

# **Forecast of Allowable Depletions in the Republican Basin During 2017 and 2027**

*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 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 should apply to the upcoming year (2017) and that the long-term forecast should be for a decade later. Therefore, this document includes the dry-year forecast of allowable depletions to streamflow in 2017 and 2027. The NeDNR and the states of 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 Compact compliance during years forecast as Compact Call Years as outlined in the Monitoring sections of the Districts Integrated Management Plans. Compliance with the terms of the Resolution constitutes compliance with the Final Settlement Stipulation and Compact.

## **Short-Term Forecast**

The outcome of NeDNR’s short-term forecast is largely dependent on three key elements. The first key element is the identification of the averaging period that will be utilized for assessing compliance for the upcoming year. The averaging period is determined based on projections of the total irrigation water supplies available to the Nebraska Bostwick Irrigation District and Kansas Bostwick Irrigation District pursuant to Resolution. The current projection is that 2017 will require the use of two-year averaging to measure Nebraska’s Compact compliance upstream of Guide Rock.

The second key element in the short-term forecast is an evaluation of the recent Republican River Compact balances for the State of Nebraska as determined using the current Republican River Compact Administration (RRCA) accounting procedures. These procedures allow for the determination of Nebraska’s Compact balance for years through the current year (2016).

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 has determined a simplified method of estimating the streamflow-related available water supply of the Republican River

Basin for Nebraska’s use. The water supply is related to eight 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, assuming that the upcoming year is a dry year, is estimated from 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 2016 Compact balance as well as forecast the available water supply and allowable depletions for 2017 is summarized in Table 1.

Table 1. Information Used (acre-feet) for 2016 Provisional Accounting and 2017 Forecast of Allowable Depletions.

Year	Item	Information Source
2016 Provisional	Pumping	2015 Pumping records
	Surface Water Use	Estimated from preliminary data and previous years values
	Stream Flow	Provisional records, end of year estimated
	Evaporation	T-1 and 2016 records
2017 Forecast	Groundwater Consumptive Use and Imported Water Supply Credit	Average of 2015 and 2016
	Surface Water Consumptive Use	Colorado: Previous two-year average
		Kansas: + (.1858 x HCL content) + 9,575
		Nebraska: - (0.0000004) x (NE lake volume) <sup>2</sup> + (0.5151) x (NE lake volume) - 41,518
Stream Flow	+ (5-year average of state line flows) x 0.41 + 0.23 x HCL content - 27,450	

Utilizing the data sources outlined in Table 1 the required components of the forecast can be calculated (Table 2).

Table 2. 2017 Forecast values in acre-feet.

Forecast Component	Forecast Value
Colorado GWCBCU	29,570
Kansas GWCBCU	17,210
Nebraska GWCBCU	199,370
Nebraska Imported Water Supply Credit	18,840
Colorado SWCBCU	780
Kansas SWCBCU	45,430
Nebraska SWCBCU	74,730
Stateline Streamflows	73,720*

GWCBCU – defined as groundwater computed beneficial consumptive use  
 SWCBCU – defined as surface water computed beneficial consumptive use  
 \* Denotes values for basin upstream of Hardy

Combining the results from the current RRCA accounting procedures and forecast procedures contained in the Monitoring and Studies Section of the Districts Integrated Management Plans, and the provisional 2015 Compact balance, an early estimate of the 2015-2016 Compact Compliance Volume for 2016 (Table 3), total Remaining Compact Compliance Volume to be applied to 2017 (Table 4), and Nebraska’s 2016 and 2017 Compact balances (Table 5) can be obtained.

Table 3. Estimated Allocations (available water supply), Computed Beneficial Consumptive Use (CBCU, groundwater and surface water consumption), Imported Water Supply Credit, and Compact Compliance Volume and Compact Total for 2015 and 2016 (the 2016 compliance period) in acre-feet.

Year	Allocation	Computed Beneficial Consumptive Use	Imported Water Supply Credit	Allocation - CBCU + IWS Credit
2016 Provisional	203,300	252,900	20,300	-29,300
2015 Provisional Balance				-13,700
2015-2016 Compliance Period CCV				-43,000
2015-2016 Compact Total				0

Note: Values are rounded to the nearest one hundred. The 2015 and 2016 values are based on RRCA accounting procedures at the Guide Rock location. 2015 and 2016 values are not finalized by the RRCA.

Table 4. Total Remaining Compact Compliance Volume at the end of 2016 after 2016 management actions.

2015-2016 Compliance Period CCV	-43,000
2016 Augmentation Water Supply Credit	33,700
<b>RCCV from 2016</b>	<b>-9,300</b>

Note: Values are rounded to the nearest one hundred. The 2015 and 2016 values are based on RRCA accounting procedures at the Guide Rock location. 2015 and 2016 values are not finalized by the RRCA.

Table 5. Forecast Allocations (available water supply), Computed Beneficial Consumptive Use (CBCU, groundwater and surface water consumption), Imported Water Supply Credit, 2016 and 2017 Compact Balances, and Compact Compliance Volume and Total Compact Shortfall for 2016 and 2017 (the projected compliance period for next year) in acre-feet.

Year	Allocation	Computed Beneficial Consumptive Use	Imported Water Supply Credit	Allocation - CBCU + IWS Credit
2017 Forecast	213,900	274,100	18,800	-41,400
2016 Provisional Balance				13,700
2016-2017 Compliance Period CCV (forecast)				-27,700
Total RCCV				-9,300
<b>2016-2017 Total Compact Obligation/Shortfall</b>				<b>-37,000</b>

Note: Values are rounded to the nearest one hundred. The 2016 values are based on RRCA accounting procedures at the Guide Rock location. 2016 values are not finalized by the RRCA. Forecast values are computed at the Guide Rock location.

The 2016-2017 two-year balance sum is -27,700 acre-feet with an additional -9,300 acre-feet of Remaining Compact Compliance Volume. Given that it is currently projected that the two-year averaging period will be in place for 2017 and that the projected balance is negative, a Compact Call Year will be in effect in 2017.

Pursuant to the RRCA Resolution, Nebraska is to make good faith efforts to ensure that by June 1, 2017, the Kansas Account (in Harlan County Lake) contains sufficient water supplies to meet the terms of the Resolution. On November 3, 2016, Kansas requested 20,000 acre-feet to be available in the Kansas Account. Subject to the terms of the Resolution, Kansas may request that any Remaining Compact Compliance Volume, for the 2016 – 2017 balancing period, be made available in the Kansas Account following October 1, 2017.

Due to the Compact Call Year designation for 2017, the Districts Integrated Management Plans requires that each District within the basin that has a projected negative two-year balance submit a plan outlining their proposed management actions to NeDNR by January 31, 2017, describing the actions they will take to ensure that groundwater consumption is less than the District’s allowable groundwater depletions. If NeDNR determines that a District’s management

actions are insufficient, then that District will be required to curtail all groundwater uses in the Ten Percent in Five Year Area. A summary of the District’s provisional 2016 balance, forecast 2017 balance, and summed balances for the compliance period, as well as, the pre- and post-June 1, 2017, Compact requirements are provided in Table 6.

Table 6. Summary of Balances, June 1, 2017, Compact requirements (based on Kansas request pursuant to Resolution), and projected total Remaining Compact Compliance Volume after June 1 management actions for each District within the Basin in acre-feet.

<b>Year</b>	<b>LRNRD</b>	<b>MRNRD</b>	<b>URNRD</b>
2016 Provisional	5,700	-400	-900
2017 Forecast	-12,800	-10,800	-17,800
Two-Year Total	-7,100	-11,200	-18,700
June 1, 2017, Compact Requirement	3,800	6,100	10,100
Projection of Remaining Compact Compliance Volume after June 1 Actions	-3,300	-5,200	-8,600

Note: Values are rounded to the nearest one hundred. The 2016 values are based on current RRCA accounting procedures at the Guide Rock location. 2016 values are not finalized by the RRCA. Forecast values are computed at the Guide Rock location. The provisional 2016 balances for each District reflect the management actions taken in 2016.

If Districts choose to use augmentation pumping as their management action, then sufficient augmentation capacity will be demonstrated by the Districts to ensure Compact compliance based on the forecast. Additionally, the Districts will coordinate to make good faith efforts to pump the augmentation water associated with their NRD management actions prior to June 1, 2017. In addition to the actions that will be taken by the Districts, NeDNR will issue an order designating next year as a Compact Call Year and carry out the necessary administration of natural flow and storage surface water appropriations within the basin. The Department will coordinate with the Districts to provide updated water supply projections throughout 2017 and inform the Districts if Kansas further requests Remaining Compact Compliance Volume in the fall of 2017.

### **Long-Term Forecast**

Due to the absence of a long-term trend in water supply, the lowest water supply in the future is likely to be similar to the lowest available supply in the past. Therefore, the maximum amount of water that may be available from streamflow for beneficial use during 2027, 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 Integrated Management Plans 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 (approximately 12 years) and jointly assess if additional management actions are necessary to accomplish this objective.

## **Summary**

Utilizing the best available information, the current RRCA accounting procedures, and the forecast procedures, it is currently predicted that if next year is dry and the two-year averaging period (2016-2017) is in effect that additional management actions will be necessary to ensure Compact compliance. The implementation of these management actions will be carried out in a manner consistent with the procedures set forth in the Monitoring and Studies Section of the Districts Integrated Management Plans and the RRCA Resolution.