year rolling average basis, depletions from groundwater pumping exceeded accretions from the mound. Under the terms of the IMP, management actions are required to maintain a hydrologically balanced condition. Discussion of next steps is required.</p> <p> Insufficient management actions were taken in 2019 to offset net depletions from previous year’s assessment. Discussion of next steps is required.</p>
<p>Tri-Basin NRD’s Results for 2019</p>	<p></p>

Full details of the hydrologically balanced assessment for 2019 are included in NeDNR’s report for the IMP for the Republican Basin portion of Tri-Basin NRD, entitled *2020 Annual Report of 2019 Data by the Nebraska Department of Natural Resources to Meet the Requirements of the Integrated Management Plan for Those Portions of the Tri-Basin Natural Resources District within the Republican River Basin* (November 9, 2020). The three-year average net effect is positive for 2019 (Figure 2), meaning that mound accretions exceeded groundwater depletions from pumping on a three-year average basis; therefore, no offsets are required in the future as a result of the 2019 test. In addition, no management actions were required to be taken by Tri-Basin NRD in 2019 to offset the results of a previous year’s test.

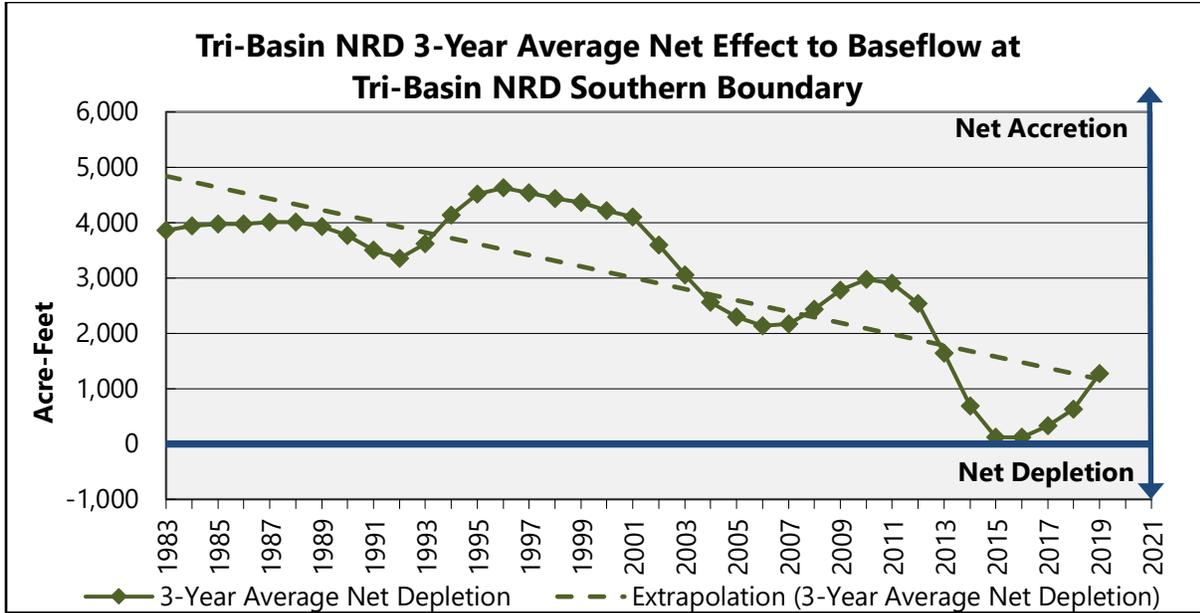


Figure 2. Rolling three-year average net effect to baseflow as the total of modeled values of streamflow depletion and mound accretions, using the August 2020 RRCA Accounting Procedures and the RRCA groundwater model.

MHO B Evaluation

MHO B is evaluated every five years as part of the basin-wide plan’s five-year technical review. No MHO B evaluation is required this year.

MHO C Evaluation

MHO C is evaluated every five years as part of the basin-wide plan’s five-year technical review. No MHO C evaluation is required this year.

MHO D Evaluation

MHO D Assessment Criteria

MHO D is to continue existing and initiate new actions that reduce the need for special regulations in the Rapid Response Area for Compact compliance.

The basin-wide plan defines the MHO D assessment as follows: during the previous year, has groundwater pumping within the Rapid Response Area of any NRD been curtailed to ensure Compact compliance? This MHO is being achieved if the answer to that question is no for each NRD. The results of this assessment are described in the next subsection.

Note that this assessment only applies to the Upper Republican, Middle Republican, and Lower Republican NRDs. The IMPs for those NRDs state that in Compact Call Years, if management actions taken by the NRD are insufficient to ensure compliance, the NRD will implement additional ground water controls and regulations to make up for any expected shortfall, which

will include curtailment of groundwater pumping within the Rapid Response Area (10 Percent/5-Year Area) of the NRD. The purpose of this MHO is to ascertain whether such curtailment occurred.

MHO D Evaluation Results for 2019

MHO D evaluation results are summarized in Table 9. For 2019, MHO D is being achieved for Upper Republican, Middle Republican, and Lower Republican NRDs, as none of the NRDs curtailed pumping within the Rapid Response Area in 2019 to ensure Compact Compliance.

Table 9. Summary of MHO D results for 2019.

Key to Possible Test Results	 MHO is being achieved. NRD did not curtail groundwater pumping within the Rapid Response Area to ensure Compact compliance. No further discussion needed.		
	 MHO is not being achieved. NRD curtailed groundwater pumping within the Rapid Response Area to ensure Compact Compliance. Discussion of next steps is required.		
NRD	Upper Republican	Middle Republican	Lower Republican
NRD's Results for 2019			

MHO E Evaluation

MHO E Assessment Criteria

MHO E is to continue existing and initiate new actions that reduce the need for administration of surface water use for Compact compliance.

The basin-wide plan defines the MHO E assessment as follows: During the previous year, has surface water use within the basin been administered to reduce surface water use to ensure Compact compliance? This MHO is being achieved if the answer to that question is no. The results of this assessment are described in the next subsection.

Note that for the purposes of MHO E, only surface water administration that occurs to fulfill Nebraska's Compact obligations as described in the IMPs for the Upper Republican, Middle Republican, and Lower Republican NRDs is included. Surface water administration that is required by the terms of the Final Settlement Stipulation (FSS) is excluded from MHO E. For more information, see "Surface Water Administration for Compact Compliance," page 71.

MHO E Evaluation Results for 2019

MHO E evaluation results are summarized in Table 10. For 2019, MHO E is being achieved, as surface water use within the basin has not been administered for Compact Compliance. For further details, see “Surface Water Administration for Compact Compliance,” page 71.

Table 10. Summary of MHO E results for 2019.

<p>Key to Possible Test Results</p>	<p> MHO is being achieved. NeDNR did not administer surface water to ensure Compact compliance, except as required under the Final Settlement Stipulation (FSS). No further discussion needed.</p> <p> MHO is not being achieved. NeDNR administered surface water to ensure Compact Compliance. Discussion of next steps is required.</p>
<p>Results for 2019</p>	<p></p>

Water Supplies and Uses in the Basin

In accordance with the requirements of *Neb. Rev. Stat. §§ 46-755 (5)(a) and 46-755 (5)(b)*, the basin-wide plan contains a monitoring plan, which includes a process to gather and evaluate data, information, and methodologies to increase understanding of the surface water and hydrologically connected groundwater system with the basin and to test the validity of the conclusions, information, and assumptions upon which the plan is based.

One component of the monitoring plan is a list of data on water supplies and uses in the Republican River Basin that will be reported annually by NeDNR and the NRDs (Table 3.1 of the basin-wide plan). As stated in the basin-wide plan’s Monitoring section, it will take time for NeDNR and the NRDs to prepare each category of data for distribution; some of the listed data are readily available within existing data sets, while others will take significantly longer for methodology development. As a result, NeDNR and the NRDs will gradually increase the number of data items that will be reported on each year as they are able. In addition, as also noted in the plan, the list of data reported is subject to change as data needs and resources change over time.

This annual report contains data for the year 2019. The following data are included in this annual report:

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Upper Republican Natural Resources District

Current Allocations

Upper Republican NRD’s allocations and related rules for the 2018–2022 allocation period are summarized in Table 11. In this context, an allocation is a regulatory measure that stipulates the amount of water available to be used for irrigation.

Table 11. Summary of current allocation for groundwater irrigation use in the Upper Republican NRD, 2018–2022 allocation period.

Total Allocation	65 Inches/Acre/5 Years
Annual or Base Allocation	Allocation is over 5 Years, not annual
Maximum Annual Use	65 Inches/Acre
Carry over amount that can be used in the following allocation period	7.5 Inches/Acre (Max)
Hard Cap	None
Pooling allowed?	Yes
How are the allocations affected by surface water use?	Allocations are not affected by surface water use. Irrigators may use their full groundwater allocation, regardless of any surface water use.
Special allocations for designated groundwater management areas? Or subbasins?	None
Rapid Response Area Allocations?	Not unless augmentation projects are insufficient to meet Republican River Compact obligations will Rapid Response Area allocations be needed. Rapid Response Area allocations would depend upon projected Compact shortfalls.
Penalty for exceeding allocation	For every inch of excess use, 2 inches of allocation lost for next allocation period.
Penalty for exceeding carry over	2 inches carry-over deducted for every inch of carry-over used above 7.5 inches

Annual Groundwater Use for Irrigation

Annual groundwater use for irrigation in Upper Republican NRD, for 2019, is summarized in Table 12. This summary includes:

- The total number of certified acres within the district. For the purposes of this report, certified acres are acres certified by the NRD to be allowed to be irrigated with groundwater.
- The total number of effective acres within the district. For the purposes of this report, effective acres are acres where groundwater irrigation was possible (i.e., certified acres minus acres enrolled in a conservation program prohibiting irrigation).
- The total volume of groundwater pumped for irrigation within the district.
- The average depth of water applied for irrigation on effective acres within the district.

Table 12. Annual groundwater use for irrigation in Upper Republican NRD, 2019. The difference between certified and effective acres is described in the body of the report.

Year	Certified Acres	Effective Acres	Volume Pumped (acre-feet)	Average Depth (inches/effective acre)
2019	440,990	430,491	344,393	9.6"

Conservation/Retirement Programs

Retired acres are acres enrolled in a program that prohibits the use of water for irrigation, either temporarily or permanently. Table 13 summarizes the number of acres within Upper Republican NRD that were enrolled in retirement programs in 2019. During 2019, retirement programs in effect in this NRD included the Conservation Reserve Enhancement Program (CREP) and the Agricultural Water Enhancement Program (AWEP). In 2019, the Upper Republican NRD also began entering into contracts with landowners to permanently retire irrigation in high stream flow-impact areas under a new program funded by the state's Water Resources Cash Fund and the URNRD. There was strong interest; total bids submitted by landowners in 2019 totaled more than \$17 million, almost twice the amount of money available under the program. Contracts to permanently retire a total of 602 acres were signed in 2019 and contracts are pending or have been signed so far in 2020 on an additional 2,795 acres. Many, but not all, of the acres in the new program are also enrolled in CREP; those that are will be permanently barred from being irrigated after CREP contracts expire.

Table 13. Acres within the Upper Republican NRD that are retired from irrigation, either permanently or temporarily. During 2019, retirement programs in effect in this NRD included the Cooperative Reserve Enhancement Program (CREP) and the Agricultural Water Enhancement Program (AWEP).

Year	Acres Enrolled in CREP	Acres Enrolled in Other Retirement Programs
2019	10,499	2,148 (AWEP and new program)

Groundwater Levels and Observation Well Locations

The locations of wells used to monitor groundwater levels for all NRDs in the District are shown in Figure 3. Groundwater level data are provided to NeDNR by this NRD as part of the analysis of MHO C for the basin-wide plan. A summary of the data will be provided in the report of the next five-year technical analysis for the plan. Groundwater level data are available from the NRD upon request.

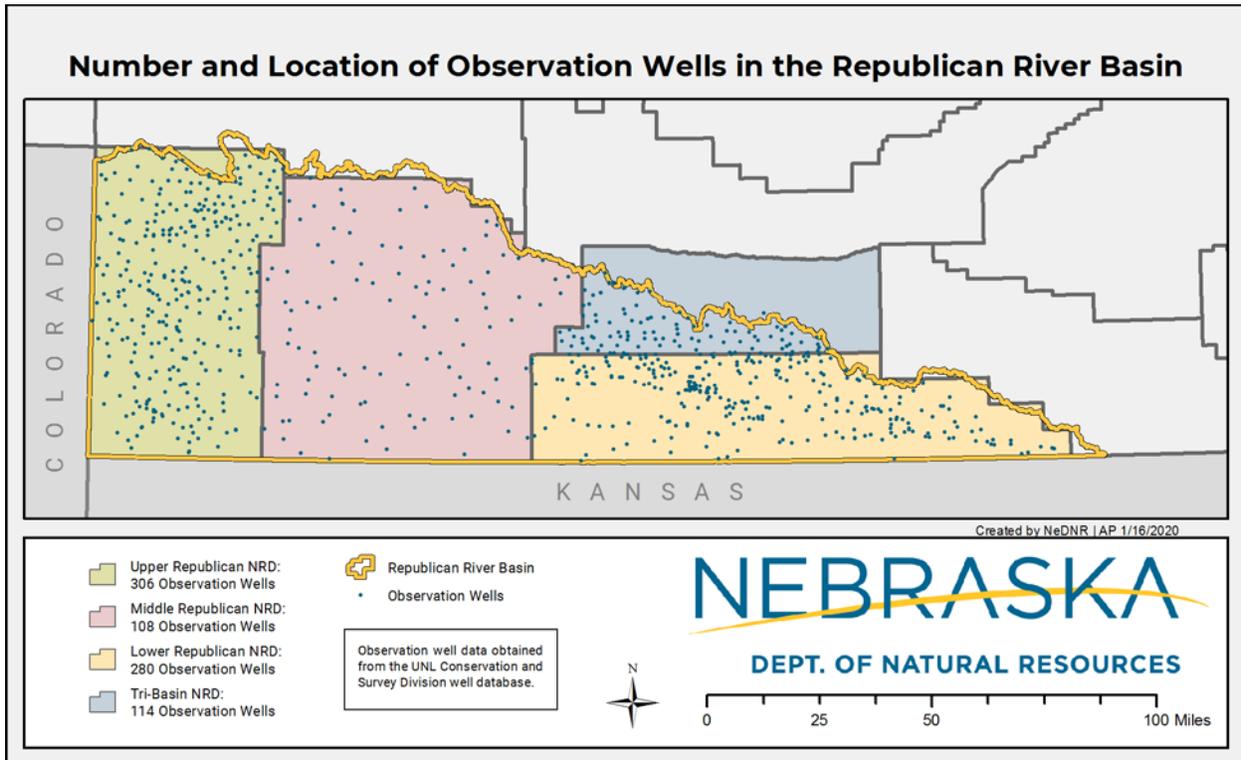


Figure 3. Location and number of groundwater observation wells within the Republican River Basin, by NRD, according to the UNL Conservation and Survey Division well database.

Curtailment of Groundwater Pumping for Compact Compliance

Under the Integrated Management Plan jointly developed by the Upper Republican NRD and NeDNR, curtailment of groundwater pumping in an area called the “Rapid Response Area” may be required by the NRD if necessary for compliance with Nebraska’s obligations under the

Republican River Compact (Compact). During 2019, Upper Republican NRD did not curtail groundwater pumping in the Rapid Response Area for Compact compliance at any time.

Middle Republican Natural Resources District

Current Allocations

Middle Republican NRD’s allocations and related rules for the 2018–2022 allocation period are summarized in Table 14. In this context, an allocation is a regulatory measure that stipulates the amount of water available to be used for irrigation.

Table 14. Summary of current allocations for groundwater irrigation use in the Middle Republican NRD, 2018–2022 allocation period.

Total Allocation	60 Inches/Acre/5 Years
Annual or Base Allocation	12 Inches/Acre/Year
Maximum Annual Use	60 Inches/Acre (15 Inches/Acre in a Compact Call Year)
Carry over amount that can be used in the following allocation period	12 Inches/Acre (Max)
Hard Cap	15 Inches/Acre/Year
Pooling allowed?	Yes
How are the allocations affected by surface water use?	Allocations are not affected by surface water use. Irrigators may use their full groundwater allocation, regardless of any surface water use.
Special allocations for designated groundwater management areas? Or subbasins?	None
Rapid Response Area Allocations?	None
Penalty for exceeding allocation	See explanation below*
Penalty for exceeding carry over	See explanation below*

***Middle Republican NRD Penalty for exceeding allocation:**

If an operator has exceeded his or her allocation, the allocation for the next allocation period shall be reduced by the number of acre inches, by which said allocation was exceeded in the prior

period. A penalty of 1 inch for every inch over the first 3 inches and 2 inches for every inch over 3 inches of overuse will be applied.

Overuse of the adjusted base allocation during a Compact Call Year shall result in a penalty of 2 inches for every inch over the first 3 inches and 3 inches for every inch over 3 inches of overuse will be applied. This penalty will result in a correction to the remaining allocation following the compact call year. This penalty shall be in addition to the penalties imposed by Rule 5-4.16 if the compact call year is the last year of an allocation period.

Annual Groundwater Use for Irrigation

Annual groundwater use for irrigation in Middle Republican NRD, for 2019, is summarized in Table 15. This summary includes:

- The total number of certified acres within the district. For the purposes of this report, certified acres are acres certified by the NRD to be allowed to be irrigated with groundwater.
- The total number of effective acres within the district. For the purposes of this report, effective acres are acres where groundwater irrigation was possible (i.e., certified acres minus acres enrolled in a conservation program prohibiting irrigation).
- The total volume of groundwater pumped for irrigation within the district.
- The average depth of water applied for irrigation on effective acres within the district.

Table 15. Annual groundwater use for irrigation in Middle Republican NRD, 2019. The difference between certified and effective acres is described in the body of the report.

Year	Certified Acres	Effective Acres	Volume Pumped (acre-feet)	Average Depth (inches/effective acre)
2019	296,782	289,660	133,735	5.72

Conservation/Retirement Programs

Retired acres are acres enrolled in a program that prohibits the use of water for irrigation, either temporarily or permanently. Table 16 summarizes the number of acres within Middle Republican NRD that were enrolled in retirement programs in 2019. During 2019, retirement programs in effect in this NRD included the Cooperative Reserve Enhancement Program (CREP) and the Agricultural Water Enhancement Program (AWEP). In 2019, the Middle Republican NRD also entered into a contract with one landowner to permanently retire 94.5 acres from surface water irrigation and contracts with three landowners to permanently retire 267.0 acres from groundwater irrigation. These permanent retirement contracts were jointly funded by the state’s Water Resources Cash Fund and the Upper Republican NRD.

Table 16. Acres within the Middle Republican NRD that are retired from irrigation, either permanently or temporarily. During 2019, retirement programs in effect in this NRD included the Cooperative Reserve Enhancement Program (CREP) and the Agricultural Water Enhancement Program (AWEP). Additionally, in 2019 MRNRD permanently retired acres from irrigation through their own program, which was partially funded by the Water Resources Cash Fund.

Year	Acres Enrolled in CREP	Acres Enrolled in Other Retirement Programs
2019	12,310	1861

Groundwater Levels and Observation Well Locations

The locations of wells used to monitor groundwater levels for all NRDs in the District are shown in Figure 3 (page 52). Groundwater level data are provided to NeDNR by this NRD as part of the analysis of MHO C for the basin-wide plan. A summary of the data will be provided in the report of the next five-year technical analysis for the plan. Groundwater level data are available from the NRD upon request.

Curtailment of Groundwater Pumping for Compact Compliance

Under the Integrated Management Plan jointly developed by the Middle Republican NRD and NeDNR, curtailment of groundwater pumping in an area called the “Rapid Response Area” may be required by the NRD if necessary for compliance with Nebraska’s obligations under the Republican River Compact (Compact). During 2019, Middle Republican NRD did not curtail groundwater pumping in the Rapid Response Area for Compact compliance at any time.

Lower Republican Natural Resources District

Current Allocations

Lower Republican NRD’s allocations and related rules for the 2018–2022 allocation period are summarized in Table 17. In this context, an allocation is a regulatory measure that stipulates the amount of water available to be used for irrigation.

Table 17. Summary of current allocations for groundwater irrigation use in the Lower Republican NRD, 2018–2022 allocation period.

Total Allocation	45 Inches/Acre/5 Years
Annual or Base Allocation	9 Inches/Acre/Year
Maximum Annual Use	45 Inches/Acre (13 Inches/Acre in a Compact Call Year)
Carry over amount that can be used in the following allocation period	9 Inches/Acre (Max)
Hard Cap	13 Inches/Acre/Year (in a Compact Call Year)
Pooling allowed?	Yes
How are the allocations affected by surface water use?	Allocations are not affected by surface water use. Irrigators may use their full groundwater allocation, regardless of any surface water use.
Special allocations for designated groundwater management areas? Or subbasins?	None
Rapid Response Area Allocations?	See explanation below**
Penalty for exceeding allocation	See penalty explanation below***
Penalty for exceeding carry over	See penalty explanation below***

****Lower Republican NRD Rapid Response Area Allocations:**

During Non-Compact Call years, the Rapid Response Area has the same Allocation as the rest of the District. During a Compact Call Year, the Allocation shall be set at the maximum allowable that would not cause the District's depletions to streamflow to exceed the District's allowable Ground Water depletions after taking into consideration other actions and controls that the District would implement. As set forth in the IMP, NeDNR will perform all calculations relating to the District's forecasted allowable Ground Water depletions, forecasted depletions, and potential yield from implementing actions and controls.

*****Lower Republican NRD Rule 3-2 Penalties:**

3-2.1. Unless otherwise provided, imposition of penalties shall be at the discretion of the Board and may include, but are not limited to:

- (a) A reduction (in whole or in part) of a Person's Allocation of Ground Water;
- (b) A reduction (in whole or in part) of a Person's Certified Irrigated Acres; and
- (c) Decommissioning of Water Wells.

3-2.2. Where penalties are enumerated in the Rules and Regulations, the Board may impose additional penalties, up to and including a permanent forfeiture of Certified Irrigated Acres, and/or a permanent forfeiture of all future Allocations, under the following circumstances: (1) previous violations of any Rule or Regulation, (2) multiple violations of these Rules and Regulations, (3) engaging in willful and wanton misconduct, or (4) certification by the record owner to the District of the non-irrigation status of certain Certified Irrigated Acres in order to opt-out of an Occupation Tax levied by the District, which status is later found to be false in whole or in part.

3-2.3. Any Person who violates a cease and desist order issued by the District pursuant to *Neb. Rev. Stat. § 46-707(h)* may be subject to a civil penalty assessed pursuant to *Neb. Rev. Stat. § 46-745*.

Annual Groundwater Use for Irrigation

Annual groundwater use for irrigation in Lower Republican NRD, for 2019, is summarized in Table 18. This summary includes:

- The total number of certified acres within the district. For the purposes of this report, certified acres are acres certified by the NRD to be allowed to be irrigated with groundwater.
- The total number of effective acres within the district. For the purposes of this report, effective acres are acres where groundwater irrigation was possible (i.e., certified acres minus acres enrolled in a conservation program prohibiting irrigation).
- The total volume of groundwater pumped for irrigation within the district.
- The average depth of water applied for irrigation on effective acres within the district.

Table 18. Annual groundwater use for irrigation in Lower Republican NRD, 2019. The difference between certified and effective acres is described in the body of the report.

Year	Certified Acres	Effective Acres	Volume Pumped (acre-feet)	Average Depth (inches/effective acre)
2019	323,045.29	310,528.06	96,209.82	3.72

Conservation/Retirement Programs

Retired acres are acres enrolled in a program that prohibits the use of water for irrigation, either temporarily or permanently. Table 19 summarizes the number of acres within Lower Republican NRD that were enrolled in retirement programs in 2019. During 2019, retirement programs in effect in this NRD included the Cooperative Reserve Enhancement Program (CREP) and the Agricultural Water Enhancement Program (AWEP).

Table 19. Acres within the Lower Republican NRD that are retired from irrigation, either permanently or temporarily. During 2019, retirement programs in effect in this NRD included the Cooperative Reserve Enhancement Program (CREP) and the Agricultural Water Enhancement Program (AWEP).

Year	Acres Enrolled in CREP	Acres Enrolled in Other Retirement Programs
2019	6,644.01	5,873.49

Groundwater Levels and Observation Well Locations

The locations of wells used to monitor groundwater levels for all NRDs in the District are shown in Figure 3 (page 52). Groundwater level data are provided to NeDNR by this NRD as part of the analysis of MHO C for the basin-wide plan. A summary of the data will be provided in the report of the next five-year technical analysis for the plan. Groundwater level data are available from the NRD upon request.

Curtailment of Groundwater Pumping for Compact Compliance

Under the Integrated Management Plan jointly developed by the Lower Republican NRD and NeDNR, curtailment of groundwater pumping in an area called the “Rapid Response Area” may be required by the NRD if necessary for compliance with Nebraska’s obligations under the Republican River Compact (Compact). During 2019, Lower Republican NRD did not curtail groundwater pumping in the Rapid Response Area for Compact compliance at any time.

Tri-Basin Natural Resources District

Current Allocations

Tri-Basin NRD’s allocations and related rules for the 2018–2020 allocation period are summarized in Table 20. In this context, an allocation is a regulatory measure that stipulates the amount of water available to be used for irrigation.

Table 20. Summary of current allocations for groundwater irrigation use in the Tri-Basin NRD, 2018–2020 allocation period.

Total Allocation	27 Inches/Acre/3 Years
Annual or Base Allocation	9 Inches/Acre/Year
Maximum Annual Use	27 Inches/Acre
Carry over amount that can be used in the following allocation period	9 Inches/Acre (Max)
Hard Cap	None
Pooling allowed?	Yes
How are the allocations affected by surface water use?	Allocations are not affected by surface water use. Irrigators may use their full groundwater allocation, regardless of any surface water use.
Special allocations for designated groundwater management areas? Or subbasins?	Allocation only required in Phase 3 groundwater quantity management areas. Current Phase 3 area is Township 5 North, Range 22 West (Union Twp.) in Gosper County.
Rapid Response Area Allocations?	None
Penalty for exceeding allocation	1.5 times the overuse amount
Penalty for exceeding carry over	1.5 times the overuse amount

Annual Groundwater Use for Irrigation

Annual groundwater use for irrigation in Tri-Basin NRD, for 2019, is summarized in Table 21. This summary includes:

- The total number of certified acres within the district. For the purposes of this report, certified acres are acres certified by the NRD to be allowed to be irrigated with groundwater.
- The total number of effective acres within the district. For the purposes of this report, effective acres are acres where groundwater irrigation was possible (i.e., certified acres minus acres enrolled in a conservation program prohibiting irrigation).
- The total volume of groundwater pumped for irrigation within the district.
- The average depth of water applied for irrigation on effective acres within the district.

Table 21. Annual groundwater use for irrigation in the Republican River Basin portion of Tri-Basin NRD, 2019. The difference between certified and effective acres is described in the body of the report.

Year	Certified Acres	Effective Acres	Volume Pumped (acre-feet)	Average Depth (inches/effective acre)
2019	190299.74	174524.91	73446.71	2.37

Conservation/Retirement Programs

Retired acres are acres enrolled in a program that prohibits the use of water for irrigation, either temporarily or permanently. Table 22 summarizes the number of acres within the Republican River Basin portion of Tri-Basin NRD that were enrolled in retirement programs in 2019. During 2019, the retirement program in effect in the Republican River Basin portion of this NRD included the Cooperative Reserve Enhancement Program (CREP).

Table 22. Acres within the Republican River Basin portion of Tri-Basin NRD that are retired from irrigation, either permanently or temporarily. During 2019, the retirement program in effect in this NRD included the Cooperative Reserve Enhancement Program (CREP).

Year	Acres Enrolled in CREP	Acres Enrolled in Other Retirement Programs
2019	2329.24	n/a

The Tri-Basin NRD Water Conservation Incentive Program (WCIP) is intended to address two natural resources management issues: insuring sustainability of groundwater supplies and protecting streamflows from diminishment due to groundwater pumping. The goal of this

voluntary program is to reduce groundwater pumping and increase irrigation water use efficiency in Tri-Basin NRD. Acres enrolled in the WCIP program in 2019 are listed in Table 23.

Tri-Basin will allow landowners to enroll up to 8000 NRD-certified irrigated acres in the program. Any parcel enrolled is subject to a voluntary five-year allocation of groundwater pumping for irrigation. The allocation is equivalent to the average corn irrigation requirement, as determined by the University of Nebraska. Once the enrollment limit is reached, water savings to the district should reach at least 650 acre-feet per year. Incentives in this program will likely be most attractive to landowners in phase two and phase three groundwater quantity management areas, so the water-use reductions should be greatest where the need is greatest (there are approximately 30,000 certified irrigated acres in Tri-Basin’s phase two and phase three townships).

In exchange for their participation, if landowners use less than their full allocation, they will be paid for the equivalent of one acre-inch of water credit per acre per year, with the opportunity to sell additional unused credits to the NRD at a set price. In addition to NRD purchases, landowners will have the opportunity to sell water credits on the open market at any agreed-upon price (private transactions require NRD board approval). Landowners will also be granted flexibility to irrigate any acres within enrolled parcels and to share (pool) allocations between parcels. Pooling agreements will be required to enable sharing allocations between parcels under different ownership.

Table 23. Acres in the Republican River Basin enrolled in the Tri-Basin NRD’s Water Conservation Incentive Program in 2019. The “New Acres Enrolled” column indicates the number of acres that were added to the program in the year indicated. The “Total Acres Enrolled” column indicates the total number of acres enrolled as of the year indicated.

Year	New Acres Enrolled	Total Acres Enrolled
2019	1449.57	1449.57

Groundwater Levels and Observation Well Locations

The locations of wells used to monitor groundwater levels for all NRDs in the District are shown in Figure 3 (page 52). Groundwater level data are provided to NeDNR by this NRD as part of the analysis of MHO C for the basin-wide plan. A summary of the data will be provided in the report of the next five-year technical analysis for the plan. Groundwater level data are available from the NRD upon request.

Nebraska Department of Natural Resources

The Republican River Basin is located at the intersection of Nebraska, Colorado, and Kansas (Table 11 and Figure 4). The Republican River Compact (Compact), administered by the Republican River Compact Administration (RRCA) is an interstate agreement that allocates consumption of the waters of the Republican River Basin among the three states. Unless otherwise indicated, the data reported in the NeDNR section of this report are either from the RRCA's approved accounting data or the data Nebraska provided to Colorado and Kansas as part of the RRCA's annual data exchange, or else they were calculated from those data using the RRCA groundwater model.

Table 24. Area of Nebraska, Kansas, and Colorado within the Republican River Basin (USGS Hydrologic Unit Code: 102500).

State	Republican River Basin Area (mi ²)
Colorado	7,816
Kansas	7,551
Nebraska	9,546

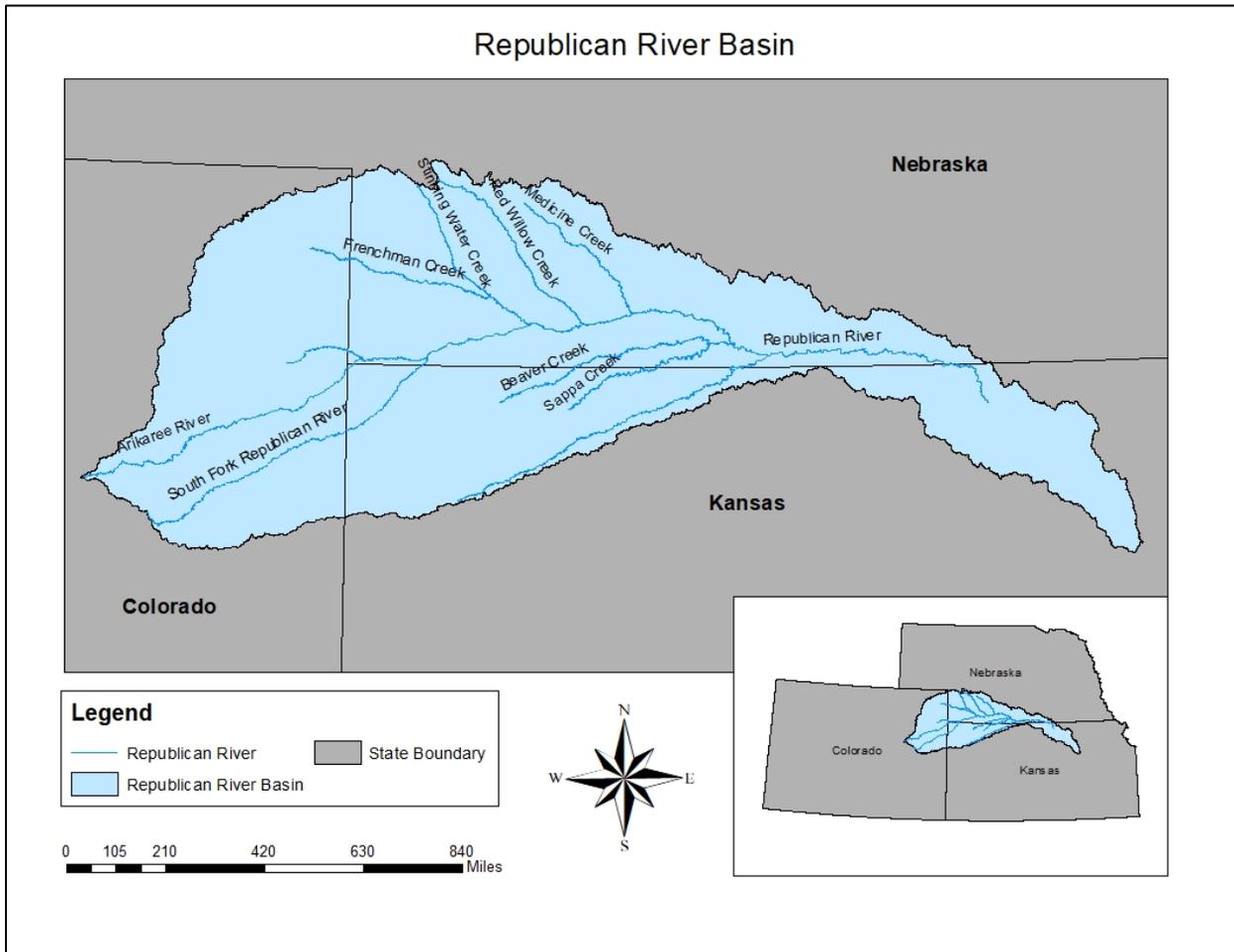


Figure 4. Extent of Republican River Basin within Nebraska, Kansas, and Colorado (USGS Hydrologic Unit Code: 102500).

Precipitation

In 2019, annual precipitation measured at National Weather Service cooperative stations across the Republican River Basin in Nebraska, as used in RRCA analyses, ranged from 18.77 inches to 42.18 inches. Figure 5 displays the 2019 precipitation at each of the cooperative stations used by the RRCA. Additional stations outside of Nebraska and the basin are used by the RRCA to fill in precipitation across the whole RRCA model area which extends beyond the basin boundary.

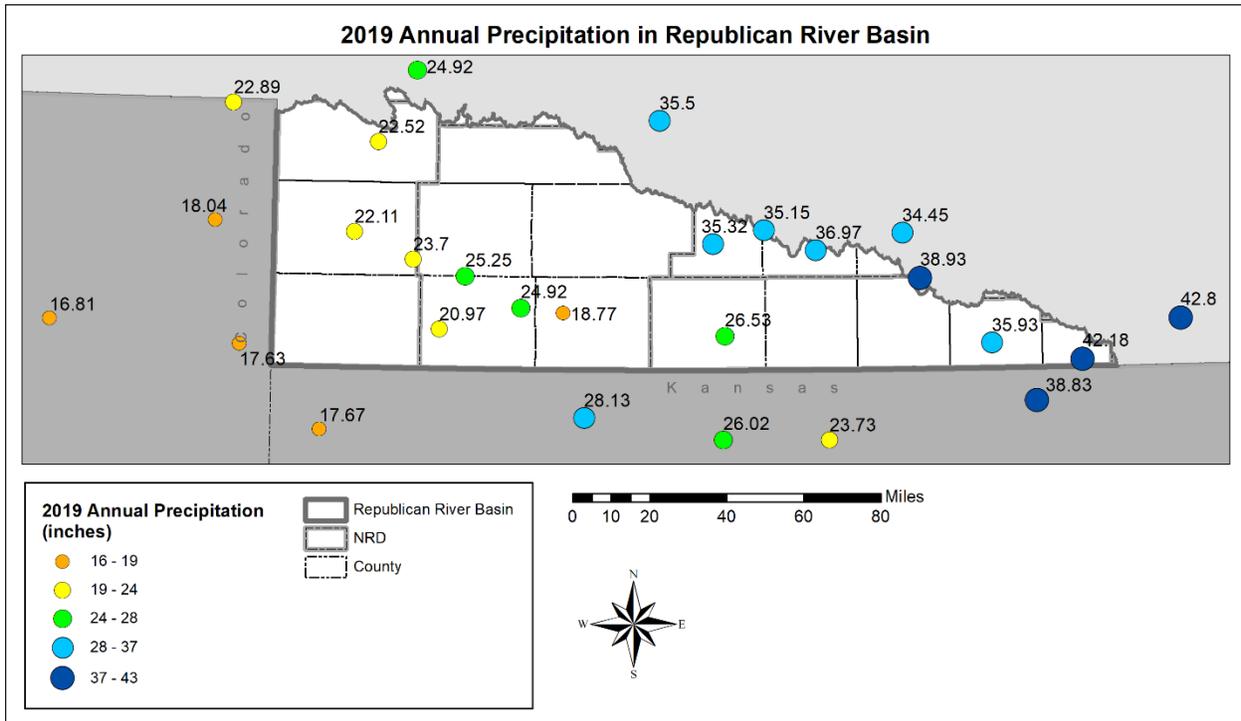


Figure 5. 2019 annual precipitation in inches from National Weather Service cooperative stations, as used in RRCA groundwater model processing.

Streamflow

Under the Republican River Compact, allocations within each Republican River subbasin include the streamflow at the downstream end of the subbasin. Subbasin streamflow is measured for the Compact by 13 USGS gages and one NeDNR gage (Figure 6 and Tables 15). The most downstream streamgages in Nebraska are on the Main Stem of the Republican River at Guide Rock and Hardy. Table 25 presents the total amount of water in acre-feet measured past each of the streamgages in 2019. For more details and to obtain continuous stream and reservoir, partial year, canal, canal return flow, and miscellaneous spot measurement data from over 250 gaging sites visit the NeDNR website: <https://nednr.nebraska.gov/RealTime/>.

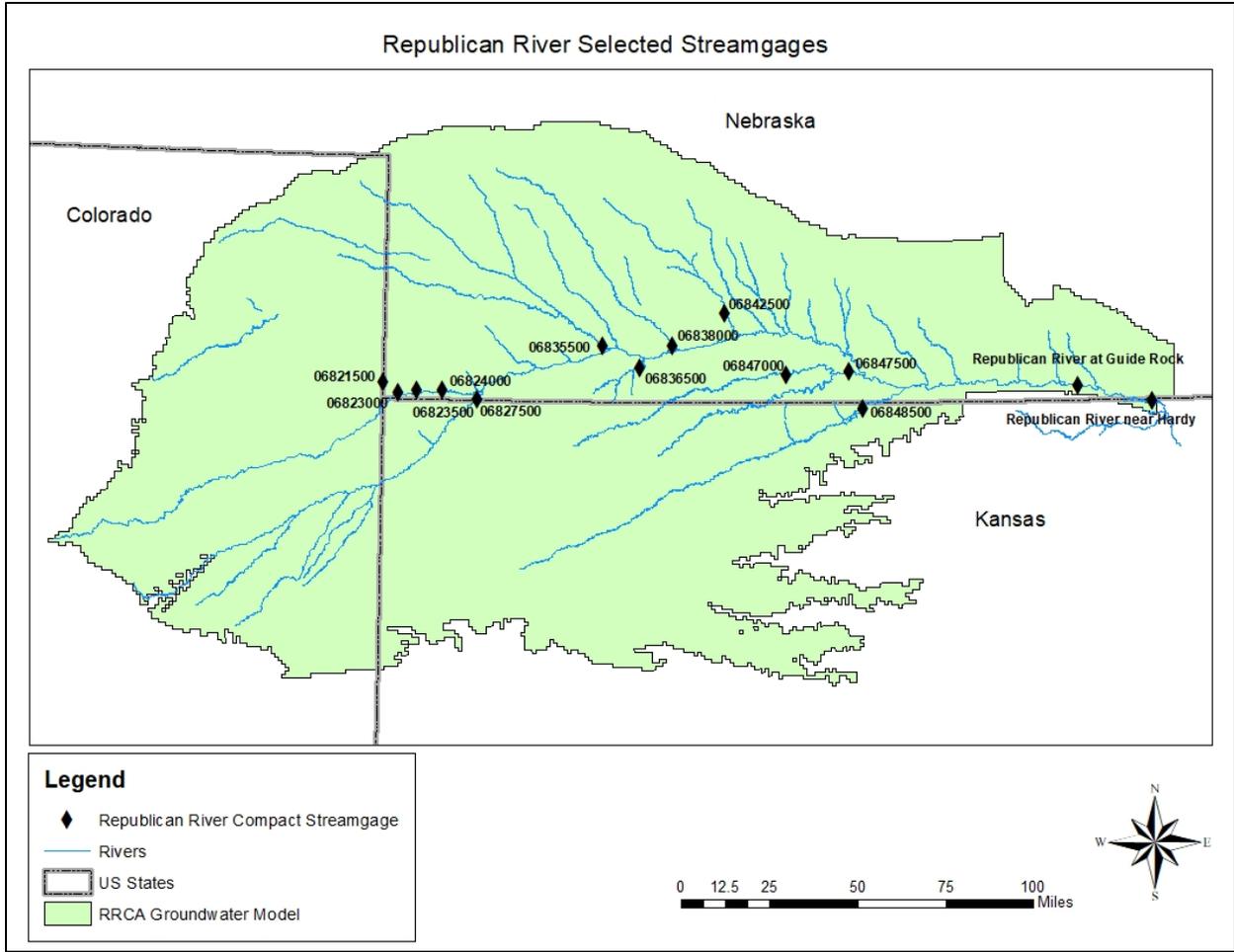


Figure 6. Location of subbasin streamgages within the Republican River Basin.

Table 25. Annual streamflow volumes in acre-feet from Republican River subbasin streamgages used in the Republican River Compact accounting.

Annual Streamflow (acre-feet)	
Streamgage	2019
USGS 06823000 - North Fork of the Republican River at Colorado-Nebraska State Line	25,436
USGS 06821500 - Arikaree River at Haigler	1,113
USGS 06823500 - Buffalo Creek near Haigler	1,355
USGS 06824000 - Rock Creek at Parks	3,748
USGS 06827500 - South Fork Republican River near Benkelman	2,385
USGS 06835500 - Frenchman Creek at Culbertson	27,267
USGS 06836500 - Driftwood Creek near McCook	3,284
USGS 06838000 - Red Willow Creek near Red Willow	3,457
NeDNR 06842500 - Medicine Creek below Harry Strunk Lake	48,769
USGS 06847000 - Beaver Creek near Beaver City	1,632
USGS 06847500 - Sappa Creek near Stamford	42,888
USGS 06848500 - Prairie Dog Creek near Woodruff, Kansas	40,960
USGS 06853020 - Republican River at Guide Rock	502,644
USGS 06853500 - Republican River near Hardy	626,375

Irrigated Acres

For the Republican River Compact Administration Groundwater Model, Nebraska currently reports irrigated acres as one of the following:

1. Groundwater-only irrigated acres.
2. Surface water-only irrigated acres or surface water and groundwater (commingled) irrigated acres.

Acres irrigated with groundwater are reported with metered pumping annually by the NRDs to NeDNR or are estimated for the portions of the RRCA model area that are in NRDs without metered pumping. Acres irrigated with surface water and commingled are flagged annually based on use from a master database developed from water right information. Annual irrigated acres within the RRCA model from 2019 have been divided into the two reporting methods and groundwater acres have been delineated by the NRD that the model cells primarily overlay (Figure 7). Nebraska annual total surface water and commingled and total groundwater irrigated acres are also presented in Table 26.

Irrigated Acres within the RRCA Groundwater Model Area in 2019

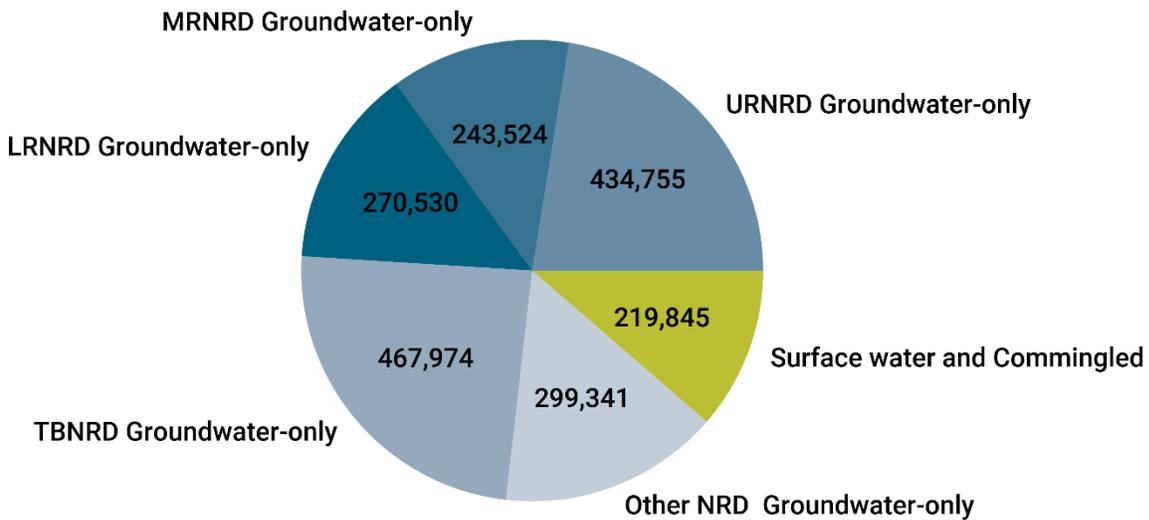


Figure 7. Annual acres irrigated by surface water and commingled (surface water and groundwater irrigated) or acres irrigated by only groundwater, delineated by the NRD that the model cells primarily overlay in the Nebraska portion of the RRCA groundwater model. Because all of Tri-Basin NRD (TBNRD) is included in the RRCA groundwater model area, the groundwater-irrigated acres shown here for Tri-Basin NRD include acres that are located in the Platte, Little Blue, and Republican River Basins.

Table 26. Annual division of acres irrigated by surface water and commingled (surface water and groundwater irrigated) or acres irrigated by only groundwater in the Nebraska portion of the RRCA groundwater model. Because all of Tri-Basin NRD is included in the RRCA groundwater model area, the groundwater-irrigated acres shown here for Tri-Basin NRD include acres that are located in the Platte, Little Blue, and Republican River Basins.

Area and Irrigation Type	2019
Nebraska Model Area – Surface Water and Commingled	219,845
Upper Republican NRD – Groundwater-only	434,755
Middle Republican NRD – Groundwater-only	243,524
Lower Republican NRD – Groundwater-only	270,530
Tri-Basin NRD – Groundwater-only	467,974
Other – Groundwater-only	299,341

Allocation and Computed Beneficial Consumptive Use (CBCU)

Under the Republican River Compact, the total water supply and how much of the total supply each state is entitled to beneficially use is referred to as “allocation.” The allocations are calculated from the water supply of the basin if it had been undepleted by the activities of man. Each state is allotted a fixed percentage of the undepleted water supply in each of the Republican River subbasins to obtain the states’ allocations. The calculated uses of the water supplies are referred to as “Computed Beneficial Consumptive Use” or “CBCU.” The CBCU in the Republican River Basin includes direct surface water uses, such as reservoir evaporation and consumption of diverted water, and withdrawal or interception of streamflow by groundwater pumping (groundwater depletions to streamflow). Groundwater pumping can have a lagged effect on streamflow. The RRCA groundwater model considers the effects of pumping since early well development in the 1940s, therefore, the groundwater consumptive use of streamflow in each year is impacted by pumping in that year and all previous years. Table 27 presents total CBCU in Colorado, total CBCU in Kansas, and the breakdown of total CBCU as surface water or groundwater CBCU from Nebraska. Nebraska groundwater CBCU are presented for the effects of pumping from each basin NRD separately (Upper Republican, Middle Republican, Lower Republican, and Tri-Basin NRDs) and all other NRDs within the model area collectively (Other NRD) in Table 27. Each NRD’s groundwater CBCU is equivalent to the net depletions to streamflow due to groundwater pumping within that NRD.

Table 27. Annual total Computed Beneficial Consumptive Use (CBCU) by Kansas and Colorado and annual Nebraska total surface water CBCU and division of groundwater CBCU (i.e., net depletions to streamflow) by each NRD. The sum of Nebraska CBCU presented in this table may vary slightly from the statewide CBCU in Nebraska’s Compact compliance tables due to rounding.

CBCU (acre-feet)	
	2019
Colorado	32,740
Kansas	47,910
Nebraska Surface Water	46,520
Lower Republican NRD Groundwater	48,401
Middle Republican NRD Groundwater	62,437
Upper Republican NRD Groundwater	88,089
Tri-Basin NRD Groundwater	14,950
Other NRD Groundwater	2,457

Reservoir Storage and Evaporation

Federal Reservoir Storage

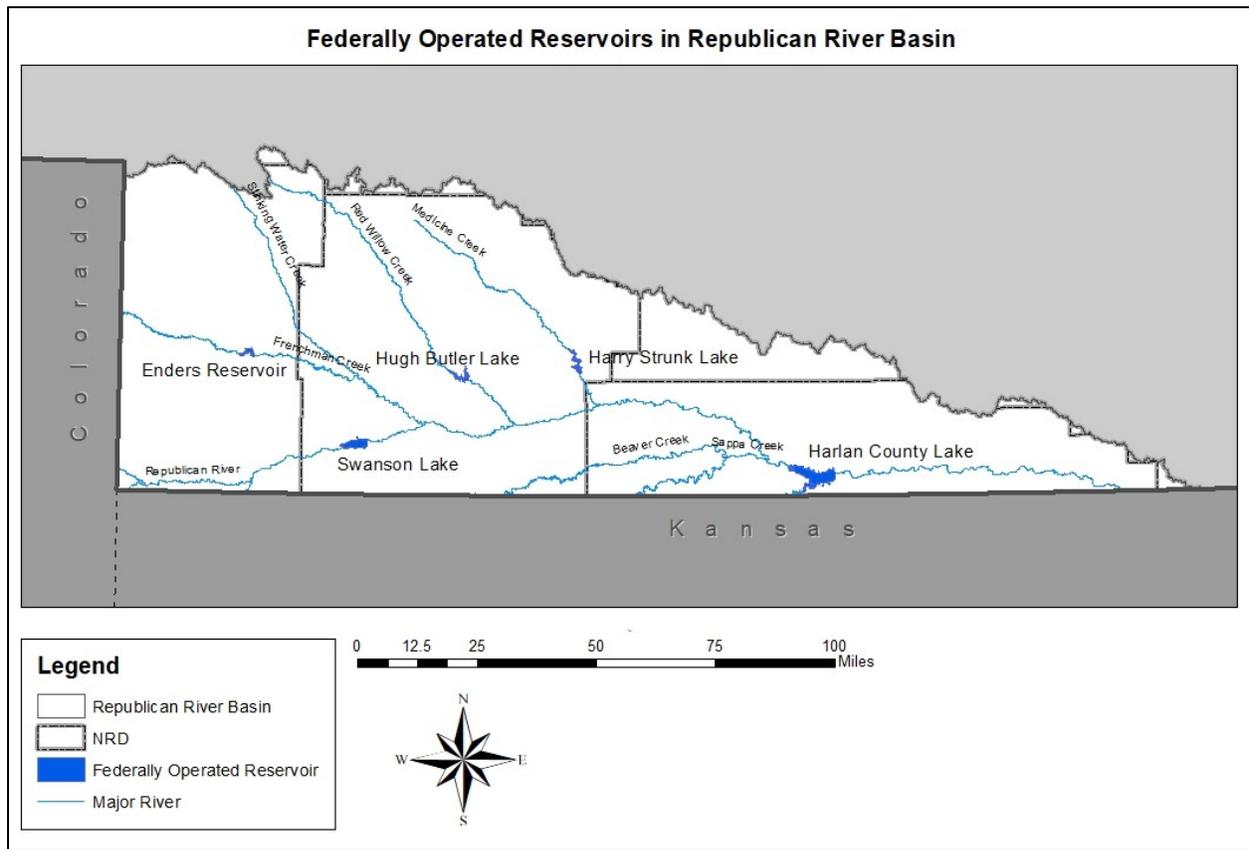


Figure 8. Location of federal reservoirs located in Nebraska portion of the Republican River Basin.

There are five federally operated reservoirs within the Republican River Basin in Nebraska: Enders Reservoir on Frenchman Creek, Hugh Butler Reservoir on Red Willow Creek, Harry Strunk Reservoir on Medicine Creek, and Swanson Lake and Harlan County Lake on the Republican River (Figure 8). Annual end of year storage volumes for 2019 relative to the reservoirs' active storage for each Republican River Basin reservoir in Nebraska are shown in Figure 9. Storage data were obtained from the United States Bureau of Reclamation (USBR), which are available on the USBR's automated data system HydroMet at <https://www.usbr.gov/gp/hydromet/>.

Federal Reservoir Total Storage at End of Year

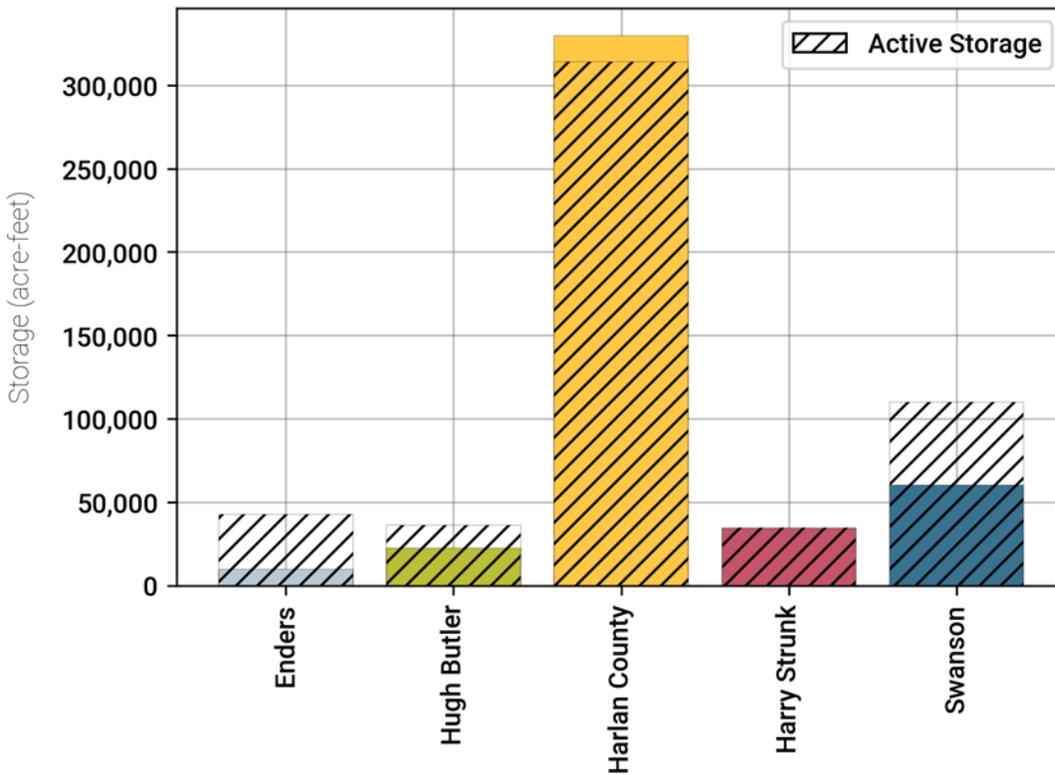


Figure 9. 2019 end-of-year reservoir contents relative to the reservoirs’ active storage (i.e., capacity at the top of active conservation elevation) for the federally operated reservoirs within the Republican River Basin in Nebraska: Enders Reservoir on Frenchman Creek, Hugh Butler Reservoir on Red Willow Creek, Harry Strunk Reservoir on Medicine Creek, and Swanson Lake and Harlan County Lake on the Republican River.

Reservoir Evaporation

In 2019 in the Republican River Basin, net evaporation from the five federal reservoirs in Nebraska was 25,547 acre-feet and 1,003 acre-feet from non-federal reservoirs. Federal and non-federal reservoir evaporation are beneficial consumptive uses of surface water. For the RRCA, federal and non-federal reservoir CBCU are calculated as net evaporation, which is evaporation from the reservoir minus precipitation directly intercepted by the reservoir.

Surface Water Municipal and Industrial CBCU

During the reporting year, there were no permitted municipal nor industrial uses of surface water in the Republican River Basin. For more information on surface water permitting, visit NeDNR’s Surface Water Permitting and Data website at: <https://dnr.nebraska.gov/surface-water>.

Surface Water Administration for Compact Compliance

Under the IMPs jointly developed by NeDNR and the Upper Republican, Middle Republican, and Lower Republican NRDs, NeDNR may administer and regulate surface water if necessary to ensure compliance with Nebraska's obligations under the Compact during Compact Call Years. Compact Call Years are years in which NeDNR's analysis following the forecast procedures contained in the IMPs for the Upper Republican, Middle Republican, and Lower Republican NRDs indicate the potential for noncompliance with the Compact if sufficient management actions are not taken. No water administration for Compact compliance due to a Compact Call occurred in 2019.

Note that only administration for Compact compliance due to a Compact Call is considered a management action for the purposes of evaluating the basin-wide plan's MHO E. Surface water is also administered under the Water-Short Year provisions of the Final Settlement Stipulation (FSS) for the Compact. This type of water administration is triggered automatically under the terms of the FSS: whenever the projected or actual irrigation supply available in Harlan County Lake is less than 130,000 acre-feet and water is needed for direct diversion at Guide Rock, Nebraska must close appropriations downstream of Harlan County Lake that are junior to February 26, 1948. Because this type of water administration is triggered automatically, it is not considered a management action for the purposes of evaluating the basin-wide plan's MHO E.

Qualitative Evaluation of Net Effect of Management Actions for Compact Compliance

Action Item 1.2.1 of the basin-wide plan is to qualitatively evaluate the net effect on water supplies of any management actions that are taken for Compact compliance. As described in the previous subsection, "Surface Water Administration for Compact Compliance," and in the subsection entitled "Curtailement of Groundwater Pumping for Compact Compliance" within each NRD's section for reporting water supplies and uses (pages 52, 56, 59), neither surface water administration nor curtailment of groundwater pumping occurred in 2019. In addition, as stated in the progress summary for Action Item 1.1.2 (page 15) no management actions were necessary as offsets in 2019. In summary, there were no management actions taken in 2019 for 2019 Compact compliance.

Some management actions were taken in 2019 that will help with Compact compliance in future years. NeDNR and all four NRDs worked with landowners to retire land from irrigation through enrollment or reenrollment in temporary or permanent retirement programs (pages 51, 55, 59, and 61). In addition, Tri-Basin NRD enrolled landowners in a voluntary allocation program to incentivize water conservation (page 61). Both retirement programs and allocation programs are expected to have a positive effect on water supplies by reducing consumptive use of water.

Augmentation Pumping and Net Impacts Analysis

This section contains a summary of pumping data for the augmentation projects in the basin, as well as NeDNR’s analysis of the net impacts of augmentation pumping for the N-CORPE and Rock Creek Augmentation projects. NeDNR’s net impacts analysis fulfills a requirement of the IMPs jointly developed by NeDNR and the Upper Republican, Middle Republican, and Lower Republican NRDs. The IMPs state that “...all new net depletions to streamflow that result from augmentation pumping (as calculated by the RRCA ground water model) will be mitigated to ensure protection of existing surface water appropriations.” All 2020 data are provisional at the time of this report.

N-CORPE Augmentation Project

Pumping

The Nebraska Cooperative Republican Platte Enhancement project (N-CORPE) is operated through an interlocal cooperative agreement formed in 2012 by Upper Republican NRD, Middle Republican NRD, Lower Republican NRD, and Twin Platte NRD. A summary of N-CORPE pumping for 2019 is provided in Table 28.

Table 28. Summary of N-CORPE augmentation project pumping. The “Days Pumped for Compact Compliance” column indicates the number of days the project was pumped to augment streamflow for Compact compliance purposes. The “Total Pumped Volume” column provides the volume of water pumped in that year for all purposes, including augmentation and maintenance pumping.

Year	Days Pumped for Compact Compliance	Total Pumped Volume (acre-feet)
2019	0	16

Net Impacts Analysis

The IMPs for the Upper Republican NRD, Middle Republican NRD, and Lower Republican NRD state that “...all new net depletions to streamflow that result from augmentation pumping (as calculated by the RRCA ground water model) will be mitigated to ensure protection of existing surface water appropriations.” This evaluation provides the most recent estimate of the difference in depletions from the historical operation of N-CORPE and depletions from a simulated continuation of irrigation pumping for lands retired through the implementation of each augmentation project.

Augmentation projects affect streamflow in two ways: by increasing streamflow through direct addition of pumped groundwater, and by impacts to baseflows (groundwater discharge to the stream) from changes in groundwater pumping, with the sum of these being the net streamflow

impacts. The amount of direct groundwater addition to streamflow is metered by the NRDs and reported to NeDNR. The impacts to baseflow are determined by comparing model-estimated impacts from the historical simulation that includes all of the augmentation pumping but ceases irrigation operations once the projects were initiated with a simulation where an estimation of irrigation pumping is included for lands retired through the development of each augmentation project and augmentation pumping from the beginning of the projects through 2020 is excluded (Figure 10 and Figure 11). All 2020 data are provisional.

The N-CORPE augmentation project was operational each year from its first year through 2017 to offset depletions for Compact compliance; 2018 and 2019 operations were for maintenance purposes; and 2020 operations primarily utilized the project's north pipeline to the Platte River for part of TPNRD's integrated management plan requirements. Net depletive effects from 2014–2019 operation were offset by augmentation pumping (Figure 12), so no additional offsets were needed. Based on current projections, 2020 net depletive effects may not be fully offset by augmentation pumping (Figure 13). An analysis of potentially negatively impacted downstream surface water users and the mitigation activities NCORPE has already enacted should be initiated.

An additional analysis was completed to determine the groundwater impacts to streamflow from the 2020 N-CORPE pumping for delivery to the Upper Platte Basin separately from previous years' pumping toward Republican Basin water supply. Due primarily to the distance of the N-CORPE wells to Republican streams, there is a time lag between groundwater pumping from the N-CORPE wells and impacts to Republican streams. This resulted in no impact of 2020 N-CORPE pumping for delivery to the Upper Platte Basin on the project's net depletion to streamflow in the Republican River Basin. In other words, all net depletive impacts in 2020 were due to previous years' augmentation pumping. We will continue this additional scenario in future years as there may be lagged impacts of 2020 Upper Platte augmentation pumping.

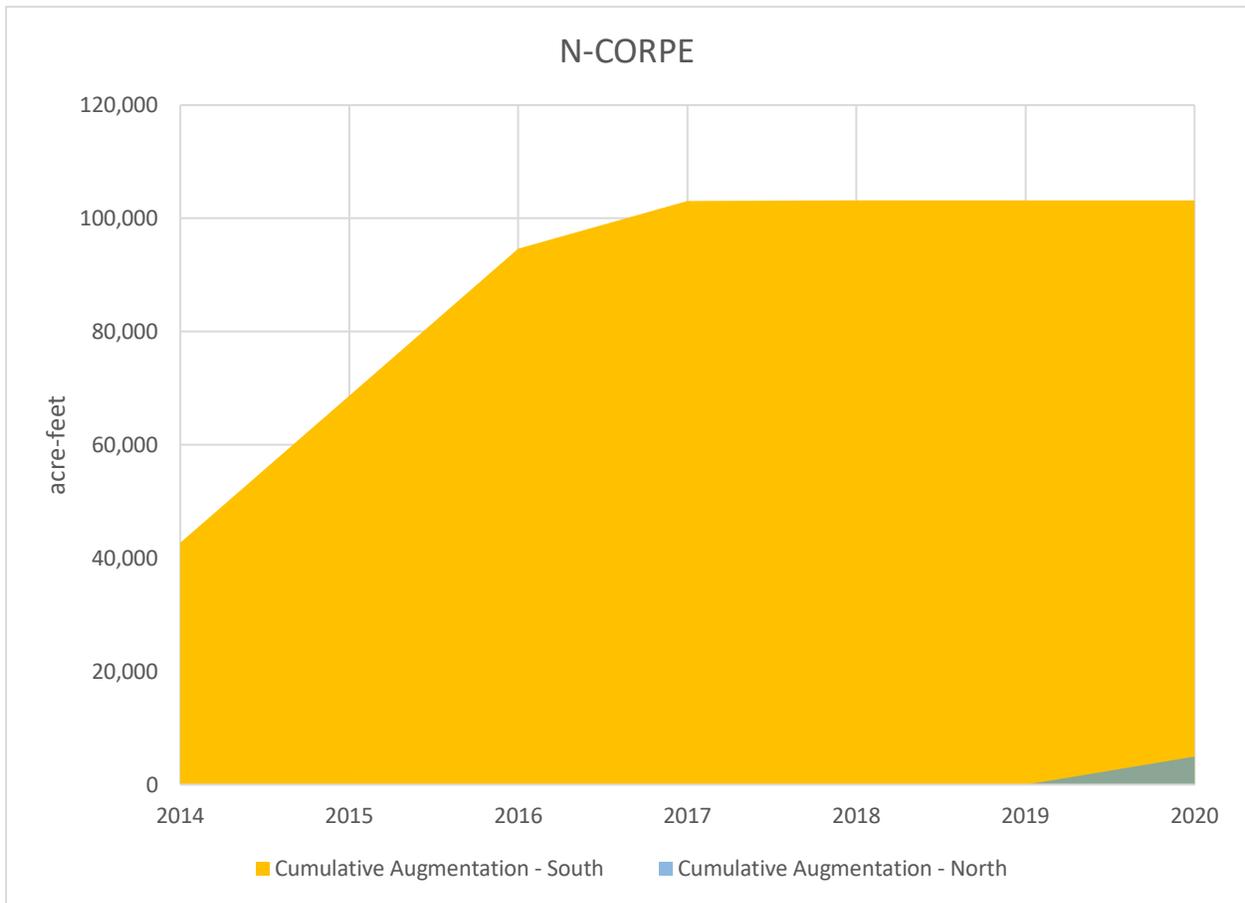


Figure 10: Cumulative water use for augmentation and estimated irrigation pumping on acres retired under the N-CORPE Augmentation Project.

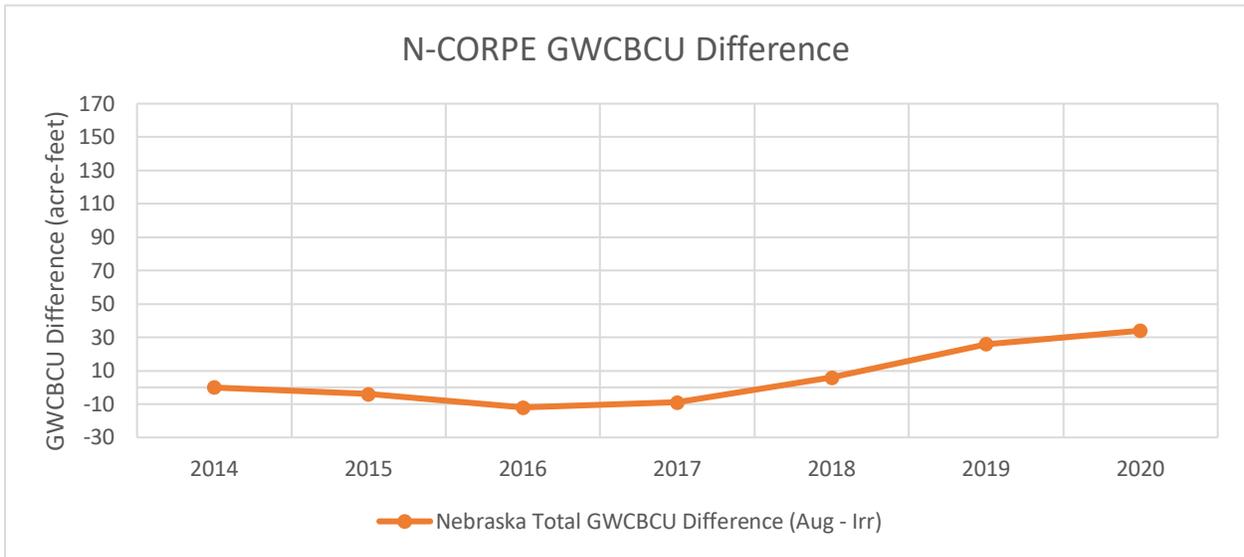


Figure 11: The difference between modeled CBCU (depletions) from N-CORPE Augmentation pumping and modeled CBCU from estimated irrigation pumping on the N-CORPE retired acres had those acres been used for irrigation. In this figure, a positive groundwater CBCU (GWBCU) difference indicates that modeled depletions from augmentation were greater than modeled CBCU from estimated irrigation pumping.

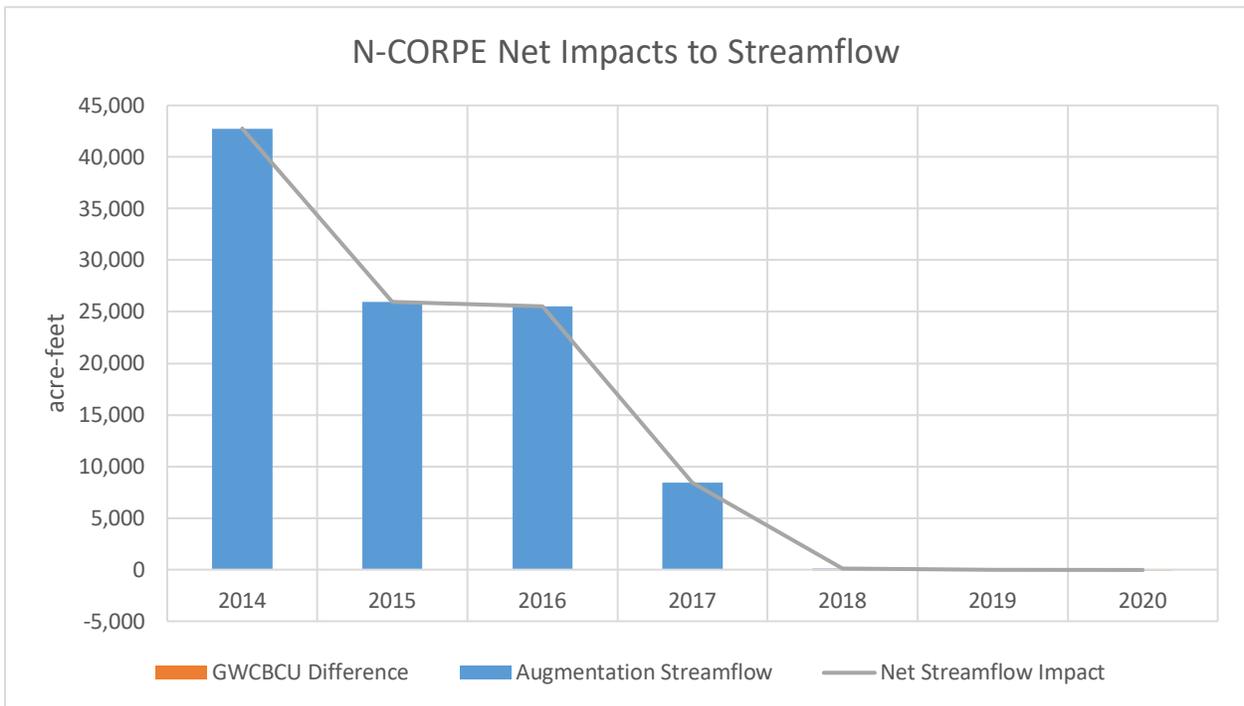


Figure 12: The net impacts to streamflow from the N-CORPE Augmentation Project. In this figure, a positive value indicates a net increase in streamflow due to N-CORPE operations, and a negative value indicates net depletions to streamflow. Because of this, the GWBCU Difference values in this chart are represented as the inverse of the GWBCU values in Figure 11.

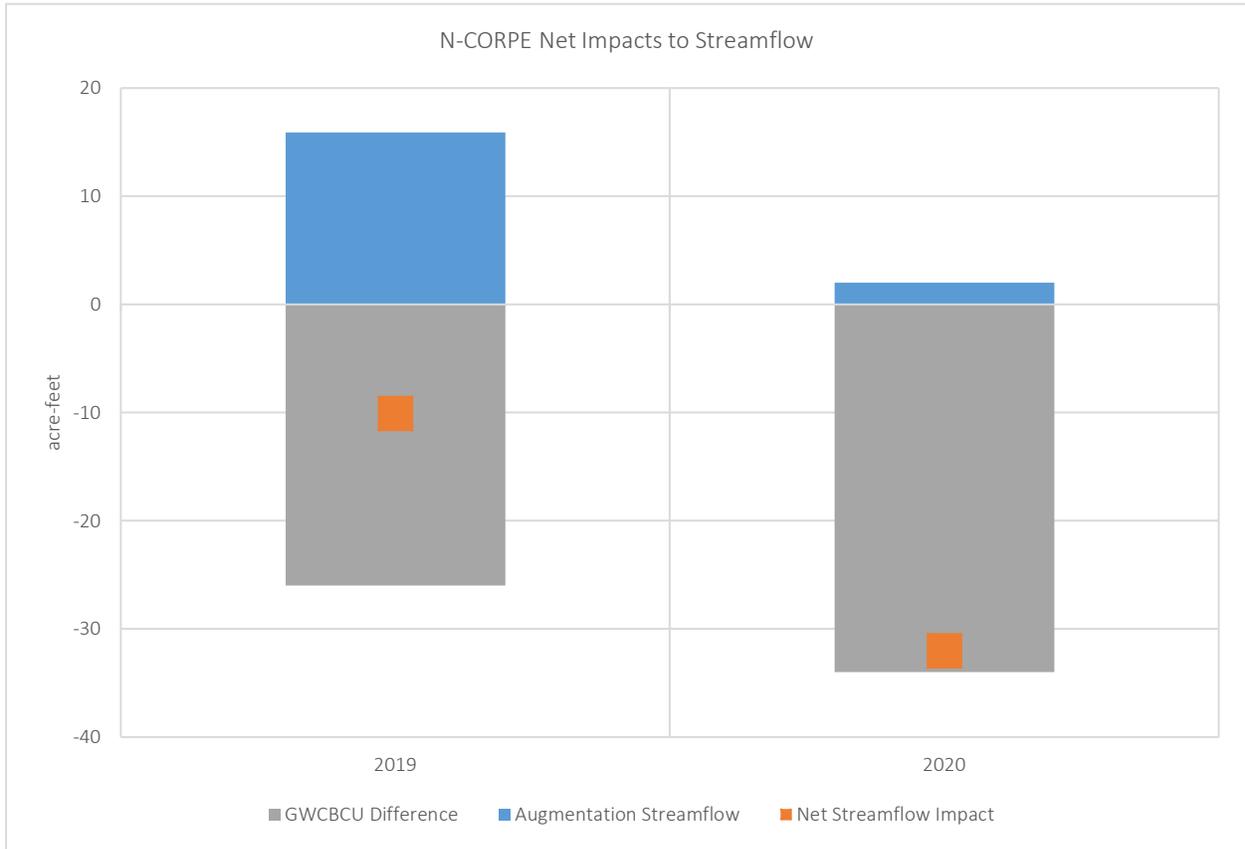


Figure 13: 2019 and 2020 net impacts to streamflow. 2020 data are provisional as of this report. In this figure, a positive value indicates a net increase in streamflow due to N-CORPE operations, and a negative value indicates net depletions to streamflow. Because of this, the GWCBCU Difference values in this chart are represented as the inverse of the GWCBCU values in Figure 11.

Rock Creek Augmentation Project

Pumping

The Rock Creek augmentation project is operated by Upper Republican NRD. A summary of Rock Creek augmentation project pumping for 2019 is provided in Table 29.

Table 29. Summary of Rock Creek augmentation project pumping. The "Days Pumped for Compact Compliance" column indicates the number of days the project was pumped to augment streamflow for Compact compliance purposes. The "Total Pumped Volume" column provides the volume of water pumped in that year for all purposes, including augmentation and maintenance pumping.

Year	Days Pumped for Compact Compliance	Pumped Volume (acre-feet)
2019	0	60

Net Impacts Analysis

The IMP for the Upper Republican NRD states that "...all new net depletions to streamflow that result from augmentation pumping (as calculated by the RRCA ground water model) will be mitigated to ensure protection of existing surface water appropriations." This evaluation provides the most recent estimate of the difference in depletions from the historical operation of the Rock Creek augmentation project and depletions from a simulated continuation of irrigation pumping for lands retired through the implementation of each augmentation project.

Augmentation projects affect streamflow in two ways: by increasing streamflow through direct addition of pumped groundwater, and by impacts to baseflows (groundwater discharge to the stream) from pumping groundwater, with the sum of these being the net streamflow impacts. The amount of direct groundwater addition to streamflow is metered by the NRDs and reported to NeDNR. The impacts to baseflow are determined by comparing model-estimated impacts from the historical simulation that includes all of the augmentation pumping but ceases irrigation operations once the projects were initiated with a simulation where an estimation of irrigation pumping is included for lands retired through the development of each augmentation project and augmentation pumping from the beginning of the projects through 2020 is excluded (Figure 14 and Figure 15). All 2020 data are provisional.

The Rock Creek augmentation project was operational each year from its first year through 2017 to offset depletions for Compact compliance and through 2020 for maintenance purposes. Any net depletive effects through 2017 were offset by augmentation pumping in those years (Figure 16). A small net depletive effect of Rock Creek in 2020 is projected to be offset by the pumping that occurred in 2020 for maintenance purposes. Augmentation pumping alone did not fully offset augmentation pumping from Rock Creek in 2018 and 2019 (Figure 17). A 2019 analysis by NeDNR concluded that maintenance pumping plus temporary retirements and permanent decertifications located either upstream of the Rock Creek confluence or in close proximity to the eastern end of the Rock Creek subbasin provides a total offset that well exceeds the new depletions from previous Rock Creek augmentation pumping, mitigating any potential effects to downstream users (see *First Annual Report for the Republican River Basin-Wide Plan: Data and Progress Updates, 2014–2018* (February 2020) for details).

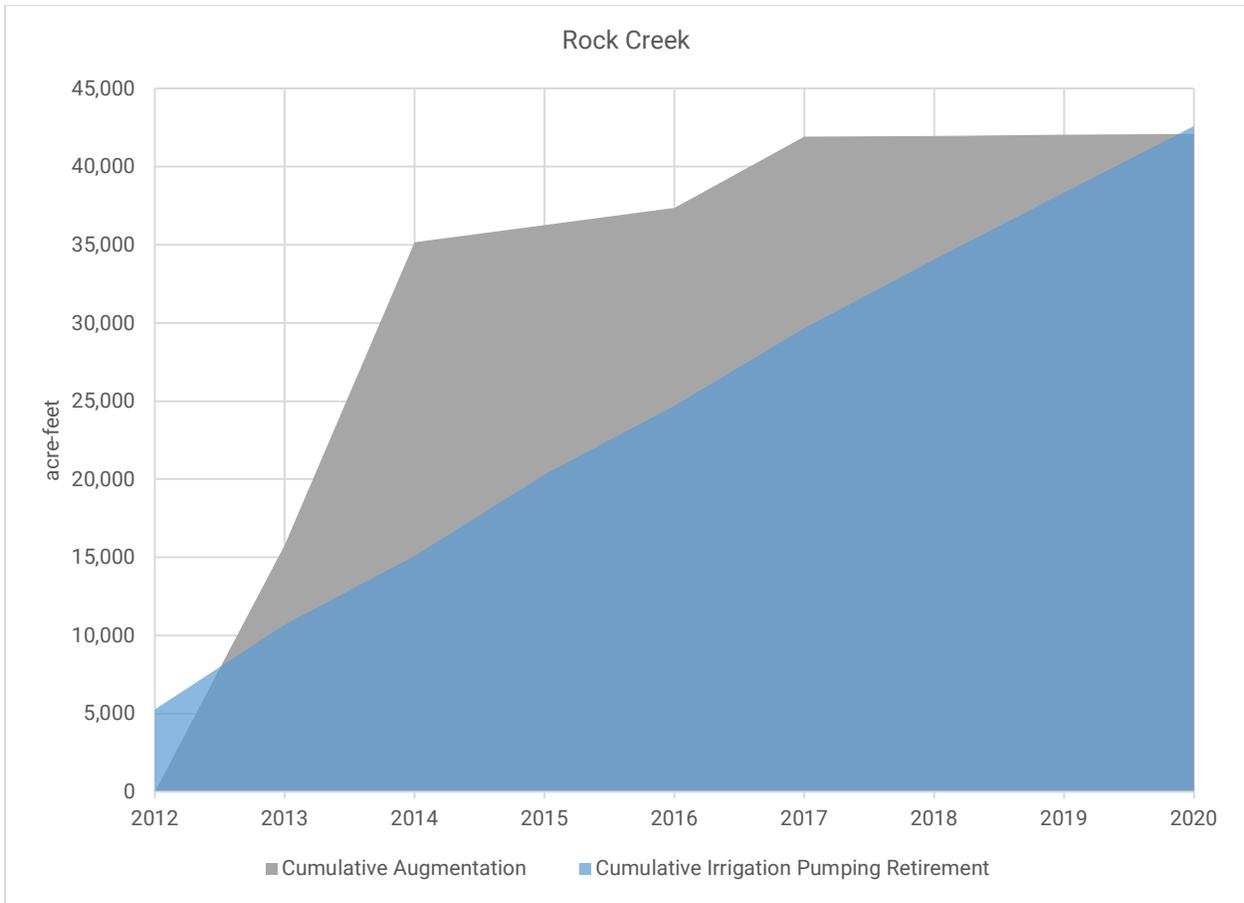


Figure 14: Cumulative water use for augmentation and estimated irrigation pumping on acres retired under the Rock Creek Augmentation Project.

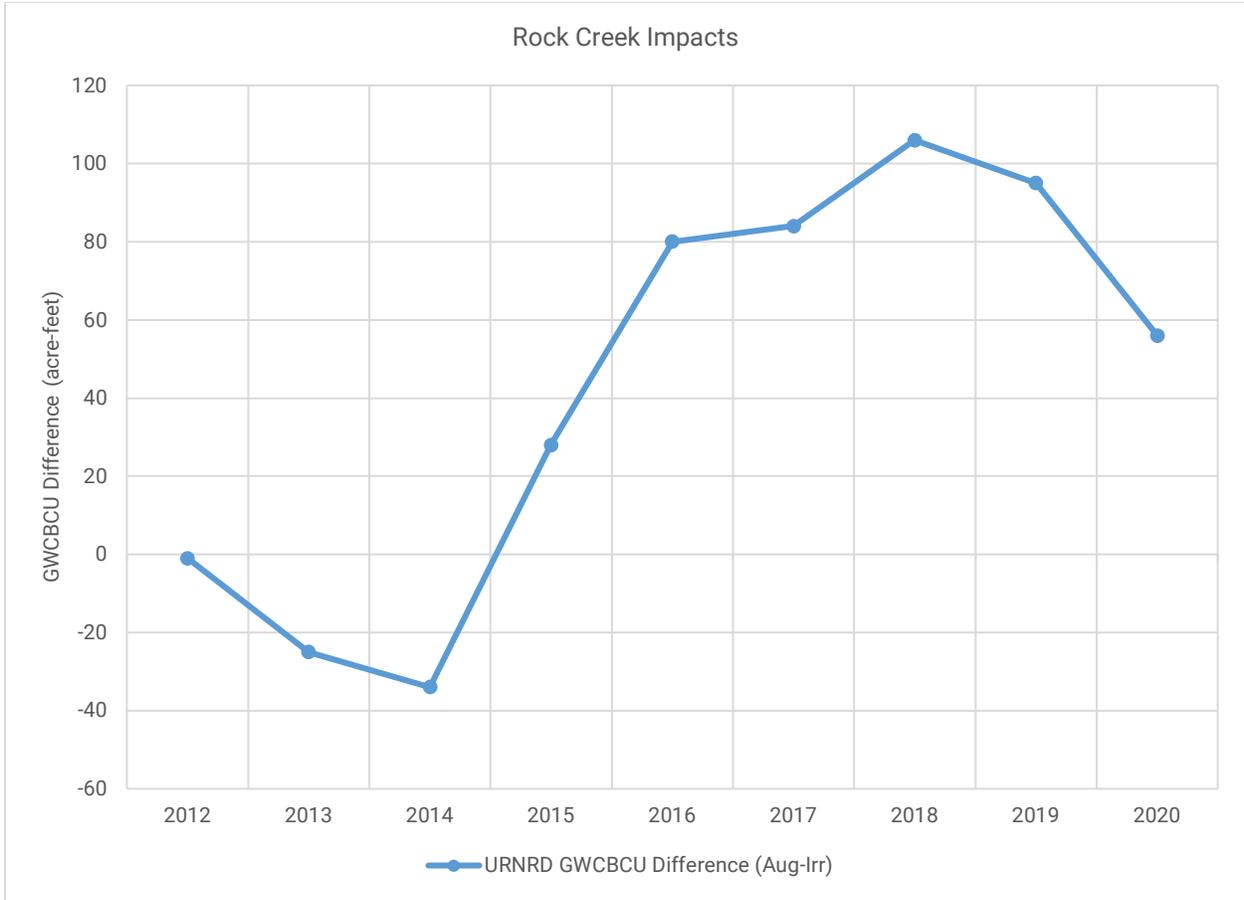


Figure 15: The difference between modeled CBCU (depletions) from Rock Creek Augmentation pumping and modeled CBCU from estimated irrigation pumping on the Rock Creek retired acres had those acres been used for irrigation. In this figure, a positive groundwater CBCU (GWBCU) difference indicates that modeled depletions from augmentation were greater than modeled CBCU from estimated irrigation pumping.

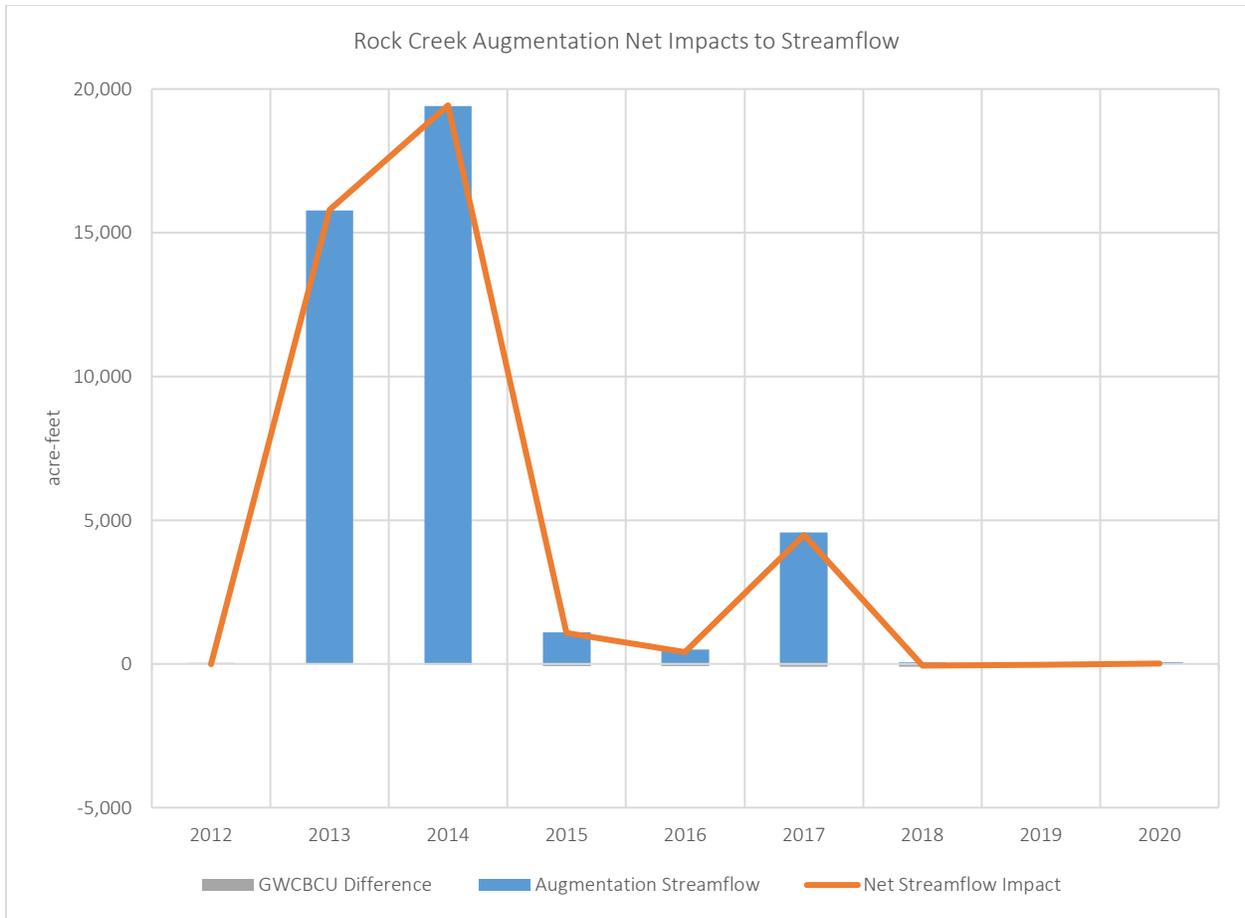


Figure 16: The net impacts to streamflow from the Rock Creek Augmentation Project. data are provisional as of this report. In this figure, a positive value indicates a net increase in streamflow due to Rock Creek project operations, and a negative value indicates net depletions to streamflow. Because of this, the GWCBCU Difference values in this chart are represented as the inverse of the GWCBCU values in Figure 15.

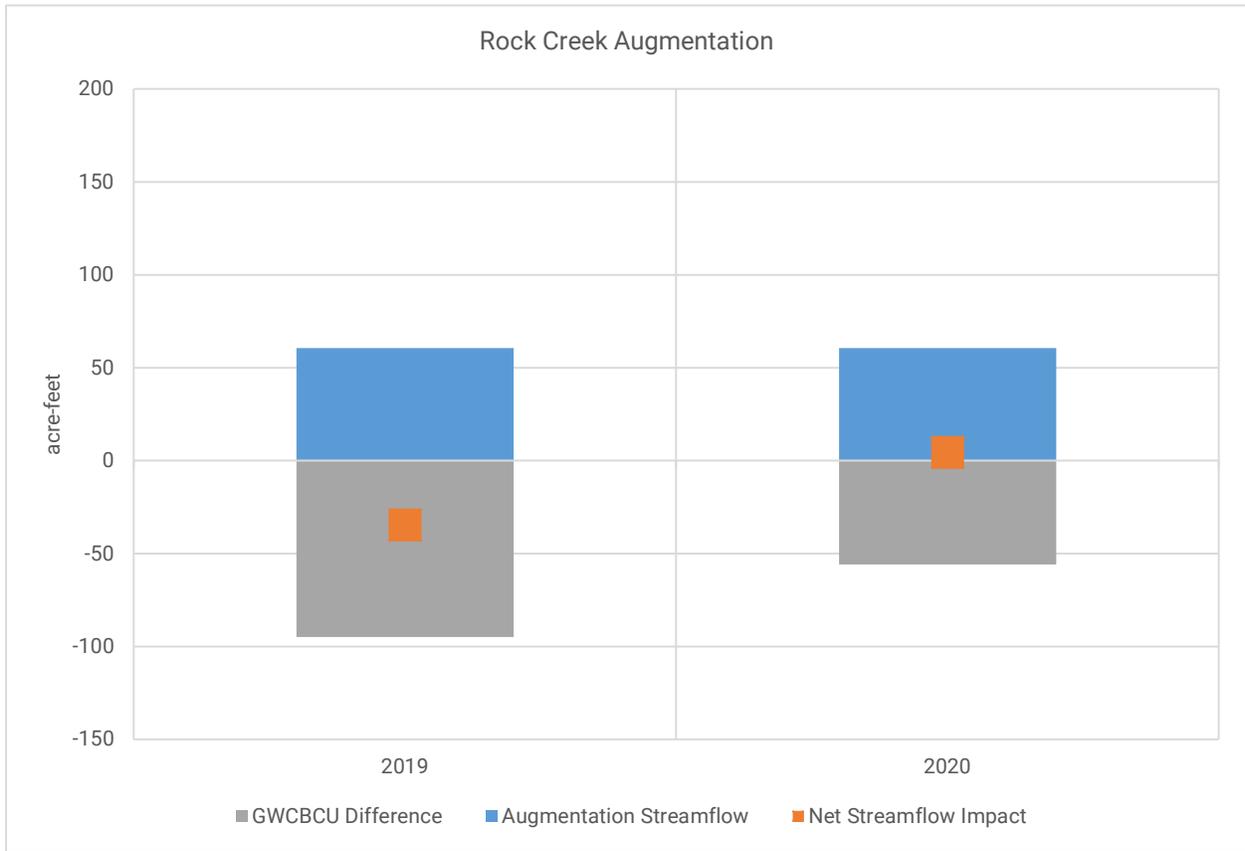


Figure 17: 2019 and 2020 net impacts to streamflow. 2020 data are provisional as of this report. In this figure, a positive value indicates a net increase in streamflow due to Rock Creek project operations, and a negative value indicates net depletions to streamflow. Because of this, the GWCBCU Difference values in this chart are represented as the inverse of the GWCBCU values in Figure 15.

Turkey Creek Augmentation Well

Pumping

The Turkey Creek augmentation well is operated by Tri-Basin NRD as part of the NRD’s Republican Basin Streamflow Augmentation Project. Construction was completed in 2016. From 2016–2019, this well was not operated for augmentation purposes.