

Attachment 1

Estimate of Nebraska's Cost of Compliance with the Republican River Compact for the Water-Short Year 2006

Report

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I. Background

This report provides estimates of the economic costs that the state of Nebraska would have incurred had the state taken the necessary steps to achieve compliance with the terms of the 1943 Republican River Compact and the May 19, 2003 Final Settlement Stipulation for the Water-Short Year 2006 (averaging years 2005 and 2006). Put another way, the costs computed here can be viewed as the benefits acquired by Nebraska for not being in compliance. Note that this analysis considers only actions necessary to meet the Water-Short Year test for 2006.

In a letter from the Kansas Department of Agriculture to the Republican River Compact Administration dated December 19, 2007, Kansas outlined its remedy for Nebraska non-compliance with the Final Settlement Stipulation. This included the shutdown of wells irrigating 514,610 acres. However, in the short run, Nebraska would have been able to meet the Water-Short Year test for 2006 through the purchase of surface water and a lesser reduction in groundwater acreage. Hence, the cost analysis employed here considers purchasing all available surface water in Nebraska in 2005 and 2006, and then balances out the additional requirements with groundwater shutdowns. This scenario for Water-Short Year 2006 compliance assumes groundwater pumping is stopped on 140,858 and 121,332 irrigated acres in 2005 and 2006, respectively. This represents an area approximately one-half mile either side of the river (Book, 2008).

This scenario to achieve compliance for Water-Short Year 2006 will have a lower cost to Nebraska than the long-run proposal that requires considerably more acres to be retired. However, it also should be pointed out that this short-run estimate likely will not bring Nebraska into long-run compliance and thus the cost estimate provided here should be viewed as a short-run least cost solution. For example, in a future dry year, there may not be enough surface water to purchase to make up the difference had only an average of 131,095 irrigated acres been retired in 2005 and 2006.

II. Direct and indirect economic impacts

The difference in irrigated and non-irrigated cash rents on land is a measure of the direct and easily observable impact of turning irrigated land into non-irrigated land. But, it generally is understood that economic impacts emanate beyond that which can be observed directly. This is due to the interconnected nature of the economy. Businesses buy from and sell to other businesses. Labor earns wages and salaries, and proprietors earn profits that are used to purchase household goods and services. Thus, when an economic change occurs, it sets in motion a "ripple" effect that impacts interlinked economic sectors elsewhere in the economy. This means that the overall economic effect is greater than the direct effect by some increment of value. This is more commonly known as the multiplier effect. By estimating the size of the multiplier effect, it becomes possible to determine the magnitude and direction of the indirect and induced (together referred to here as simply indirect) economic effects that are known to accompany the observable direct economic changes. Impact Analysis for Planning (IMPLAN) software was used to calculate the multiplier effect and estimate the direct and indirect impacts of groundwater retirement on value added to the economy.

Change in crop revenue between irrigated and non-irrigated land is an input required of our IMPLAN analysis. For that number we used the \$217 per acre number provided in table 4 of Supalla et al. (2006), who have computed an economic analysis of Nebraska irrigation in the Republican River Watershed in 2006. Starting with that \$217 per acre difference in crop revenue, our IMPLAN analysis derived a total (direct and indirect) impact to value added (a broad measure of total income and, thus, total state economic welfare) of \$180.20 per acre. Supalla et al. (2006) reported a measure of direct impact of \$82/acre (from table 2 in their report). Hence, this suggests a multiplier of 2.1976 (i.e., $180.20/82$) to go from direct to total impacts. In this report we use the difference in irrigated and non-irrigated land rent as a measure of direct impacts, and subsequently use the multiplier to arrive at indirect or total value-added economic impacts.

III. Additional surface water purchases required in 2005 and 2006

Based on runs from the hydrologic model underlying our analysis, surface water purchased by Nebraska to achieve compliance in 2005 and 2006 could not be delivered to the farm gate in Nebraska for use there by Nebraska's irrigators. Measured at the farm gate, 14,300 acre-feet in 2005 and 32,700 acre-feet in 2006 would not have been available to Nebraska farmers (see Book, 2008 table 5).

IV. Water quantity per acre of land affected

Using the differences between irrigated and non-irrigated land rent as the measure of economic cost requires an estimate of irrigation inches applied per acre to convert acre-feet of water at the farm gate to acres of irrigated production. Based on average irrigation amounts for the affected counties, it was assumed that 11.71 and 11.47 inches of irrigation water were applied per acre in 2005 and 2006, respectively.¹ These application depths correspond to 0.976 and 0.956 acre-foot per acre of land, for 2005 and 2006, respectively, whether associated with stopped groundwater pumping or unused surface water. Because it is assumed that wells near the river are shut down, we assume lost surface water usage cannot be made up with groundwater pumping in areas affected.

V. Dollar values brought to 2008

A 3.41% annual interest rate is used to adjust all time-based dollar values to the present, which is considered to be 2008.² Note once again that this is an analysis of what Nebraska would "owe" Kansas in 2008 for its being out of compliance in only the years 2005 and 2006.

VI. Rents

Table 1 shows rent values used in this analysis and the average number of irrigation inches applied in the 22-county area of the Republican River Basin. For example, the direct impact of stopping groundwater pumping on one acre in 2006 would be \$85.20. Likewise, giving up one acre-foot of water equates to a direct impact of \$89.14 per acre given 11.47 inches of irrigation water (0.956 acre-foot) applied per acre of land.

¹ These are simple averages of county-specific depths used for the baseline scenario based on 1990-2006 climatic conditions. This run is detailed in section 2a of the March 11, 2008 Kansas City RRCA meeting information provided by Nebraska.

² The discount rate is based on the average 3-month T-bill rate from January 2004 through December 2007.

VII. Cost estimate results

The total (direct and indirect) cost associated with retiring 140,858 acres of irrigated land in 2005 and 121,332 acres in 2006 is estimated to be \$53,081,441 in 2008 dollars (Table 2). These retired acreages are based on the assumption that the maximum amount of surface water available would have been purchased, thus making it unavailable to Nebraska producers. This reduction in surface water would have been a total of 47,000 acre-feet (see Book, 2008 table 5), which is estimated to have a total cost, in 2008 dollars, of \$9,844,763 over the 2005 and 2006 years (Table 3). Thus, the total cost to Nebraska of being in compliance under this short-run scenario for the two-year period (2005 and 2006) is \$62,926,203.

VIII. Summary

This report provides estimates of Nebraska's economic gains due to non-compliance with the Compact for Water-Short year 2006. It does this by estimating the economic costs that the state of Nebraska would have incurred had the state taken the necessary steps to achieve short-run compliance with the terms of the 1943 Republican River Compact and the May 19, 2003 Final Settlement Stipulation for this test of compliance.

Kansas has proposed a long-run solution for Nebraska to reach compliance that would require retiring 514,610 acres from irrigated production. Because Nebraska could come into compliance with this particular test of compliance with lesser groundwater acreage reduction, an alternative was considered for this analysis. However, it is important to recognize that the scenario considered here likely would not bring Nebraska into long-run compliance. This scenario assumed Nebraska would purchase the maximum amount of surface water possible so as to minimize the amount of acres irrigated with groundwater that would have to be retired. The 2005 and 2006 cost for this scenario was estimated as \$62,926,203.

The estimate of Nebraska's gains provided by this report involves remedies predicated on reduced groundwater pumping and reduced surface water usage. The number of acres presumed transformed from irrigated to nonirrigated crop land, and the quantities of required surface water reductions, were provided to the economics team (Book, 2008). Other combinations of reduced groundwater usage and/or surface water reductions would yield other estimates of Nebraska's gains.

References

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Tables

Table 1. Nebraska Average Cash Rents per Acre for Irrigated and Nonirrigated Cropland¹

Year	Irrigated	Nonirrigated	Difference	Inches/acre ²	Ac-ft/acre	Diff/ac-ft ³
2003	\$122.20	\$42.00	\$80.20	15.99	1.333	\$60.19
2004	\$125.20	\$44.00	\$81.20	13.25	1.104	\$73.54
2005	\$128.10	\$44.00	\$84.10	11.71	0.976	\$86.18
2006	\$126.70	\$41.50	\$85.20	11.47	0.956	\$89.14
2007	\$137.40	\$45.00	\$92.40	n/a	n/a	n/a
2008	\$164.90	\$54.50	\$110.40	n/a	n/a	n/a

¹ Based on the average of the South and Southwest regions, where each region is a weighted average of center pivot (80%) and gravity irrigation (20%). Source: Johnson

² County-level pumping amounts by year data provided by Nebraska.

³ Diff/ac-ft is the rent difference per acre adjusted to reflect one acre-foot of water.

Table 2. Nebraska's Cost of Reduction of Groundwater Use

Year	Acreage	Rent Difference	Direct Costs	Indirect Costs	Total Costs	Adjusted Total Costs ¹	Cost/Ac-Ft Gained ²
2005	140,858	\$84.10	\$11,846,158	\$14,186,894	\$26,033,052	\$28,788,080	
2006	121,332	\$85.20	\$10,337,486	\$12,380,117	\$22,717,604	\$24,293,361	
Total						\$53,081,441	\$1,171

¹ Adjusted to reflect costs in 2008 dollars.

² Based on a total of 45,316 ac-ft of surface water gained over this time period valued at the farm gate.

Table 3. Nebraska's Cost of Reduction of Surface Water Use

Year	Acre Foot Shortage	Value per Acre Foot	Direct Costs ¹	Indirect Costs	Total Costs	Adjusted Total Costs ²	Cost/Ac-Ft Purchased
2005	14,300	\$86.18	\$1,232,413	\$1,475,931	\$2,708,345	\$2,994,964	\$209.44
2006	32,700	\$89.14	\$2,914,776	\$3,490,720	\$6,405,496	\$6,849,799	\$209.47
Total	47,000		\$4,147,189	\$4,966,651	\$9,113,841	\$9,844,763	\$209.46

¹ Based on acre-foot shortage and the value per acre foot derived from rent differences (Table 1).

² Adjusted to reflect costs in 2008 dollars.