

## **2022 Forecast of Allowable Depletions in the Republican River Basin**

*Nebraska Department of Natural Resources  
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### **Background**

The State of Nebraska is party to an interstate compact for the management of the Republican River Basin with the states of Colorado and Kansas, administered by the Republican River Compact Administration (RRCA). Pursuant to the current integrated management plans (IMPs) and Neb. Rev. Stat. § 46-715(6), the Nebraska Department of Natural Resources (NeDNR) in consultation with the Lower Republican Natural Resources District, Middle Republican Natural Resources District, and Upper Republican Natural Resources District (Districts) is required to provide an annual short-term and long-term forecast of maximum allowable depletions to streamflow that will ensure compliance with interstate compacts. The NeDNR has determined that the short-term forecast applies to the upcoming year (2022) and that the long-term forecast estimates what conditions may be ten years into the future. Therefore, this document includes the dry-year forecast of allowable depletions to streamflow in 2022 and 2032.

The States of Nebraska, Colorado, and Kansas, acting through the RRCA, adopted a “*Resolution Approving Long-Term Agreements Related to the Operation of Harlan County Lake for Compact Call Years*” (Resolution). The August 24, 2016, Resolution outlines certain actions that Nebraska will take toward Republican River Compact (Compact) compliance during years forecast as Compact Call Years as outlined in the Monitoring and Studies Technical Memorandum sections of the District IMPs. Compliance with the terms of the Resolution constitutes compliance with the Final Settlement Stipulation and Compact.

### **Short-Term Forecast**

The outcome of Nebraska’s short-term forecast is largely dependent on three key elements, much of which are from data secured through the RRCA Compact accounting procedures. These three elements are detailed in the following sections.

#### **1. Applicable compliance tests for 2022**

The first key element of the short-term forecast is the identification of the averaging period that will be utilized for assessing compliance for the upcoming year. The compliance tests use five-year averaging upstream of Hardy in every year and may also include an additional test based on two-year averaging upstream of Guide Rock. The averaging period and applicable accounting points are determined based on projections of the total irrigation water supplies available to the Nebraska Bostwick Irrigation District and Kansas Bostwick Irrigation District. The current projection is that 2022 will require the use of five-year averaging to measure Nebraska’s Compact compliance upstream of Hardy, but that the additional test of two-year averaging upstream of Guide Rock will not apply.

## 2. Previous year balances

The second key element in the short-term forecast is an evaluation of the recent Compact accounting balances for the State of Nebraska as determined using the current RRCA accounting procedures. These procedures allow for the determination of Nebraska's Compact balance for years through the current year (2021). Nebraska's Compact balances through 2020 have been approved and finalized by the RRCA. The 2021 balances are provisional. The information used to estimate the 2021 Compact balances are presented in Table 1. Nebraska's 2017-2020 RRCA-approved balances and 2021 provisional balances upstream of Guide Rock and Hardy are presented in Table 2.

Table 1. Information Used (acre-feet) for 2021 provisional Accounting.

Item	Information Source
Groundwater Use	Prior years' pumping records
Surface Water Use	Estimated from preliminary data and previous years values
Stream Flow	Provisional records, end-of-year estimated
Evaporation	Prior years' records, provisional, end-of-year estimated records

Table 2. Nebraska's 2017- 2020 RRCA-approved balances and 2021 provisional balances upstream of Guide Rock and Hardy.

Year	RRCA Status	Upstream of Guide Rock Balance*	Upstream of Hardy Balance
2017	Approved	-	35,800
2018	Approved	-	1,500
2019	Approved	-	153,000
2020	Approved	55,800	69,700
2021	Nebraska Provisional	23,400	25,500
2020-2021 Balance		79,200	-
2017-2021 Balance		-	285,500

\* Balances for upstream of Guide Rock are included but not applicable for 2021 compliance.

Note: Values are rounded to the nearest one hundred acre-feet. 2021 values are preliminary and have not been approved by the RRCA.

### 3. Forecast of available water supplies and consumption for 2022

The third key element is the forecast of available water supplies and consumption within Nebraska for the upcoming year. To carry out this forecast, NeDNR uses a simplified method of estimating the streamflow-related available water supply of the Republican River Basin for Nebraska’s use. The water supply forecast is based on eight key variables:

- Surface water consumptive use in Colorado,
- Surface water consumptive use in Kansas,
- Surface water consumptive use in Nebraska,
- Groundwater consumptive use in Colorado,
- Groundwater consumptive use in Kansas,
- Groundwater consumptive use in Nebraska,
- Nebraska’s Imported Water Supply Credit, and
- Surface water flow at the Kansas – Nebraska state line.

These eight variables may be estimated for the next year:

- Surface water consumption in Colorado is estimated using a two-year average,
- Surface water consumption in Kansas is related to the water available for irrigation in Harlan County Lake at the end of each year,
- Surface water consumption in Nebraska is related to water available for irrigation in the five Bureau of Reclamation project reservoirs in Nebraska at the start of each year,
- Groundwater consumption and the Imported Water Supply Credit are estimated in all three states using a two-year average, and
- Streamflow is estimated assuming that the upcoming year is a dry year and is based on the volume of water in Harlan County Lake and the most recent five years of streamflow.

Historically, Nebraska’s share of the available water supply has been approximately half of the total water supply calculated using these methods. The information used to estimate the forecast of the available water supply and allowable depletions for 2022 are summarized in Table 3.

Table 3. Information Used (acre-feet) for 2022 Forecast of Allowable Depletions.

Year	Item	Information Source
2022 Forecast	Groundwater Consumptive Use and Imported Water Supply Credit	Average of 2020 and 2021
	Surface Water Consumptive Use	Colorado: Previous two-year average of T – 1 and T – 2 SwCBCU <sub>co</sub>
		Kansas: + (.1858 x HCL content) + 9,575
		Nebraska: - (0.0000004) x (NE lake volume) <sup>2</sup> + (0.52) x (NE lake volume) – 42,000
Stream Flow	0.41 + (5-year average of previous years’ Stateline Streamflow) + 0.23 x HCL content - 27,450	

Utilizing the data sources outlined in Table 3, the required components of the forecast can be calculated (Table 4).

Table 4. 2022 Forecast values in acre-feet, where GWCBCU is defined as groundwater computed beneficial consumptive use and SWCBCU is defined as surface water computed beneficial consumptive use.

Forecast Component	Forecast Value Upstream of Guide Rock	Forecast Value Upstream of Hardy
Colorado GWCBCU	28,600	28,600
Kansas GWCBCU	14,500	14,500
Nebraska GWCBCU	183,200	185,000
Nebraska Imported Water Supply Credit	20,700	20,700
Colorado SWCBCU	200	200
Kansas SWCBCU	61,600	61,600
Nebraska SWCBCU	97,600	98,100
Streamflows	136,800	159,600

The 2022 Compact balances – of allocations (available water supply), computed beneficial consumptive use (CBCU, groundwater and surface water consumption), and Imported Water Supply Credit – are calculated from the forecast procedures contained in the Monitoring and Studies Technical Memorandum Section of the IMPs (Table 5).

Table 5. Forecast 2022 Allocations (available water supply), Computed Beneficial Consumptive Use (CBCU, groundwater and surface water consumption), Imported Water Supply Credit, and Compact Balances for Guide Rock and Hardy in acre-feet.

Year	Allocation	Computed Beneficial Consumptive Use	Imported Water Supply Credit	Allocation - CBCU + IWS Credit (Balance)
2022 Forecast upstream of Guide Rock	261,200	280,800	20,700	1,100
2022 Forecast upstream of Hardy	273,800	283,000	20,700	11,400

Note: Values are rounded to the nearest one hundred acre-feet.

Combining the results from the three key elements (applicable compliance test for 2022, previous years' balances, and forecast of available water supplies and consumption for 2022), Nebraska's 2018-2022 five-year total balance upstream of Hardy is forecast to be in excess of 10,000 acre-feet positive, and the additional two-year averaging test upstream of Guide Rock will not be applicable (Table 6).

Table 6. 2018-2020 approved Compact balance total upstream of Hardy, 2021 provisional balances upstream of Guide Rock and Hardy, and 2022 forecast balances upstream of Guide Rock and Hardy in acre-feet.

Year	Upstream of Guide Rock Balance*	Upstream of Hardy Balance
2018-2020 total, approved	-	224,200
2021, provisional	23,400	25,500
2022, forecast	1,100	11,400
Two-year (2021-2022) Total	24,500	-
Five-year (2018-2022) Total	-	261,100

\* Balances for upstream of Guide Rock are included but not applicable for 2022 compliance.

Note: Values are rounded to the nearest one hundred acre-feet. 2021 values are preliminary and have not been approved by the RRCA.

### Compact Call Year Evaluation

The Monitoring and Studies Technical Memorandum of the District IMPs specifies the process that will be completed by NeDNR to determine a Compact Call Year. The process of determining if the following year will be a Compact Call Year is completed in two evaluations: one evaluation for the 5-year Hardy balances and one for the 2-year Guide Rock balances. Both evaluations must be completed each year, as shown in Figure 1.

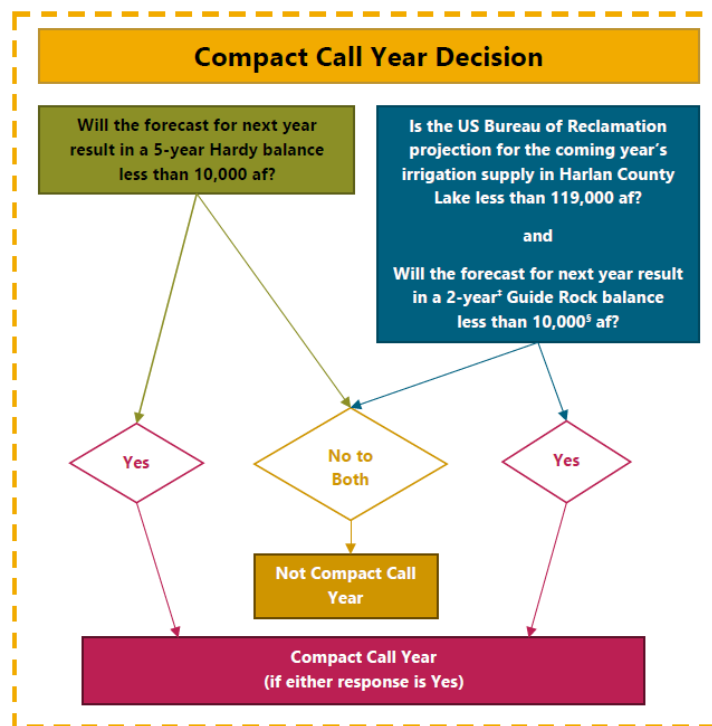


Figure 1. The Compact Call Year decision framework for the Republican River Basin consists of two evaluations: one evaluation for the 5-year Hardy balances and one for the 2-year Guide Rock balances, as illustrated in this figure.

The forecast for 2022 resulted in a 5-year Hardy balance of 261,100 AF. The US Bureau of Reclamation projection for 2022 irrigation supply in Harlan County Lake is 130,000 AF and the 2-year Guide Rock balance is 24,500 AF. Based on review of the IMP evaluations with the information presented in this document, a Compact Call Year designation is not required for 2022.

**Review of Resolution Provisions**

2020 was not designated as a Compact Call Year. The balance of Remaining Compact Compliance Volume (RCCV) was equal to 9,300 acre-feet on January 1, 2020, and was immediately reduced by 20%. An equal volumetric reduction (1,860 acre-feet) is applied to the balance of RCCV for four subsequent years. On January 1, 2021, RCCV was reduced to 5,580 acre-feet, and on January 1, 2022, RCCV will be reduced to 3,720 acre-feet.

**Summary of the Short-Term Forecast for 2022**

Nebraska’s 2022 compliance will be measured by the five-year average upstream of Hardy which is projected to be in excess of 10,000 acre-feet positive. Therefore, the Districts are not expected to have any Compact Call Year obligations for 2022. Additionally, District obligations related to RCCV from previous year carry-over will be reduced as illustrated in Table 7.

Table 7. Remaining Compact Compliance Volume obligation for each District within the Basin in acre-feet after January 1, 2022.

Year	LRNRD	MRNRD	URNRD
Total Remaining Compact Compliance Volume	1,640	1,840	240

**Long-Term Forecast**

Due to the absence of a long-term trend in water supply, the periods of low water supplies in the future are likely to be similar to periods of low water supplies from the past. Historically, the minimum water supplies that have been available to Nebraska were approximately 200,000 acre-feet. Therefore, the amount of water that may be available from streamflow for beneficial use ten years in the future (2032), assuming several consecutive dry years, is estimated to be approximately 200,000 acre-feet. In an effort to continue to ensure long-term Compact compliance through future dry years, the Compliance Standards in the IMPs outline objectives to maintain groundwater depletions at a relatively constant level over the long-term. The NeDNR and Districts will continue to evaluate the trends in long-term groundwater depletions over typical wet and dry cycles and jointly assess whether additional management actions are necessary to accomplish this objective.