

**Dave Heineman**  
Governor

# STATE OF NEBRASKA

**DEPARTMENT OF NATURAL RESOURCES**  
Brian P. Dunnigan, P.E.  
Director

July 10, 2013

IN REPLY TO:

David Barfield, P.E.  
Kansas Commissioner, RRCA  
Kansas State Engineer  
Division of Water Resources  
109 SW 9<sup>th</sup> Street, 2nd Floor  
Topeka, KS 66612-1283

Dick Wolfe, P.E.  
Colorado Commissioner, RRCA  
Colorado State Engineer  
Colorado Division of Water Resources  
1313 Sherman Street, Room 818  
Denver, CO 80203

RE: Notice of Invocation of Non-Binding Arbitration Pursuant to FSS § VII.B.1; Nebraska Cooperative Republican Platte Enhancement (N-CORPE) Augmentation Plan

Dear Commissioners Barfield and Wolfe:

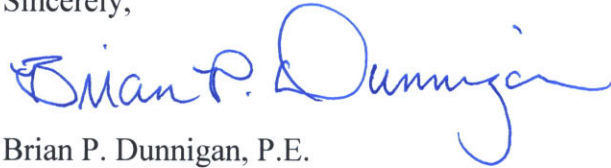
The State of Nebraska hereby notifies the States of Kansas and Colorado that it is invoking non-binding arbitration pursuant to Subsections VII.B.1 (General Dispute Resolution Provisions) and VII.C (Fast Track Dispute Resolution) of the Final Settlement Stipulation (FSS). The issue to be arbitrated and the scope of the dispute are set forth in the letter attached hereto as Exhibit A. The timeframe designation is attached hereto as Exhibit B. A copy of this notice is being provided today to the United States.

The issue to be arbitrated is whether Nebraska's proposed N-CORPE Augmentation Plan (Plan) should be approved as consistent with the FSS. Nebraska submitted the Plan to the RRCA via letter dated June 10, 2013. At a Special Meeting of the Republican River Compact Administration (RRCA) conducted telephonically on July 9, 2013, Nebraska presented a resolution emailed on July 3, 2013 (see Exhibit C) purporting to adopt the proposed Plan. Colorado voted in favor of the resolution; Kansas voted against it.

Commissioners Barfield and Wolfe  
July 10, 2013  
Page 2 of 2

The issue has been submitted to the RRCA and addressed by the RRCA within the meaning of the FSS.

Sincerely,



Brian P. Dunnigan, P.E.  
Director

Enclosures

cc: John Chaffin, U.S. Department of the Interior  
James J. DuBois, U.S. Department of Justice  
Col. Anthony J. Hofmann, U.S. Army Corps of Engineers  
Aaron M. Thompson, U.S. Bureau of Reclamation

**Exhibit A**

**Letter and N-CORPE Augmentation Plan**



**Dave Heineman**  
Governor

# STATE OF NEBRASKA

**DEPARTMENT OF NATURAL RESOURCES**  
Brian P. Dunnigan, P.E.  
Director

June 10, 2013

IN REPLY TO:

David Barfield, P.E.  
Kansas Commissioner, RRCA  
Division of Water Resources  
109 SW 9<sup>th</sup> Street, 2nd Floor  
Topeka, KS 66612-1283

Dick Wolfe, P.E.  
Colorado Commissioner, RRCA  
Colorado Division of Water Resources  
1313 Sherman Street, Room 818  
Denver, CO 80203

RE: Nebraska Cooperative Republican Platte Enhancement (N-CORPE) Augmentation Plan Proposal; Submittal to Republican River Compact Administration (RRCA)

Dear Commissioners Barfield and Wolfe:

The State of Nebraska hereby submits its Nebraska Cooperative Republican Platte Enhancement (N-CORPE) Augmentation Plan Proposal (Proposal) to the RRCA pursuant to Subsection VII.A of the Final Settlement Stipulation (FSS). A complete description of the Proposal is set forth in the attached Exhibit A.

Pursuant to Subsection VII.A.3 of the FSS, Nebraska hereby designates this as a "Fast Track" issue and seeks its resolution within the next 30 days. A timeframe for resolution, including non-binding arbitration (if necessary), is included as Exhibit B. Nebraska proposes to hold a workshop on the Proposal. The workshop would be held via conference call and GoTo meeting. Nebraska proposes Friday, June 28, 2013, for the workshop with Thursday, June 27, 2013, as a backup date. Accordingly, Nebraska requests that the Chairman please schedule a Special Meeting of the RRCA on or before July 10, 2013.

Sincerely,

A handwritten signature in blue ink that reads "Brian P. Dunnigan".

Brian P. Dunnigan, P.E.  
Director

Enclosures

cc: John Chaffin, U.S. Department of the Interior  
James J. DuBois, U.S. Department of Justice  
Col. Anthony J. Hofmann, U.S. Army Corps of Engineers  
Aaron M. Thompson, U.S. Bureau of Reclamation

**Exhibit A**

**Nebraska Cooperative Republican  
Platte Enhancement (N-CORPE)  
Augmentation Project**

**Submitted to the Republican River Compact Administration**

**June 10, 2013**



## I. Project Background and FSS Requirements for Augmentation Projects

The Twin Platte Natural Resources District (TPNRD), Lower Republican Natural Resources District (LRNRD), Middle Republican Natural Resources District (MRNRD), and Upper Republican Natural Resources District (URNRD) are collaboratively developing the Nebraska Cooperative Republican Platte Enhancement (N-CORPE) Project, located in southwest Nebraska (Figure 1). The purpose of this project is to assist Nebraska in maintaining compliance with the Republican River Compact (Compact), and to enhance streamflow in the Platte River Basin.

The N-CORPE Project (Project) involves the retirement of the majority of the 114 existing irrigation wells and the 15,736 certified irrigated acres those wells irrigated. Approximately thirty augmentation wells will be utilized for the Project, providing an optimized capacity and spatial distribution to match the design capacity of the Project. The lands that were previously cropped are being seeded back to natural grasses. Groundwater pumped from the new augmentation wells will be delivered by means of two separate pipelines: one that spans the approximately six miles from the wells to the discharge location directly into Medicine Creek (a tributary of the Republican River), and the other designed to carry water north to the South Platte River.

The Final Settlement Stipulation (FSS) specifically recognizes augmentation as a management tool to facilitate Compact compliance. Augmentation is referenced in three locations throughout the FSS. The first occurs in Section III in the list of exceptions to the moratorium on new wells. Subsection III.B.1.k., states that the moratorium on new wells shall not apply to the following type of wells:

*Wells acquired or constructed by a State for the sole purpose of offsetting stream depletions in order to comply with its Compact Allocations. Provided that, such Wells shall not cause any new net depletion to stream flow either annually or long-term. The determination of net depletions from these Wells will be computed by the RRCA Groundwater Model and included in the State's Computed Beneficial Consumptive Use. **Augmentation plans** and related accounting procedures submitted under this Subsection III.B.1.k. shall be approved by the RRCA prior to implementation [emphasis added].*

The second and third references to augmentation occur in Section IV, which lay out the provisions for Compact accounting under the FSS. Subsection IV.A., states the following:

*The States will determine Virgin Water Supply, Computed Water Supply, Allocations, Imported Water Supply Credit, augmentation credit and Computed Beneficial Consumptive Use based on a methodology set forth in the RRCA Accounting Procedures, attached hereto as Appendix C.*

There presently are no “methodologies” set forth in the Republican River Compact Administration Accounting Procedures and Reporting Requirements (RRCA Accounting Procedures) to determine the augmentation credit referenced in Subsection IV.A. The only additional guidance in the FSS is found in Subsection IV.H.:

*Augmentation credit, as further described in Subsection III.B.1.k., shall be calculated in accordance with the RRCA Accounting Procedures and by using the RRCA Groundwater Model [emphasis added].*

Finally, Subsection I.F. of the FSS provides the following:

*The RRCA may modify the RRCA Accounting Procedures, or any portion thereof, in any manner consistent with the Compact and this Stipulation.*

Taken together, these references suggest the following:

1. If the Project involves the acquisition or construction of augmentation wells in the moratorium area, those wells may not cause a “new net depletion” either annually or over the “long-term.”
2. The RRCA Groundwater Model (Model) will be used to determine the extent of any net depletion and whether such net depletion is “new.”
3. The RRCA Accounting Procedures will be revised to reflect an appropriate methodology for calculating the augmentation credit.
4. The Model will be used in calculating the credit, assuming, of course, that the Project involves an activity that impacts groundwater Computed Beneficial Consumptive Use (CBCU).
5. The RRCA must approve any augmentation plan and related changes to the RRCA Accounting Procedures before a state may receive “augmentation credit” for the project, beyond the effect of simply increasing water supply, which will manifest itself in the current RRCA Accounting Procedures.

The States elaborated on these concepts before Special Master Vincent McKusick in 2003. (Transcript at 81-3; *id.* at 16-17.) Using the example there provided, a State would be entitled to claim as an “augmentation credit” all water pumped to the stream.

## **II. Baseline Conditions of the Project Area**

This section describes the conditions of the project area prior to the acquisition of lands to implement the Project (Figure 2). Table 1 provides information on the certified irrigated acreage of the 114 irrigation wells which were acquired as part of the land purchase. The majority of the cropped lands (irrigated acres and dryland acres) that were acquired as part of this project will be seeded back to natural grasses, and irrigation that previously occurred will be retired permanently.

The portion of the Project area containing augmentation wells is located outside of the moratorium area (see Figures 2 and 3), as defined in the FSS (see Sections III.B.1.a.ii and III.B.1.b), and as a result is not subject to the additional requirements in Section III.B.1.k concerning new net depletions.

### **III. Operational Aspects of the Project**

This section describes the operational conditions of the Project (see Figure 3). The new augmentation wells developed as part of the Project will be used to offset stream depletions to assist the State of Nebraska with Compact compliance efforts. The actual amount delivered in any one year will be subject to current conditions affecting Nebraska's Compact compliance outlook, and any additional State objectives. During years in which the State of Nebraska is operating the project to ensure Compact compliance (termed Compact Operation Years), groundwater pumping will likely exceed the average annual historical groundwater pumping for irrigation in the Project area. If the Project is operated in other intervening years to meet State objectives, groundwater pumping will be significantly less than the average annual historical groundwater pumping. Overall, average annual groundwater pumping under the Project may significantly exceed the average annual historical groundwater pumping (the moratorium in the FSS does not apply to this area as discussed above).

The Project is being designed with the capacity to provide an augmentation delivery of approximately 60,000 acre-feet in a given year. Nebraska will notify the states by April 1, prior to the initiation of Project operations in the upcoming year, to inform them of the volume of water that is intended to be pumped by the Project. The groundwater pumping associated with the new augmentation wells will be incorporated into the Model on an annual basis and any groundwater CBCU resulting from Project operations will be charged to the State of Nebraska. A detailed analysis of potential net depletions associated with Project operations relative to historical conditions is described in Section IV.

The augmentation water delivered to Medicine Creek via the Project pipeline will be measured and incorporated into the RRCA Accounting Procedures. Details of the RRCA Accounting Procedure modifications necessary to properly account for the Augmentation Water Supply (AWS) Credit are described in Section V and Appendix A.

### **IV. Groundwater Modeling Analysis of the Project**

As noted above, Nebraska plans to operate the Project in a significantly different pattern of total annual pumping and with average annual groundwater pumping that may significantly exceed the historical average annual groundwater pumping for irrigation. While this type of operation is permissible under the FSS, Nebraska understands that the States may have questions about the overall effect that such a change may have with regard to CBCU. Therefore, this section describes two evaluations of any change in the groundwater CBCU with respect to potential augmentation deliveries to address questions or concerns that may be raised by the other States.

The change in groundwater CBCU, or new depletion, is determined by comparing the groundwater CBCU under the baseline (i.e., groundwater pumping for irrigation in the Project area) simulation of the Model to the groundwater CBCU that results from a Model simulation with the Project operating under this augmentation plan. Then, any new depletion is compared to the AWS Credit in that same year to determine the net streamflow accretion



benefit from Project operations. The analysis in this section evaluates operations under a historical period scenario and operations under a hypothetical future scenario.

***A. Net Streamflow Accretion Benefits from Project Operations When Assessed Against Historical Baseline Conditions***

This analysis evaluates hypothetical Project operations under historical circumstances that may have warranted operation of the Project. The 1985-2010 period was chosen for this historical scenario to represent a reasonably long historic period while capturing multiple cycles of Compact Operation Years. The historic groundwater CBCU under baseline Project conditions is represented by the Model simulations for the period 1985 through 2010 (26 years). The Model files used in this baseline simulation were intended to be consistent with the historical files developed for assisting with the RRCA annual accounting. These same Model simulations were then updated to reflect how Project operations may have functioned through this period. The key difference for the Model simulation of Project operations is that the historical recharge due to irrigation, and groundwater pumping, was modified for those Model cells which correspond to the Project area.

The recharge was modified to remove the additional recharge associated with irrigation for the entire simulation period, since irrigation would not occur on the majority of Project lands under augmentation operations. The baseline pumping conditions were modified to reflect a volume of 60,000 acre-feet during Compact Operation Years (Table 2). This is not intended to imply that Project pumping of 60,000 acre-feet per year would have been necessary for Compact compliance in all or any of these years; the single value was adopted in the scenario for simplicity and to demonstrate a likely potential maximum impact of Project operations. Documentation and model files for this simulation are contained in Appendix B.

The Compact Operation Years include 1988-1991 and 2002-2006. The Compact Operation Years were chosen from the historical record as they represent periods of lower water supplies when it is more likely that the Project would be operated to offset a projected shortfall in Nebraska's Compact balance. The results of the historical simulation under Project operations, as compared to historical operations, are summarized in Table 3 and Figure 4. Under the Project operations described in Table 2, these Project operations would result in large increases to streamflow (i.e., approximately 60,000 acre-feet) during years with Project pumping, and would potentially cause only very small (i.e., hundreds of acre-feet) additional depletions (i.e., negative accretion benefits) when Project pumping was not occurring.

***B. Net Depletions of Project Operations When Assessed Against Future Baseline Conditions***

The second analysis of Project operations was to evaluate Project operations under a hypothetical future scenario. The scenario employed was created by the State of Kansas for expert reports generated in 2011 for Kansas v. Nebraska and Colorado, Original No. 126. It is recognized that this scenario represents one of an infinite number of potential future scenarios and in no way serves as a barometer of what future conditions may be.

This analysis is simply presented to illustrate how Project operations will likely impact streamflow over the long-term.

This portion of the analysis was completed by comparing the results of a simulation of hypothetical future conditions for the period 2010-2069 for the following conditions:

1. The certified irrigated acres continue to be irrigated in a manner consistent with the historical hydrology, with some consideration for current regulations.
2. With the irrigation removed and the Project operated to provide augmentation deliveries during Compact Operation Years.

This hypothetical future scenario was developed by repeating the years 1995-2009 four times into the future. The key difference for the Model simulation of Project operations is that the recharge due to irrigation, and groundwater pumping, were modified for those Model cells which correspond to the Project area.

The recharge was modified to remove the additional recharge associated with irrigation for the entire simulation period, since irrigation would not occur on Project lands under augmentation operations. The baseline pumping conditions were modified to reflect a volume of 60,000 acre-feet during Compact Operation Years, and zero pumping during other years (Table 4). This is not intended to imply that Project pumping of 60,000 acre-feet per year will be necessary for Compact compliance in any particular year in the future; the single value was adopted in the scenario for simplicity and to demonstrate a likely potential maximum impact of Project operations. Documentation and model files for this simulation are contained in Appendix B.

The results of the future scenario under Project operations, as compared to historical operations, are summarized in Table 5 and Figure 5. Under the Project operations described in Table 4, these Project operations will result in large increases to streamflow (i.e., nearly 60,000 acre-feet) during years with Project pumping, and will potentially cause additional depletions (i.e., negative accretion benefits) that increase to only about 1,400 acre-feet per year after 60 years during years when Project pumping is not occurring.

## **V. RRCA Accounting Procedure Modifications for Augmentation Credit Calculations**

The examples above demonstrate how the Model will determine any new depletion from the operation of the Project. Modifications to the RRCA Accounting Procedures are required to incorporate the AWS Credit to be provided in conjunction with the Project. The August 12, 2010, version of the RRCA Accounting Procedures is included as Appendix A, with the modifications required to implement this proposal indicated in red-line format. Below is an example of the current RRCA sub-basin calculations for determining the Virgin Water Supply (VWS) from the gaged streamflows (Gage), the CBCU, and the Imported Water Supply Credit (IWS). The VWS is used to determine the allocations for Kansas and Nebraska in the Medicine Creek subbasin. Nebraska's allocation is then used, in conjunction with Nebraska's CBCU and the IWS, to determine Nebraska's balance in the Medicine Creek subbasin.

This simple example is further expanded to illustrate how Nebraska’s proposed modifications to the RRCA Accounting Procedures would incorporate the AWS. For the following examples it is assumed that all consumptive use in the Medicine Creek subbasin is derived from groundwater pumping. The amount of groundwater CBCU, as determined by the Model, is 1,000 acre-feet without the augmentation pumping and increases to 1,100 acre-feet with augmentation pumping. The subbasin gaged streamflow is assumed to be 1,000 acre-feet without augmentation. The streamflow increases to 60,900 acre-feet with 60,000 acre-feet of augmentation pumping. The 60,900 acre-feet value that represents subbasin gage flows with augmentation pumping is derived by taking the original 1,000 acre-feet gage value, subtracting 100 acre-feet based on the increase in CBCU from 1000 acre-feet to 1,100 acre-feet, and adding the 60,000 acre-feet of water delivered to the stream via the project pipeline. The magnitudes of all values used in these examples are for illustrative purposes, only.

***Current RRCA Accounting Procedures for Medicine Creek Subbasin:***

$$\text{VWS} = \text{Gage} + \text{All CBCU} - \text{IWS}$$

$$\text{VWS} = 1,000 + 1,000 - 400 = 1,600$$

$$\text{Nebraska Allocation} = 0.5355^1 * 1,600 = 857$$

$$\text{Kansas Allocation} = 0.4645 * 1,600 = 743$$

$$\text{Nebraska Balance in Medicine Creek Subbasin} = \text{Nebraska Allocation} - \text{Nebraska CBCU} + \text{IWS} = 857 - 1,000^2 + 400 = 257$$

***Proposed RRCA Accounting Procedures that include Project Operations:***

$$\text{VWS} = \text{Gage} + \text{All CBCU} - \text{IWS} - \text{AWS Credit}$$

$$\text{VWS} = [1,000 - 100 + 60,000] + 1,100 - 400 - 60,000 = 60,900 + 1,100 - 400 - 60,000 = 1,600$$

$$\text{Nebraska Allocation} = 0.5355 * 1,600 = 857$$

$$\text{Kansas Allocation} = 0.4645 * 1,600 = 743$$

$$\text{Nebraska Balance in Medicine Creek Subbasin} = \text{Nebraska Allocation} - \text{Nebraska CBCU} + \text{IWS} + \text{AWS Credit} = 857 - 1,100 + 400 + 60,000 = 60,157$$

As shown in the results above, the modified accounting procedures account for the project operations appropriately by increasing Nebraska’s balance under Project operations by 59,900 acre-feet, the net impact of operating the Project under this example (60,000 acre-feet of pumping into the stream minus the increase of 100 acre-feet in CBCU). The Kansas (and Nebraska) allocation is unaffected because the VWS does not change.

---

<sup>1</sup> The allocation percentages for both Nebraska and Kansas include each state’s share of the unallocated water supply and assume that the VWS is equivalent to the CWS (i.e., no flood flows included).

<sup>2</sup> Assumes all CBCU is assigned to Nebraska.

The Main Stem accounting procedures would remain unchanged as the necessary modifications are reflected in the Designated Drainage Basin<sup>3</sup> where the Augmentation Plan is being implemented. Examples of the impact of the AWS Credit on the final Compact Accounting Balance for Tables 3C and 5C are illustrated below (Tables 6 and 7)<sup>4</sup>. Similar modifications to those made to Tables 3C and 5C of the RRCA Accounting Procedures would also be made to Tables 5D and 5E.

## VI. Alternative State-Based Operation

While not required by the FSS, as explained above, Nebraska presently contemplates additional pumping outside of Compact Operation Years designed to accomplish State-based objectives. This additional State-based pumping would be targeted at offsetting any new depletions that occur outside of Compact Operation Years. Therefore, the following examples build on the scenarios developed above to include additional State-based pumping, for both historical and future scenarios, respectively. The modifications to the RRCA Accounting Procedures for regular Project Operations, as shown in Section V, would also be used to assess the accounting impacts from State-based pumping. While Nebraska does not require, and does not seek, RRCA approval of these additional operations for State-based objectives, Nebraska is notifying the RRCA of this possibility in the spirit of transparency and providing the following examples to address questions or concerns that may be raised by the other States.

The first example demonstrates the effect of additional State-based pumping under the historical scenario. The years for the simulation when this additional pumping would occur include 1985-1987, 1992-2001, and 2007-2010. In this example, the baseline pumping conditions were modified in a manner that included groundwater pumping of 1,800 acre-feet during years with additional State-based pumping (17 of 26 years) and a volume of 60,000 acre-feet during Compact Operation Years (Table 8). The minimum pumping value of 1,800 acre-feet was adopted as the pumping volume for State-based pumping in this scenario because it was determined to be more than sufficient to offset any new depletion related to Compact Operation Years and it would be approximately representative of the magnitude of pumping during these years. The additional State-based pumping would result in accretion benefits in all of the historic years, as shown in Table 9. Furthermore, the increase in new depletions with the addition of the State-based pumping is very small. Documentation and model files for this simulation are also contained in Appendix B.

Under the future conditions scenario, for conditions with additional State-based pumping, the baseline pumping conditions were modified in a manner that reduced groundwater pumping to 1,800 acre-feet during years with additional State-based pumping (40 of 60 years) and modified groundwater pumping to reflect a volume of 60,000 acre-feet during Compact Operation Years (Table 10). This example would exceed Compact requirements, by ensuring accretion benefits in all years, should the State of Nebraska choose to adopt that objective. The minimum pumping value of 1,800 acre-feet was adopted as the pumping volume in this scenario because it was determined to be more than sufficient to offset any new depletion related to Compact Operation Years. The additional State-based pumping would result in

<sup>3</sup> As defined in the RRCA Accounting Procedures pg. 6.

<sup>4</sup> The values contained in Tables 6 and 7 are for illustrative purposes only.

accretion benefits in all of the future conditions years, as shown in Table 11. Again, the increase in new depletions with the addition of the State-based pumping is very small. Documentation and model files for this simulation are also contained in Appendix B.

## **VII. Summary**

This report has described the required elements of an augmentation plan located outside of the moratorium area pursuant to the requirements set forth in the FSS. Nebraska has included additional elements within this plan, beyond those strictly required by the FSS, to accommodate previous comments provided by the other states, to address any concerns the states may have related to data sharing and future tracking of Project operations, and to demonstrate additional potential operations of the Project to meet State-based objectives. Nebraska submits this plan with time being of the essence and seeks the good faith efforts of the states in working to implement this plan in a timely fashion.

Well ID	2012 Certified Acres
38498	133.1
38610	126.4
53163	123.4
53164	136.6
53165	128.2
53166	131.1
53167	130.3
54001	133.2
54002	133.2
56570	130.9
57725	130.7
57726	132
57727	132.8
57728	134.7
57729	132.4
57730	133.9
64073	127.3
64074	133.3
64075	130.1
66054	131.4
66056	125.9
69199	135.8
69200	133
69426	135.3
69427	133.8
69428	137.6
69429	137
69430	138
69532	129.8
71281	196.6
72762	133.79
72763	116.02
72764	116.52
72765	139.84
72766	139.67
72767	114.9
72768	115.89
72769	135.42
72770	136.05
72771	139.72
72772	138.88
72773	136.33
72774	125.4
72775	124.4
72776	128.7
72777	131.2
72778	125.6
72779	125.6
72780	135
72781	132
72782	130.1
72783	131.1
72784	132.1
72785	128.4
72786	131.2
72787	133.2
72788	126.4
72789	130.1
72790	132.6
72791	127.7
72792	131.1
72793	129.3
72794	126.2
73823	129.2
73824	131.1

73825	133.3
73826	133.3
75381	132.59
75382	131.88
75383	130.95
75384	133.29
75385	140.72
75386	130.03
75387	138.59
75388	137.75
75389	142.06
75390	139.64
75391	139.09
75392	138.67
75393	141.36
75394	140.57
75395	136.96
75396	141.68
75397	135.2
75398	136.1
75399	133.3
75400	131.8
75401	134
75402	136.5
75403	133.4
75404	133.9
75405	134.7
75406	136.9
75407	132.3
75408	133.1
75409	134.7
75410	132.5
75411	132.7
75412	134.8
77643	140.02
77644	137.55
77645	136.38
77646	136.42
80952	365
80955	300
80956	290
114336	134.48
135853	127.42
135854	125.92
135869	132.5
135870	128.58
144226	136.56
144227	136.18
144337	132.57
TOTAL	15,736.44

**Table 1: Historical Certified Acres.**

Year	Groundwater Pumping under Project Operations
1985	0
1986	0
1987	0
1988	60,000
1989	60,000
1990	60,000
1991	60,000
1992	0
1993	0
1994	0
1995	0
1996	0
1997	0
1998	0
1999	0
2000	0
2001	0
2002	60,000
2003	60,000
2004	60,000
2005	60,000
2006	60,000
2007	0
2008	0
2009	0
2010	0

**Table 2. Groundwater pumping incorporated into the historical project operations simulation (ac-ft).**



Year	New Depletion	AWS Credit	Accretion Benefit
1985	-2	0	2
1986	-26	0	26
1987	-62	0	62
1988	-99	60,000	60,099
1989	-134	60,000	60,134
1990	-156	60,000	60,156
1991	-151	60,000	60,151
1992	-102	0	102
1993	3	0	-3
1994	141	0	-141
1995	257	0	-257
1996	345	0	-345
1997	399	0	-399
1998	422	0	-422
1999	442	0	-442
2000	431	0	-431
2001	401	0	-401
2002	356	60,000	59,644
2003	327	60,000	59,673
2004	317	60,000	59,683
2005	344	60,000	59,656
2006	404	60,000	59,596
2007	526	0	-526
2008	655	0	-655
2009	795	0	-795
2010	918	0	-918

**Table 3: Simulated new depletion under project operations groundwater pumping, AWS credit, and the accretion benefit of project operation to the stream (negative depletion values indicate an accretion to streamflow). Accretion Benefit = AWS credit - New Depletion. Values in ac-ft.**

Year	Groundwater Pumping under Project Operations
2010	0
2011	0
2012	0
2013	0
2014	0
2015	0
2016	0
2017	60,000
2018	60,000
2019	60,000
2020	60,000
2021	60,000
2022	0
2023	0
2024	0
2025	0
2026	0
2027	0
2028	0
2029	0
2030	0
2031	0
2032	60,000
2033	60,000
2034	60,000
2035	60,000
2036	60,000
2037	0
2038	0
2039	0
2040	0
2041	0
2042	0
2043	0
2044	0
2045	0
2046	0
2047	60,000
2048	60,000
2049	60,000
2050	60,000
2051	60,000
2052	0
2053	0
2054	0
2055	0
2056	0
2057	0
2058	0
2059	0

2060	0
2061	0
2062	60,000
2063	60,000
2064	60,000
2065	60,000
2066	60,000
2067	0
2068	0
2069	0

**Table 4. Groundwater pumping incorporated into the future project operations scenario. Values in ac-ft.**

Year	New Depletion	AWS Credit	Accretion Benefit
2010	-1	0	1
2011	-14	0	14
2012	-31	0	31
2013	-63	0	63
2014	-103	0	103
2015	-138	0	138
2016	-181	0	181
2017	-215	60,000	60,215
2018	-273	60,000	60,273
2019	-312	60,000	60,312
2020	-306	60,000	60,306
2021	-251	60,000	60,251
2022	-170	0	170
2023	-38	0	38
2024	105	0	-105
2025	230	0	-230
2026	327	0	-327
2027	377	0	-377
2028	399	0	-399
2029	419	0	-419
2030	396	0	-396
2031	380	0	-380
2032	332	60,000	59,668
2033	304	60,000	59,696
2034	272	60,000	59,728
2035	275	60,000	59,725
2036	322	60,000	59,678
2037	423	0	-423
2038	546	0	-546
2039	685	0	-685
2040	797	0	-797
2041	893	0	-893
2042	924	0	-924
2043	924	0	-924
2044	952	0	-952
2045	895	0	-895
2046	875	0	-875
2047	790	60,000	59,210
2048	785	60,000	59,215
2049	740	60,000	59,260
2050	734	60,000	59,266
2051	756	60,000	59,244
2052	877	0	-877
2053	975	0	-975
2054	1103	0	-1,103
2055	1201	0	-1,201
2056	1298	0	-1,298
2057	1305	0	-1,305
2058	1291	0	-1,291
2059	1316	0	-1,316
2060	1243	0	-1,243
2061	1223	0	-1,223

2062	1102	60,000	58,898
2063	1110	60,000	58,890
2064	1064	60,000	58,936
2065	1045	60,000	58,955
2066	1054	60,000	58,946
2067	1184	0	-1,184
2068	1273	0	-1,273
2069	1389	0	-1,389

**Table 5: Simulated future new depletion under project operations groundwater pumping, AWS credit, and the accretion benefit of project operations to the stream (negative depletion values indicate an accretion to streamflow). Accretion Benefit = AWS credit - New Depletion. Values in ac-ft.**

Nebraska				
	Col. 1	Col. 2	Col. 3	Col. 4
Year	Allocation	Computed Beneficial Consumptive Use	Imported Water Supply Credit <b>and/or Augmentation Water Supply Credit</b>	Difference between Allocation and the Computed Beneficial Consumptive Use offset by Imported Water Supply Credit and/or Augmentation Water Supply Credit Col 1 - (Col 2 - Col 3)
Year 2002	236,550	265,910	13,996	-15,364
	236,550	265,910	13,996	-15,364
Year 2003	227,580	262,780	9,782	-25,418
	227,580	262,780	9,782	-25,418
Year 2004	205,630	252,650	10,386	-36,634
	205,630	252,650	10,386	-36,634
Year 2005	199,450	<b>254,740</b>	<b>71,965</b>	<b>16,675</b>
	199,450	253,740	11,965	-42,325
Current Year 2006	187,090	<b>229,420</b>	<b>72,214</b>	<b>29,884</b>
	187,090	228,420	12,214	-29,116
Average	211,260	<b>253,100</b>	<b>35,670</b>	<b>-6,170</b>
	211,260	252,700	11,670	-29,770

**Table 6. Example of RRCA Accounting Procedure Table 3C Results with the Augmentation Water Supply Credit (top values in each column) and without the Augmentation Water Supply Credit (bottom values in each column). The gray shaded years (2005-2006) represent Compact Operation Years in which hypothetical new depletions (1,000 acre-feet) and deliveries (60,000 acre-feet) of operating the project are superimposed on the historical accounting data. Bold values represent data values that differ from the historical values due to project operations.**

Nebraska								
Year	Allocation			Computed Beneficial Consumptive Use			Imported Water Supply Credit and/or Augmentation Water Supply Credit	Difference Between Allocation and the Computed Beneficial Consumptive Use offset by Imported Water Supply Credit and/or Augmentation Water Supply Credit Above Guide Rock
Column	Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8
	State Wide Allocation	Allocation below Guide Rock	State Wide Allocation above Guide Rock	State Wide CBCU	CBCU below Guide Rock	State Wide CBCU above Guide Rock	Credits above Guide Rock	Col 3 - (Col 6 - Col 7)
Previous Year (2005)	199,450	4,586	194,864	<b>254,740</b>	4,052	<b>250,688</b>	<b>71,965</b>	<b>16,141</b>
	199,450	4,586	194,864	253,740	4,052	249,688	11,965	-42,859
Current Year (2006)	187,090	2,286	184,804	<b>229,420</b>	3,057	<b>226,363</b>	<b>72,214</b>	<b>30,655</b>
	187,090	2,286	184,804	228,420	3,057	225,363	12,214	-28,345
Average	193,270	3,440	189,830	<b>242,080</b>	3,550	<b>238,530</b>	<b>72,090</b>	<b>23,390</b>
	193,270	3,440	189,830	241,080	3,550	237,530	12,090	-35,610

**Table 7. Example of RRCA Accounting Procedure Table 5C Results with the Augmentation Water Supply Credit (top values in each column) and without the Augmentation Water Supply Credit (bottom values in each column). The gray shaded years (2005-2006) represent Compact Operation Years in which hypothetical new depletions (1,000 acre-feet) and deliveries (60,000 acre-feet) of operating the project are superimposed on the historical accounting data. Bold values represent data values that differ from the historical values due to project operations.**

Year	Groundwater Pumping under State-Based Operations
1985	1,800
1986	1,800
1987	1,800
1988	60,000
1989	60,000
1990	60,000
1991	60,000
1992	1,800
1993	1,800
1994	1,800
1995	1,800
1996	1,800
1997	1,800
1998	1,800
1999	1,800
2000	1,800
2001	1,800
2002	60,000
2003	60,000
2004	60,000
2005	60,000
2006	60,000
2007	1,800
2008	1,800
2009	1,800
2010	1,800

**Table 8: Groundwater pumping incorporated into the historical project operations simulation, with State-Based Operations that include additional State-based Pumping. Values in ac-ft.**



Year	Project Operations			State-Based Operations			Additional Depletion from Additional State-based Pumping
	New Depletion	AWS Credit	Accretion Benefit	New Depletion	AWS Credit	Accretion Benefit	
1985	-2	0	2	-2	1,800	1,802	0
1986	-26	0	26	-26	1,800	1,826	0
1987	-62	0	62	-62	1,800	1,862	1
1988	-99	60,000	60,099	-96	60,000	60,096	2
1989	-134	60,000	60,134	-129	60,000	60,129	5
1990	-156	60,000	60,156	-148	60,000	60,148	9
1991	-151	60,000	60,151	-139	60,000	60,139	12
1992	-102	0	102	-86	1,800	1,886	15
1993	3	0	-3	21	1,800	1,779	18
1994	141	0	-141	160	1,800	1,640	19
1995	257	0	-257	279	1,800	1,521	22
1996	345	0	-345	371	1,800	1,429	26
1997	399	0	-399	430	1,800	1,370	30
1998	422	0	-422	457	1,800	1,343	35
1999	442	0	-442	484	1,800	1,316	42
2000	431	0	-431	478	1,800	1,322	47
2001	401	0	-401	453	1,800	1,347	53
2002	356	60,000	59,644	413	60,000	59,587	57
2003	327	60,000	59,673	393	60,000	59,607	66
2004	317	60,000	59,683	389	60,000	59,611	73
2005	344	60,000	59,656	422	60,000	59,578	78
2006	404	60,000	59,596	484	60,000	59,516	80
2007	526	0	-526	612	1,800	1,188	86
2008	655	0	-655	742	1,800	1,058	87
2009	795	0	-795	883	1,800	917	88
2010	918	0	-918	1,008	1,800	792	89

**Table 9: Comparison of Project Operations and State-Based Operations with simulated new depletion under groundwater pumping, AWS credit, and accretion benefit to the stream (negative depletion values indicate an accretion to streamflow). Accretion Benefit = AWS credit - New Depletion. Values in ac-ft.**

Year	Groundwater Pumping with State-Based Operations
2010	1,800
2011	1,800
2012	1,800
2013	1,800
2014	1,800
2015	1,800
2016	1,800
2017	60,000
2018	60,000
2019	60,000
2020	60,000
2021	60,000
2022	1,800
2023	1,800
2024	1,800
2025	1,800
2026	1,800
2027	1,800
2028	1,800
2029	1,800
2030	1,800
2031	1,800
2032	60,000
2033	60,000
2034	60,000
2035	60,000
2036	60,000
2037	1,800
2038	1,800
2039	1,800
2040	1,800
2041	1,800
2042	1,800
2043	1,800
2044	1,800
2045	1,800
2046	1,800
2047	60,000
2048	60,000
2049	60,000
2050	60,000
2051	60,000
2052	1,800
2053	1,800
2054	1,800
2055	1,800
2056	1,800
2057	1,800
2058	1,800
2059	1,800

2060	1,800
2061	1,800
2062	60,000
2063	60,000
2064	60,000
2065	60,000
2066	60,000
2067	1,800
2068	1,800
2069	1,800

**Table 10: Groundwater pumping incorporated into the future project operations simulation, with State-Based Operations that include additional State-based Pumping. Values in ac-ft.**

Year	Project Operations			State-Based Operations			Additional Depletion from Additional State-based Pumping
	New Depletion	AWS Credit	Accretion Benefit	New Depletion	AWS Credit	Accretion Benefit	
2010	-1	0	1	-1	1,800	1,801	0
2011	-14	0	14	-14	1,800	1,814	0
2012	-31	0	31	-30	1,800	1,830	1
2013	-63	0	63	-61	1,800	1,861	2
2014	-103	0	103	-97	1,800	1,897	6
2015	-138	0	138	-128	1,800	1,928	10
2016	-181	0	181	-168	1,800	1,968	13
2017	-215	60,000	60,215	-198	60,000	60,198	17
2018	-273	60,000	60,273	-248	60,000	60,248	25
2019	-312	60,000	60,312	-281	60,000	60,281	31
2020	-306	60,000	60,306	-272	60,000	60,272	34
2021	-251	60,000	60,251	-212	60,000	60,212	39
2022	-170	0	170	-125	1,800	1,925	45
2023	-38	0	38	9	1,800	1,791	47
2024	105	0	-105	153	1,800	1,647	48
2025	230	0	-230	279	1,800	1,521	49
2026	327	0	-327	381	1,800	1,419	54
2027	377	0	-377	436	1,800	1,364	59
2028	399	0	-399	464	1,800	1,336	65
2029	419	0	-419	485	1,800	1,315	66
2030	396	0	-396	467	1,800	1,333	71
2031	380	0	-380	459	1,800	1,341	79
2032	332	60,000	59,668	411	60,000	59,589	79
2033	304	60,000	59,696	394	60,000	59,606	90
2034	272	60,000	59,728	369	60,000	59,631	97
2035	275	60,000	59,725	374	60,000	59,626	99
2036	322	60,000	59,678	420	60,000	59,580	98
2037	423	0	-423	531	1,800	1,269	108
2038	546	0	-546	652	1,800	1,148	106
2039	685	0	-685	791	1,800	1,009	106
2040	797	0	-797	904	1,800	896	107
2041	893	0	-893	1005	1,800	795	112
2042	924	0	-924	1037	1,800	763	113
2043	924	0	-924	1036	1,800	764	112
2044	952	0	-952	1072	1,800	728	120
2045	895	0	-895	1015	1,800	785	120
2046	875	0	-875	1003	1,800	797	128
2047	790	60,000	59,210	914	60,000	59,086	124
2048	785	60,000	59,215	918	60,000	59,082	133
2049	740	60,000	59,260	878	60,000	59,122	138
2050	734	60,000	59,266	878	60,000	59,122	144
2051	756	60,000	59,244	898	60,000	59,102	142
2052	877	0	-877	1029	1,800	771	152
2053	975	0	-975	1124	1,800	676	149
2054	1103	0	-1,103	1250	1,800	550	147
2055	1201	0	-1,201	1348	1,800	452	147
2056	1298	0	-1,298	1447	1,800	353	149
2057	1305	0	-1,305	1453	1,800	347	148
2058	1291	0	-1,291	1437	1,800	363	146

2059	1316	0	-1,316	1470	1,800	330	154
2060	1243	0	-1,243	1395	1,800	405	152
2061	1223	0	-1,223	1381	1,800	419	158
2062	1102	60,000	58,898	1253	60,000	58,747	151
2063	1110	60,000	58,890	1275	60,000	58,725	165
2064	1064	60,000	58,936	1233	60,000	58,767	169
2065	1045	60,000	58,955	1217	60,000	58,783	172
2066	1054	60,000	58,946	1225	60,000	58,775	171
2067	1184	0	-1,184	1363	1,800	437	179
2068	1273	0	-1,273	1451	1,800	349	178
2069	1389	0	-1,389	1564	1,800	236	175

**Table 11: Comparison of Project Operations and State-Based Operations with simulated future new depletion under groundwater pumping, AWS credit, and accretion benefit to the stream (negative depletion values indicate an accretion to streamflow). Accretion Benefit = AWS credit - New Depletion. Values in ac-ft.**

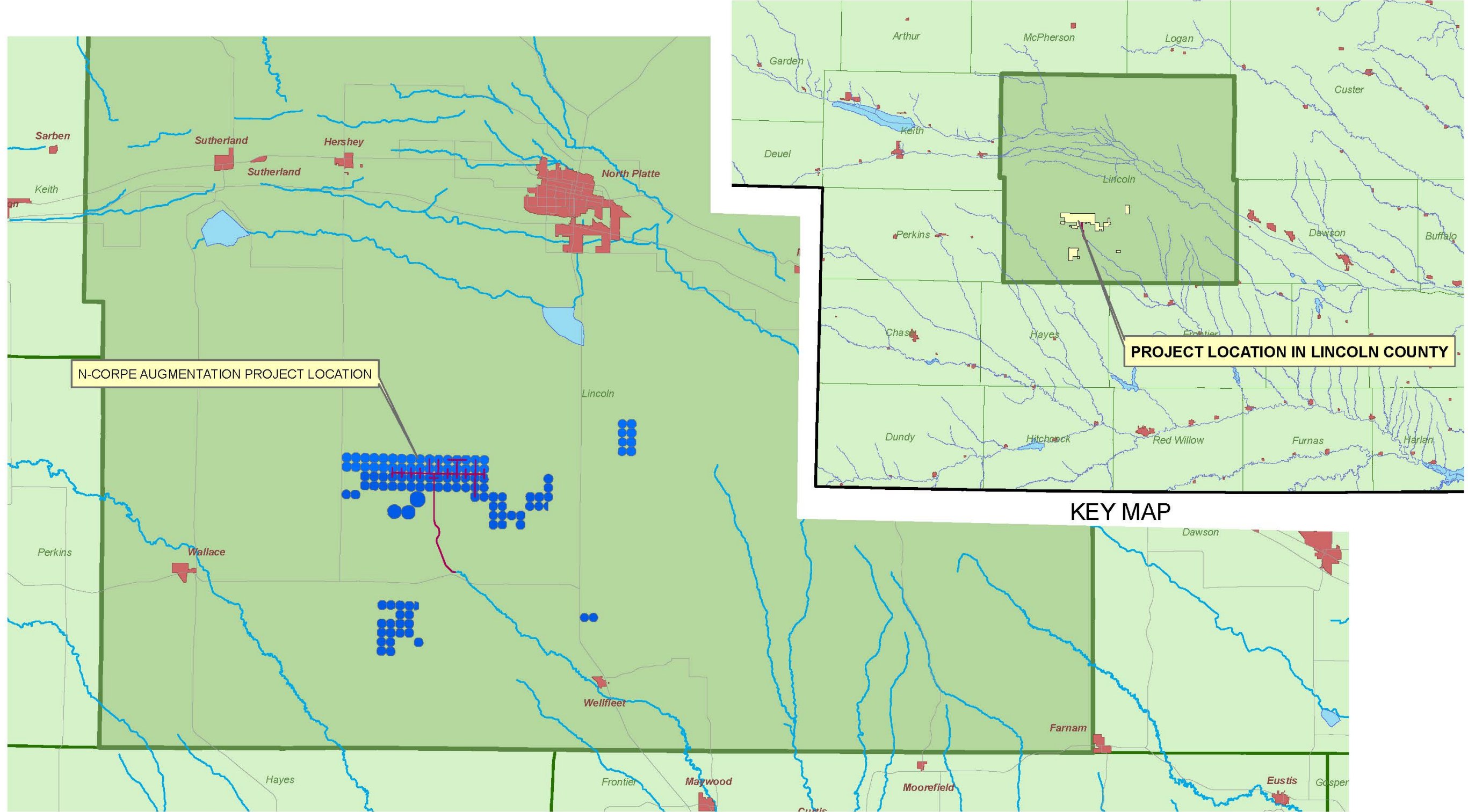


FIGURE 1: PROJECT LOCATION MAP

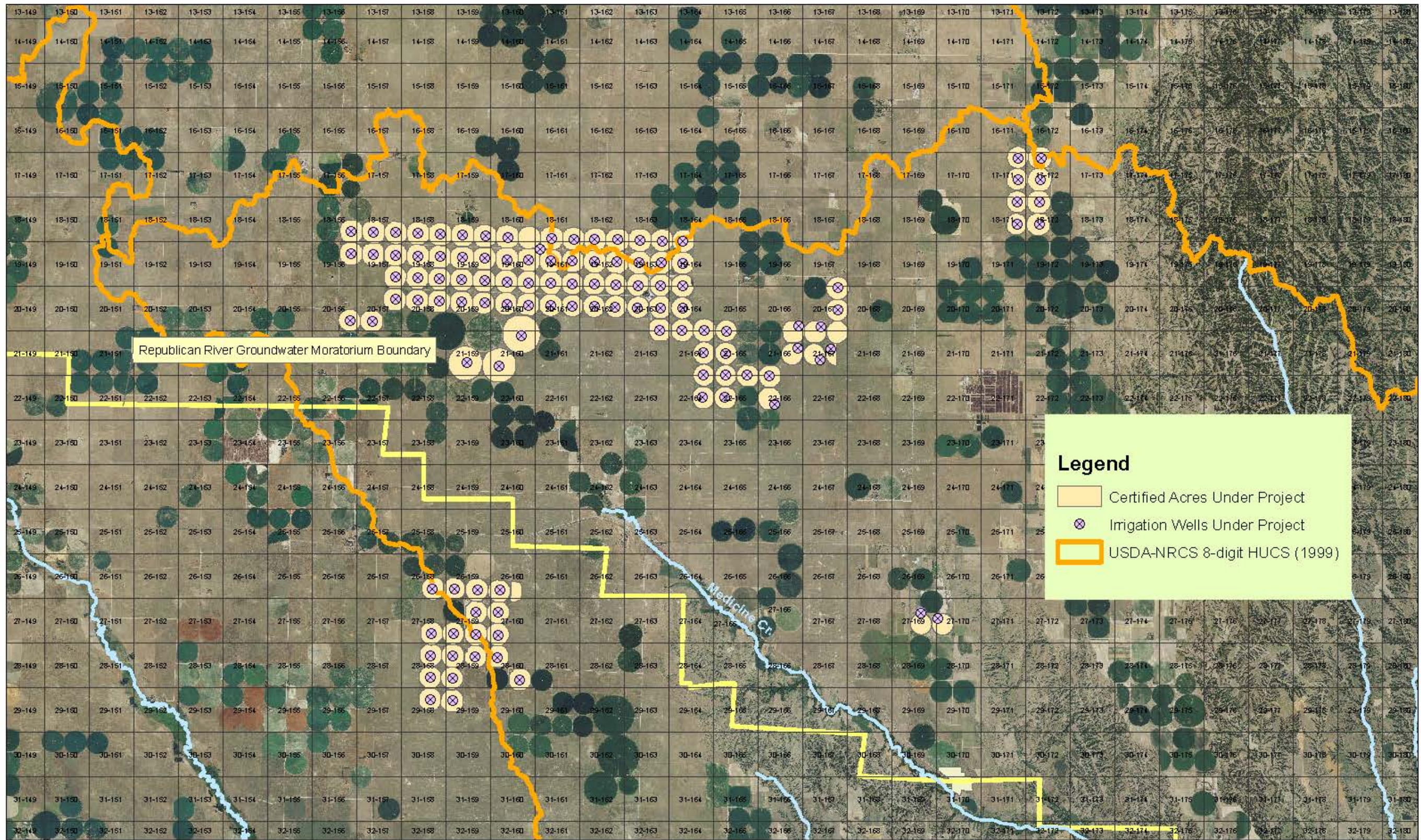


FIGURE 2: N-CORPE AUGMENTATION AREA PRIOR TO ACQUISITION

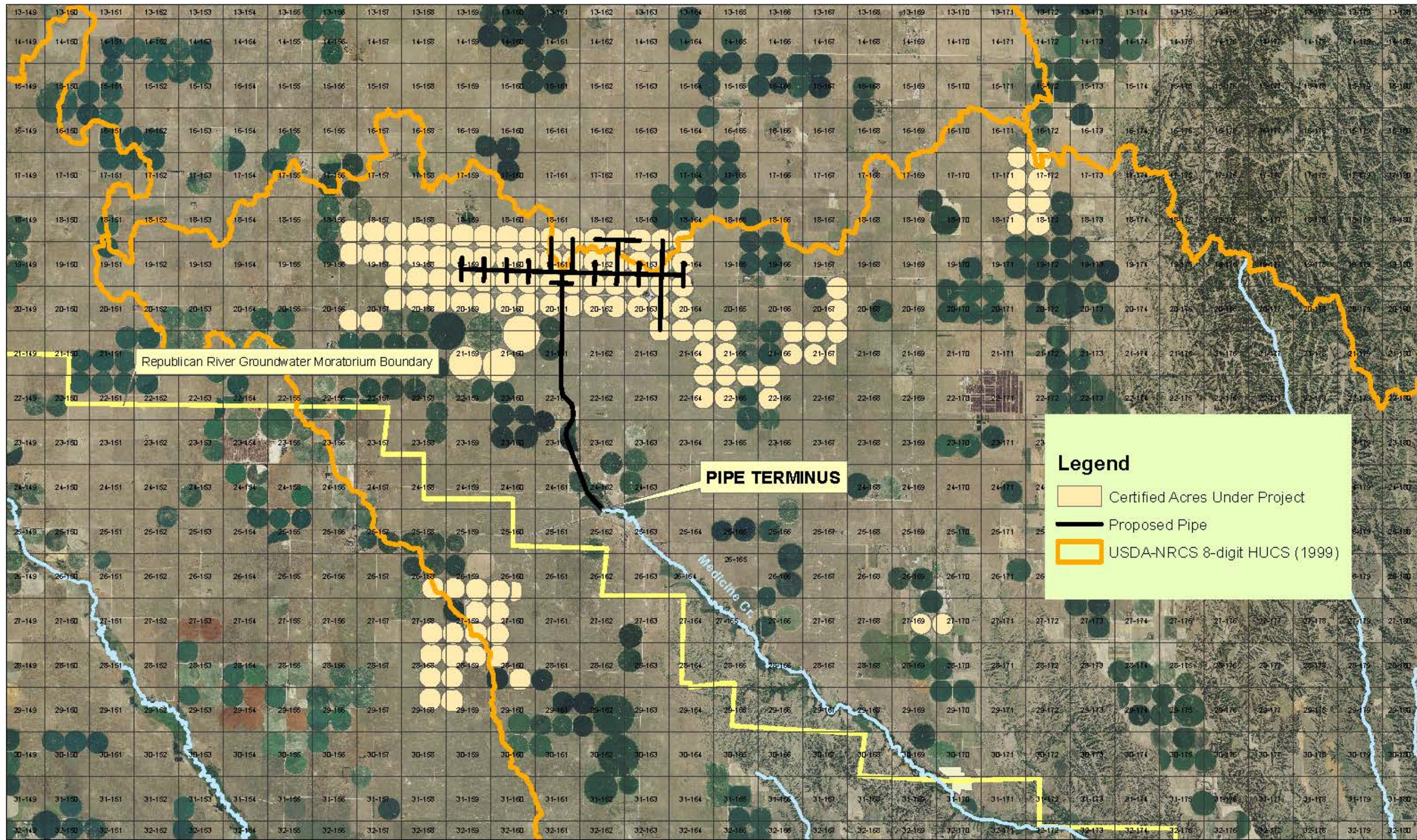


FIGURE 3: N-CORPE AUGMENTATION PROJECT PLAN



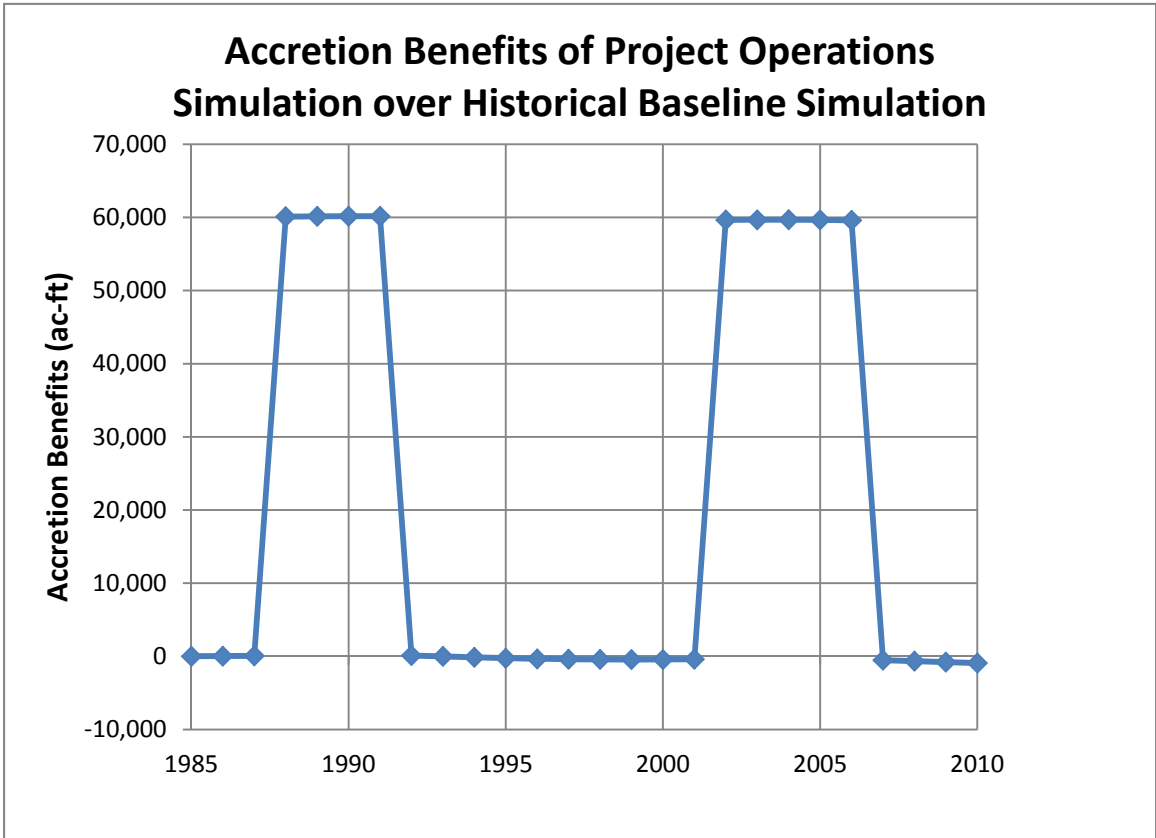


Figure 4. Accretion Benefits from Project Operations over Historical Baseline Simulation, considering Project Operations Pumping, AWS credit, and the net depletions to the stream from project operation).

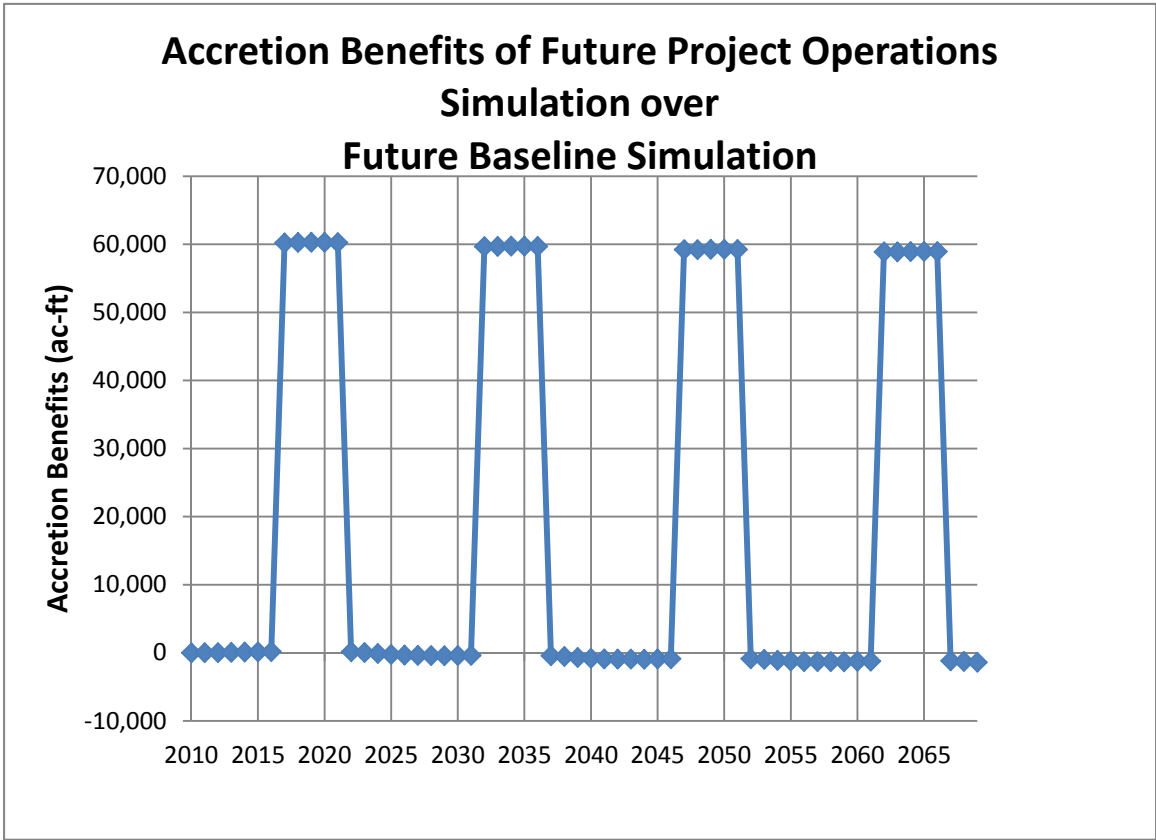


Figure 5. Accretion Benefits from Future Project Operations over Future Baseline Simulation, considering Project Operations Pumping, AWS credit, and the net depletions to the stream from project operation).

# Appendix A

# Republican River Compact Administration

## ACCOUNTING PROCEDURES AND REPORTING REQUIREMENTS

Revised August 12, 2010

Comment [A1]: Update to new date

Table of Contents

**I. Introduction** .....5

**II. Definitions**.....5

**III. Basic Formulas** ..... 10

**A. Calculation of Annual Virgin Water Supply** ..... 11

        1. Sub-basin calculation: ..... 11

        2. Main Stem Calculation: ..... 11

        3. Imported Water Supply Credit Calculation: ..... 12

**B. Calculation of Computed Water Supply** ..... 12

        1. Flood Flows ..... 13

**C. Calculation of Annual Allocations**..... 13

**D. Calculation of Annual Computed Beneficial Consumptive Use**..... 14

        1. Groundwater ..... 14

        2. Surface Water ..... 14

**E. Calculation to Determine Compact Compliance Using Five-Year Running Averages**... 15

**F. Calculations To Determine Colorado’s and Kansas’s Compliance with the Sub-basin Non-Impairment Requirement**..... 15

**G. Calculations To Determine Projected Water Supply** ..... 15

        1. Procedures to Determine Water Short Years..... 15

        2. Procedures to Determine 130,000 Acre Feet Projected Water Supply ..... 16

**H. Calculation of Computed Water Supply, Allocations and Computed Beneficial Consumptive Use Above and Below Guide Rock During Water-Short Administration Years** ..... 17

**I. Calculation of Imported Water Supply Credits During Water-Short Year Administration Years**..... 17

        1. Monthly Imported Water Supply Credits ..... 18

        2. Imported Water Supply Credits Above Harlan County Dam..... 18

        3. Imported Water Supply Credits Between Harlan County Dam and Guide Rock During the Irrigation Season ..... 18

        4. Imported Water Supply Credits Between Harlan County Dam and Guide Rock During the Non-Irrigation Season ..... 19

        5. Other Credits ..... 20

**J. Calculations of Compact Compliance in Water-Short Year Administration Years** ..... 20

**IV. Specific Formulas**..... 20

**A. Computed Beneficial Consumptive Use**..... 20

        1. Computed Beneficial Consumptive Use of Groundwater: ..... 20

        2. Computed Beneficial Consumptive Use of Surface Water: ..... 21

            a) Non-Federal Canals ..... 21

            b) Individual Surface Water Pumps ..... 21

            c) Federal Canals ..... 21

            d) Non-irrigation Uses ..... 22

            e) Evaporation from Federal Reservoirs ..... 22

                (1) Harlan County Lake, Evaporation Calculation ..... 22

(2) Evaporation Computations for Bureau of Reclamation Reservoirs.....	24
f) Non-Federal Reservoir Evaporation: .....	25
<b>B. Specific Formulas for Each Sub-basin and the Main Stem .....</b>	<b>25</b>
<b>3. North Fork of Republican River in Colorado .....</b>	<b>26</b>
<b>4. Arikaree River 2.....</b>	<b>27</b>
<b>5. Buffalo Creek.....</b>	<b>27</b>
<b>6. Rock Creek .....</b>	<b>28</b>
<b>7. South Fork Republican River.....</b>	<b>28</b>
<b>8. Frenchman Creek in Nebraska .....</b>	<b>29</b>
<b>9. Driftwood Creek.....</b>	<b>29</b>
<b>10. Red Willow Creek in Nebraska .....</b>	<b>30</b>
<b>11. Medicine Creek.....</b>	<b>31</b>
<b>12. Beaver Creek .....</b>	<b>32</b>
<b>13. Sappa Creek.....</b>	<b>32</b>
<b>14. Prairie Dog Creek.....</b>	<b>33</b>
<b>15. The North Fork of the Republican River in Nebraska and the Main Stem of the     Republican River between the junction of the North Fork and the Arikaree River     and the Republican River near Hardy.....</b>	<b>34</b>
<b>V. Annual Data/ Information Requirements, Reporting, and Verification .....</b>	<b>37</b>
<b>A. Annual Reporting.....</b>	<b>38</b>
<b>1. Surface water diversions and irrigated acreage:.....</b>	<b>38</b>
<b>2. Groundwater pumping and irrigated acreage: .....</b>	<b>38</b>
<b>3. Climate information:.....</b>	<b>39</b>
<b>4. Crop Irrigation Requirements: .....</b>	<b>40</b>
<b>5. Streamflow Records from State-Maintained Gaging Records:.....</b>	<b>40</b>
<b>6. Platte River Reservoirs: .....</b>	<b>40</b>
<b>7. Water Administration Notification:.....</b>	<b>41</b>
<b>8. Moratorium: .....</b>	<b>41</b>
<b>9. Non-Federal Reservoirs: .....</b>	<b>42</b>
<b>B. RRCA Groundwater Model Data Input Files .....</b>	<b>42</b>
<b>C. Inputs to RRCA Accounting.....</b>	<b>42</b>
<b>1. Surface Water Information .....</b>	<b>43</b>
<b>2. Groundwater Information .....</b>	<b>44</b>
<b>3. Summary.....</b>	<b>44</b>
<b>D. Verification .....</b>	<b>45</b>
<b>1. Documentation to be Available for Inspection Upon Request.....</b>	<b>45</b>
<b>2. Site Inspection.....</b>	<b>45</b>
<b>TABLES .....</b>	<b>46</b>
Table 1: Annual Virgin and Computed Water Supply, Allocations and Computed Beneficial Consumptive Uses by State, Main Stem and Sub-basin .....	46
Table 2: Original Compact Virgin Water Supply and Allocations .....	47
Table 3A: Table to Be Used to Calculate Colorado's Five-Year Running Average Allocation and Computed Beneficial Consumptive Use for Determining Compact Compliance .....	48

Table 3B. Table to Be Used to Calculate Kansas's Five-Year Running Average Allocation and Computed Beneficial Consumptive Use for Determining Compact Compliance .....48

Table 4A: Colorado Compliance with the Sub-basin Non-impairment Requirement .....51

Table 4B: Kansas Compliance with the Sub-basin Non-impairment Requirement.....51

Table 5A: Colorado Compliance During Water-Short Year Administration .....52

Table 5B: Kansas Compliance During Water-Short Year Administration .....52

Table 5C: Nebraska Compliance During Water-Short Year Administration .....53

Table 5D: Nebraska Compliance Under a Alternative Water-Short Year Administration Plan..54

Table 5E: Nebraska Tributary Compliance During Water-Short Year Administration .....54

FIGURES.....56

Basin Map Attached to Compact that Shows the Streams and the Basin Boundaries.....56

Line Diagram of Designated Drainage Basins Showing Federal Reservoirs and Sub-basin Gaging Stations .....57

Map Showing Sub-basins, Streams, and the Basin Boundaries .....58

ATTACHMENTS.....59

Attachment 1: Sub-basin Flood Flow Thresholds .....59

Attachment 2: Description of the Consensus Plan for Harlan County Lake .....60

Attachment 3: Inflows to Harlan County Lake 1993 Level of Development.....66

Attachment 4: Evaporation Loss Harlan County Lake 1993 Level of Development .....68

Attachment 5: Projected Water Supply Spread Sheet Calculations .....70

Attachment 6: Computing Water Supplies and Consumptive Use Above Guide Rock .....72

Attachment 7: Calculations of Return Flows from Bureau of Reclamation Canals .....73

## **I. Introduction**

This document describes the definitions, procedures, basic formulas, specific formulas, and data requirements and reporting formats to be used by the RRCA to compute the Virgin Water Supply, Computed Water Supply, Allocations, Imported Water Supply Credit, [Augmentation Water Supply Credit](#), and Computed Beneficial Consumptive Use. These computations shall be used to determine supply, allocations, use and compliance with the Compact according to the Stipulation. These definitions, procedures, basic and specific formulas, data requirements and attachments may be changed by consent of the RRCA consistent with Subsection I.F of the Stipulation. This document will be referred to as the RRCA Accounting Procedures. Attached to these RRCA Accounting Procedures as Figure 1 is the map attached to the Compact that shows the Basin, its streams and the Basin boundaries.

## **II. Definitions**

The following words and phrases as used in these RRCA Accounting Procedures are defined as follows:

**Additional Water Administration Year** - a year when the projected or actual irrigation water supply is less than 130,000 Acre-feet of storage available for use from Harlan County Lake as determined by the Bureau of Reclamation using the methodology described in the Harlan County Lake Operation Consensus Plan attached as Appendix K to the Stipulation.

**Allocation(s)**: the water supply allocated to each State from the Computed Water Supply;

**Annual**: yearly from January 1 through December 31;

**Augmentation Plan**: [the detailed program used by a State to offset stream depletions in order to comply with its Compact Allocations. The Augmentation Plans shall be approved by the RRCA prior to implementation;](#)

**Augmentation Water Supply Credit**: [The amount of water measured and discharged under an approved Augmentation Plan to a Designated Drainage Basin for the purpose of offsetting stream depletions to comply with a States' Compact allocation. The Augmentation Water Supply Credit of a State shall not be included in the Virgin Water Supply in the aforementioned Designated Drainage Basin and shall be counted as a credit/offset against the Computed Beneficial Consumptive Use of water allocated to that State;](#)

**Basin**: the Republican River Basin as defined in Article II of the Compact;



**Beneficial Consumptive Use:** that use by which the Water Supply of the Basin is consumed through the activities of man, and shall include water consumed by evaporation from any reservoir, canal, ditch, or irrigated area;

**Change in Federal Reservoir Storage:** the difference between the amount of water in storage in the reservoir on December 31 of each year and the amount of water in storage on December 31 of the previous year. The current area capacity table supplied by the appropriate federal operating agency shall be used to determine the contents of the reservoir on each date;

**Compact:** the Republican River Compact, Act of February 22, 1943, 1943 Kan. Sess. Laws 612, codified at Kan. Stat. Ann. § 82a-518 (1997); Act of February 24, 1943, 1943 Neb. Laws 377, codified at 2A Neb. Rev. Stat. App. § 1-106 (1995), Act of March 15, 1943, 1943 Colo. Sess. Laws 362, codified at Colo. Rev. Stat. §§ 37-67-101 and 37-67-102 (2001); Republican River Compact, Act of May 26, 1943, ch. 104, 57 Stat. 86;

**Computed Beneficial Consumptive Use:** for purposes of Compact accounting, the stream flow depletion resulting from the following activities of man:

- Irrigation of lands in excess of two acres;
- Any non-irrigation diversion of more than 50 Acre-feet per year;
- Multiple diversions of 50 Acre-feet or less that are connected or otherwise combined to serve a single project will be considered as a single diversion for accounting purposes if they total more than 50 Acre-feet;
- Net evaporation from Federal Reservoirs;
- Net evaporation from Non-federal Reservoirs within the surface boundaries of the Basin;
- Any other activities that may be included by amendment of these formulas by the RRCA;

**Computed Water Supply:** the Virgin Water Supply less the Change in Federal Reservoir Storage in any Designated Drainage Basin, and less the Flood Flows;

**Designated Drainage Basins:** the drainage basins of the specific tributaries and the Main Stem of the Republican River as described in Article III of the Compact. Attached hereto as Figure 3 is a map of the Sub-basins and Main Stem;

**Dewatering Well:** a Well constructed solely for the purpose of lowering the groundwater elevation;

**Federal Reservoirs:**

- Bonny Reservoir
- Swanson Lake
- Enders Reservoir
- Hugh Butler Lake
- Harry Strunk Lake

Republican River Compact Administration

Accounting Procedures and Reporting Requirements  
Revised August 2010

Keith Sebelius Lake  
Harlan County Lake  
Lovewell Reservoir

**Flood Flows:** the amount of water deducted from the Virgin Water Supply as part of the computation of the Computed Water Supply due to a flood event as determined by the methodology described in Subsection III.B.1.;

**Gaged Flow:** the measured flow at the designated stream gage;

**Guide Rock:** a point at the Superior-Courtland Diversion Dam on the Republican River near Guide Rock, Nebraska; the Superior-Courtland Diversion Dam gage plus any flows through the sluice gates of the dam, specifically excluding any diversions to the Superior and Courtland Canals, shall be the measure of flows at Guide Rock;

**Historic Consumptive Use:** that amount of water that has been consumed under appropriate and reasonably efficient practices to accomplish without waste the purposes for which the appropriation or other legally permitted use was lawfully made;

**Imported Water Supply:** the water supply imported by a State from outside the Basin resulting from the activities of man;

**Imported Water Supply Credit:** the accretions to stream flow due to water imports from outside of the Basin as computed by the RRCA Groundwater Model. The Imported Water Supply Credit of a State shall not be included in the Virgin Water Supply and shall be counted as a credit/offset against the Computed Beneficial Consumptive Use of water allocated to that State, except as provided in Subsection V.B.2. of the Stipulation and Subsections III.I. – J. of these RRCA Accounting Procedures;

**Main Stem:** the Designated Drainage Basin identified in Article III of the Compact as the North Fork of the Republican River in Nebraska and the main stem of the Republican River between the junction of the North Fork and the Arikaree River and the lowest crossing of the river at the Nebraska-Kansas state line and the small tributaries thereof, and also including the drainage basin Blackwood Creek;

**Main Stem Allocation:** the portion of the Computed Water Supply derived from the Main Stem and the Unallocated Supply derived from the Sub-basins as shared by Kansas and Nebraska;

**Meeting(s):** a meeting of the RRCA, including any regularly scheduled annual meeting or any special meeting;

**Modeling Committee:** the modeling committee established in Subsection IV.C. of the Stipulation;

Republican River Compact Administration

Accounting Procedures and Reporting Requirements  
Revised August 2010

**Moratorium:** the prohibition and limitations on construction of new Wells in the geographic area described in Section III. of the Stipulation;

**Non-federal Reservoirs:** reservoirs other than Federal Reservoirs that have a storage capacity of 15 Acre-feet or greater at the principal spillway elevation;

**Northwest Kansas:** those portions of the Sub-basins within Kansas;

**Replacement Well:** a Well that replaces an existing Well that a) will not be used after construction of the new Well and b) will be abandoned within one year after such construction or is used in a manner that is excepted from the Moratorium pursuant to Subsections III.B.1.c.-f. of the Stipulation;

**RRCA:** Republican River Compact Administration, the administrative body composed of the State officials identified in Article IX of the Compact;

**RRCA Accounting Procedures:** this document and all attachments hereto;

**RRCA Groundwater Model:** the groundwater model developed under the provisions of Subsection IV.C. of the Stipulation and as subsequently adopted and revised through action of the RRCA;

**State:** any of the States of Colorado, Kansas, and Nebraska;

**States:** the States of Colorado, Kansas and Nebraska;

**Stipulation:** the Final Settlement Stipulation to be filed in *Kansas v. Nebraska and Colorado*, No. 126, Original, including all Appendices attached thereto;

**Sub-basin:** the Designated Drainage Basins, except for the Main Stem, identified in Article III of the Compact. For purposes of Compact accounting the following Sub-basins will be defined as described below:

North Fork of the Republican River in Colorado drainage basin is that drainage area above USGS gaging station number 06823000, North Fork Republican River at the Colorado-Nebraska State Line,

Arikaree River drainage basin is that drainage area above USGS gaging station number 06821500, Arikaree River at Haigler, Nebraska,

Buffalo Creek drainage basin is that drainage area above USGS gaging station number 06823500, Buffalo Creek near Haigler, Nebraska,

Rock Creek drainage basin is that drainage area above USGS gaging station number 06824000, Rock Creek at Parks, Nebraska,

South Fork of the Republican River drainage basin is that drainage area above USGS gaging station number 06827500, South Fork Republican River near Benkelman, Nebraska,

Frenchman Creek (River) drainage basin in Nebraska is that drainage area above USGS gaging station number 06835500, Frenchman Creek in Culbertson, Nebraska,

Driftwood Creek drainage basin is that drainage area above USGS gaging station number 06836500, Driftwood Creek near McCook, Nebraska,

Red Willow Creek drainage basin is that drainage area above USGS gaging station number 06838000, Red Willow Creek near Red Willow, Nebraska,

Medicine Creek drainage basin is that drainage area above the Medicine Creek below Harry Strunk Lake, State of Nebraska gaging station number 06842500; and the drainage area between the gage and the confluence with the Main Stem,

Sappa Creek drainage basin is that drainage area above USGS gaging station number 06847500, Sappa Creek near Stamford, Nebraska and the drainage area between the gage and the confluence with the Main Stem; and excluding the Beaver Creek drainage basin area downstream from the State of Nebraska gaging station number 06847000 Beaver Creek near Beaver City, Nebraska to the confluence with Sappa Creek,

Beaver Creek drainage basin is that drainage area above State of Nebraska gaging station number 06847000, Beaver Creek near Beaver City, Nebraska, and the drainage area between the gage and the confluence with Sappa Creek,

Prairie Dog Creek drainage basin is that drainage area above USGS gaging station number 06848500, Prairie Dog Creek near Woodruff, Kansas, and the drainage area between the gage and the confluence with the Main Stem;

Attached hereto as Figure 2 is a line diagram depicting the streams, Federal Reservoirs and gaging stations;

**Test hole:** a hole designed solely for the purpose of obtaining information on hydrologic and/or geologic conditions;

**Trenton Dam:** a dam located at 40 degrees, 10 minutes, 10 seconds latitude and 101 degrees, 3 minutes, 35 seconds longitude, approximately two and one-half miles west of the town of Trenton, Nebraska;

**Unallocated Supply:** the “water supplies of upstream basins otherwise unallocated” as set forth in Article IV of the Compact;

**Upstream of Guide Rock, Nebraska:** those areas within the Basin lying west of a line proceeding north from the Nebraska-Kansas state line and following the western edge of Webster County, Township 1, Range 9, Sections 34, 27, 22, 15, 10 and 3 through Webster County, Township 2, Range 9, Sections 34, 27 and 22; then proceeding west along the southern edge of Webster County, Township 2, Range 9, Sections 16, 17 and 18; then proceeding north following the western edge of Webster County, Township 2, Range 9, Sections 18, 7 and 6, through Webster County, Township 3, Range 9, Sections 31, 30, 19, 18, 7 and 6 to its intersection with the northern boundary of Webster County. Upstream of Guide Rock, Nebraska shall not include that area in Kansas east of the 99° meridian and south of the Kansas-Nebraska state line;

**Virgin Water Supply:** the Water Supply within the Basin undepleted by the activities of man;

**Water Short Year Administration:** administration in a year when the projected or actual irrigation water supply is less than 119,000 acre feet of storage available for use from Harlan County Lake as determined by the Bureau of Reclamation using the methodology described in the Harlan County Lake Operation Consensus Plan attached as Appendix K to the Stipulation.

**Water Supply of the Basin or Water Supply within the Basin:** the stream flows within the Basin, excluding Imported Water Supply;

**Well:** any structure, device or excavation for the purpose or with the effect of obtaining groundwater for beneficial use from an aquifer, including wells, water wells, or groundwater wells as further defined and used in each State’s laws, rules, and regulations.

**III. Basic Formulas**

The basic formulas for calculating Virgin Water Supply, Computed Water Supply, Imported Water Supply, Allocations and Computed Beneficial Consumptive Use are set forth below. The results of these calculations shall be shown in a table format as shown in Table 1.

Basic Formulas for Calculating Virgin Water Supply, Computed Water Supply, Allocations and Computed Beneficial Consumptive Use	
Sub-basin VWS	= Gage + All CBCU + ΔS – IWS – AWS
Main Stem VWS	= Hardy Gage – Σ Sub-basin gages + All CBCU in the Main Stem + ΔS – IWS
CWS	= VWS - Δ S – FF

Allocation for each State in each Sub-basin And Main Stem	=	CWS x %
State's Allocation	=	Σ Allocations for Each State
State's CBCU	=	Σ State's CBCUs in each Sub-basin and Main Stem

Abbreviations:

CBCU = Computed Beneficial Consumptive Use

FF = Flood Flows

Gage = Gaged Flow

IWS = Imported Water Supply Credit

AWS = Augmentation Water Supply Credit

CWS = Computed Water Supply

VWS = Virgin Water Supply

% = the ratio used to allocate the Computed Water Supply between the States. This ratio is based on the allocations in the Compact

Δ S = Change in Federal Reservoir Storage

**A. Calculation of Annual Virgin Water Supply**

**1. Sub-basin calculation:**

The annual Virgin Water Supply for each Sub-basin will be calculated by adding: a) the annual stream flow in that Sub-basin at the Sub-basin stream gage designated in Section II., b) the annual Computed Beneficial Consumptive Use above that gaging station, and c) the Change in Federal Reservoir Storage in that Sub-basin; and from that total subtract any Imported Water Supply Credit and any Augmentation Water Supply Credit. The Computed Beneficial Consumptive Use will be calculated as described in Subsection III. D. Adjustments for flows diverted around stream gages and for Computed Beneficial Consumptive Uses in the Sub-basin between the Sub-basin stream gage and the confluence of the Sub-basin tributary and the Main Stem shall be made as described in Subsections III. D. 1 and 2 and IV. B.

**2. Main Stem Calculation:**

The annual Virgin Water Supply for the Main Stem will be calculated by adding: a) the flow at the Hardy gage minus the flows from the Sub-basin gages listed in Section II, b) the annual Computed Beneficial Consumptive Use in the Main Stem, and c) the Change in Federal Reservoir Storage from Swanson Lake and Harlan

County Lake; and from that total subtract any Imported Water Supply Credit for the Main Stem. Adjustments for flows diverted around Sub-basin stream gages and for Computed Beneficial Consumptive Uses in a Sub-basin between the Sub-basin stream gage and the confluence of the Sub-basin tributary and the Mains Stem shall be made as described in Subsections III. D. 1 and 2 and IV.B.,

**3. Imported Water Supply Credit Calculation:**

The amount of Imported Water Supply Credit shall be determined by the RRCA Groundwater Model. The Imported Water Supply Credit of a State shall not be included in the Virgin Water Supply and shall be counted as a credit/offset against the Computed Beneficial Consumptive Use of water allocated to that State. Currently, the Imported Water Supply Credits shall be determined using two runs of the RRCA Groundwater Model:

- a. The “base” run shall be the run with all groundwater pumping, groundwater pumping recharge, and surface water recharge within the model study boundary for the current accounting year turned “on.” This will be the same “base” run used to determine groundwater Computed Beneficial Consumptive Uses.
- b. The “no NE import” run shall be the run with the same model inputs as the base run with the exception that surface water recharge associated with Nebraska’s Imported Water Supply shall be turned “off.”

The Imported Water Supply Credit shall be the difference in stream flows between these two model runs. Differences in stream flows shall be determined at the same locations as identified in Subsection III.D.1. for the “no pumping” runs. Should another State import water into the Basin in the future, the RRCA will develop a similar procedure to determine Imported Water Supply Credits.

**4. Augmentation Water Supply Credit: The amount of water measured and discharged under an approved Augmentation Plan to a Designated Drainage Basin for the purpose of offsetting stream depletions to comply with a States’ Compact allocation.**

**B. Calculation of Computed Water Supply**

On any Designated Drainage Basin without a Federal Reservoir, the Computed Water Supply will be equal to the Virgin Water Supply of that Designated Drainage Basin minus Flood Flows.

On any Designated Drainage Basin with a Federal Reservoir, the Computed Water Supply will be equal to the Virgin Water Supply minus the Change in Federal Reservoir Storage in that Designated Drainage Basin and minus Flood Flows.

**1. Flood Flows**

If in any calendar year there are five consecutive months in which the total actual stream flow<sup>1</sup> at the Hardy gage is greater than 325,000 Acre-feet, or any two consecutive months in which the total actual stream flow is greater than 200,000 Acre-feet, the annual flow in excess of 400,000 Acre-feet at the Hardy gage will be considered to be Flood Flows that will be subtracted from the Virgin Water Supply to calculate the Computed Water Supply, and Allocations. The Flood Flow in excess of 400,000 Acre-feet at the Hardy gage will be subtracted from the Virgin Water Supply of the Main Stem to compute the Computed Water Supply unless the Annual Gaged Flows from a Sub-basin were in excess of the flows shown for that Sub-basin in Attachment 1. These excess Sub-basin flows shall be considered to be Sub-basin Flood Flows.

If there are Sub-basin Flood Flows, the total of all Sub-basin Flood Flows shall be compared to the amount of Flood Flows at the Hardy gage. If the sum of the Sub-basin Flood Flows are in excess of the Flood Flow at the Hardy gage, the flows to be deducted from each Sub-basin shall be the product of the Flood Flows for each Sub-basin times the ratio of the Flood Flows at the Hardy gage divided by the sum of the Flood Flows of the Sub-basin gages. If the sum of the Sub-basin Flood Flows is less than the Flood Flow at the Hardy gage, the entire amount of each Sub-basin Flood Flow shall be deducted from the Virgin Water Supply to compute the Computed Water Supply of that Sub-basin for that year. The remainder of the Flood Flows will be subtracted from the flows of the Main Stem.

**C. Calculation of Annual Allocations**

Article IV of the Compact allocates 54,100 Acre-feet for Beneficial Consumptive Use in Colorado, 190,300 Acre-feet for Beneficial Consumptive Use in Kansas and 234,500 Acre-feet for Beneficial Consumptive Use in Nebraska. The Compact provides that the Compact totals are to be derived from the sources and in the amounts specified in Table 2.

The Allocations derived from each Sub-basin to each State shall be the Computed Water Supply multiplied by the percentages set forth in Table 2. In addition, Kansas shall receive 51.1% of the Main Stem Allocation and the Unallocated

---

<sup>1</sup> These actual stream flows reflect Gaged Flows after depletions by Beneficial Consumptive Use and change in reservoir storage above the gage.



Supply and Nebraska shall receive 48.9% of the Main Stem Allocation and the Unallocated Supply.

#### **D. Calculation of Annual Computed Beneficial Consumptive Use**

##### **1. Groundwater**

Computed Beneficial Consumptive Use of groundwater shall be determined by use of the RRCA Groundwater Model. The Computed Beneficial Consumptive Use of groundwater for each State shall be determined as the difference in streamflows using two runs of the model:

The “base” run shall be the run with all groundwater pumping, groundwater pumping recharge, and surface water recharge within the model study boundary for the current accounting year “on”.

The “no State pumping” run shall be the run with the same model inputs as the base run with the exception that all groundwater pumping and pumping recharge of that State shall be turned “off.”

An output of the model is baseflows at selected stream cells. Changes in the baseflows predicted by the model between the “base” run and the “no-State-pumping” model run is assumed to be the depletions to streamflows. i.e., groundwater computed beneficial consumptive use, due to State groundwater pumping at that location. The values for each Sub-basin will include all depletions and accretions upstream of the confluence with the Main Stem. The values for the Main Stem will include all depletions and accretions in stream reaches not otherwise accounted for in a Sub-basin. The values for the Main Stem will be computed separately for the reach above Guide Rock, and the reach below Guide Rock.

##### **2. Surface Water**

The Computed Beneficial Consumptive Use of surface water for irrigation and non-irrigation uses shall be computed by taking the diversions from the river and subtracting the return flows to the river resulting from those diversions, as described in Subsections IV.A.2.a.-d. The Computed Beneficial Consumptive Use of surface water from Federal Reservoir and Non-Federal Reservoir evaporation shall be the net reservoir evaporation from the reservoirs, as described in Subsections IV.A.2.e.-f.

For Sub-basins where the gage designated in Section II. is near the confluence with the Main Stem, each State's Sub-basin Computed Beneficial Consumptive Use of surface water shall be the State's Computed Beneficial Consumptive Use of surface water above the Sub-basin gage. For Medicine Creek, Sappa Creek, Beaver Creek and Prairie Dog Creek, where the gage is not near the confluence with the Main Stem, each State's Computed Beneficial Consumptive Use of surface water shall be the sum of the State's Computed Beneficial Consumptive Use of surface water above the gage, and its Computed Beneficial Consumptive Use of surface water between the gage and the confluence with the Main Stem.

**E. Calculation to Determine Compact Compliance Using Five-Year Running Averages**

Each year, using the procedures described herein, the RRCA will calculate the Annual Allocations by Designated Drainage Basin and total for each State, the Computed Beneficial Consumptive Use by Designated Drainage Basin and total for each State and the Imported Water Supply Credit [and the Augmentation Water Supply Credit](#) that a State may use for the preceding year. These results for the current Compact accounting year as well as the results of the previous four accounting years and the five-year average of these results will be displayed in the format shown in Table 3.

**F. Calculations To Determine Colorado's and Kansas's Compliance with the Sub-basin Non-Impairment Requirement**

The data needed to determine Colorado's and Kansas's compliance with the Sub-basin non-impairment requirement in Subsection IV.B.2. of the Stipulation are shown in Tables 4.A. and B.

**G. Calculations To Determine Projected Water Supply**

**1. Procedures to Determine Water Short Years**

The Bureau of Reclamation will provide each of the States with a monthly or, if requested by any one of the States, a more frequent update of the projected or actual irrigation supply from Harlan County Lake for that irrigation season using the methodology described in the Harlan County Lake Operation Consensus Plan, attached as Appendix K to the Stipulation. The steps for the calculation are as follows:

Step 1. At the beginning of the calculation month (1) the total projected inflow for the calculation month and each succeeding month through the end of May shall be added to the previous end of month Harlan County Lake content and (2) the total projected 1993 level evaporation loss for the calculation month and each succeeding month through the end of May shall then be subtracted. The total projected inflow shall be the 1993 level average monthly inflow or the running average monthly inflow for the previous five years, whichever is less.

Step 2. Determine the maximum irrigation water available by subtracting the sediment pool storage (currently 164,111 Acre-feet) and adding the summer sediment pool evaporation (20,000 Acre-feet) to the result from Step 1.

Step 3. For October through January calculations, take the result from Step 2 and using the Shared Shortage Adjustment Table in Attachment 2 hereto, determine the preliminary irrigation water available for release. The calculation using the end of December content (January calculation month) indicates the minimum amount of irrigation water available for release at the end of May. For February through June calculations, subtract the maximum irrigation water available for the January calculation month from the maximum irrigation water available for the calculation month. If the result is negative, the irrigation water available for release (January calculation month) stays the same. If the result is positive the preliminary irrigation water available for release (January calculation month) is increased by the positive amount.

Step 4. Compare the result from Step 3 to 119,000 Acre-feet. If the result from Step 3 is less than 119,000 Acre-feet Water Short Year Administration is in effect.

Step 5. The final annual Water-Short Year Administration calculation determines the total estimated irrigation supply at the end of June (calculated in July). Use the result from Step 3 for the end of May irrigation release estimate, add the June computed inflow to Harlan County Lake and subtract the June computed gross evaporation loss from Harlan County Lake.

## **2. Procedures to Determine 130,000 Acre Feet Projected Water Supply**

To determine the preliminary irrigation supply for the October through June calculation months, follow the procedure described in steps 1 through 4 of the "Procedures to determine Water Short Years" Subsection III. G. 1. The result from step 4 provides the forecasted water supply, which is compared to 130,000 Acre-feet. For the July through September calculation months, use the previous end of calculation month preliminary irrigation supply, add the previous month's Harlan County Lake computed inflow and subtract the previous month's computed gross

evaporation loss from Harlan County Lake to determine the current preliminary irrigation supply. The result is compared to 130,000 Acre-feet.

**H. Calculation of Computed Water Supply, Allocations and Computed Beneficial Consumptive Use Above and Below Guide Rock During Water-Short Administration Years.**

For Water-Short-Administration Years, in addition to the normal calculations, the Computed Water Supply, Allocations, Computed Beneficial Consumptive Use and Imported Water Supply Credits, and Augmentation Water Supply Credits shall also be calculated above Guide Rock as shown in Table 5C. These calculations shall be done in the same manner as in non-Water-Short Administration years except that water supplies originating below Guide Rock shall not be included in the calculations of water supplies originating above Guide Rock. The calculations of Computed Beneficial Consumptive Uses shall be also done in the same manner as in non-Water-Short Administration years except that Computed Beneficial Consumptive Uses from diversions below Guide Rock shall not be included. The depletions from the water diverted by the Superior and Courtland Canals at the Superior-Courtland Diversion Dam shall be included in the calculations of Computed Beneficial Consumptive Use above Guide Rock. Imported Water Supply Credits and Augmentation Water Supply Credits above Guide Rock, as described in Sub-section III.I., may be used as offsets against the Computed Beneficial Consumptive Use above Guide Rock by the State providing the Imported Water Supply Credits or Augmentation Water Supply Credits.

The Computed Water Supply of the Main Stem reach between Guide Rock and the Hardy gage shall be determined by taking the difference in stream flow at Hardy and Guide Rock, adding Computed Beneficial Consumptive Uses in the reach (this does not include the Computed Beneficial Consumptive Use from the Superior and Courtland Canal diversions), and subtracting return flows from the Superior and Courtland Canals in the reach. The Computed Water Supply above Guide Rock shall be determined by subtracting the Computed Water Supply of the Main Stem reach between Guide Rock and the Hardy gage from the total Computed Water Supply. Nebraska's Allocation above Guide Rock shall be determined by subtracting 48.9% of the Computed Water Supply of the Main Stem reach between Guide Rock and the Hardy gage from Nebraska's total Allocation. Nebraska's Computed Beneficial Consumptive Uses above Guide Rock shall be determined by subtracting Nebraska's Computed Beneficial Consumptive Uses below Guide Rock from Nebraska's total Computed Beneficial Consumptive Use.

**I. Calculation of Imported Water Supply Credits During Water-Short Year Administration Years.**

Imported Water Supply Credit during Water-Short Year Administration years shall be calculated consistent with Subsection V.B.2.b. of the Stipulation.

The following methodology shall be used to determine the extent to which Imported Water Supply Credit, as calculated by the RRCA Groundwater Model, can be credited to the State importing the water during Water-Short Year Administration years.

### **1. Monthly Imported Water Supply Credits**

The RRCA Groundwater Model will be used to determine monthly Imported Water Supply Credits by State in each Sub-basin and for the Main Stem. The values for each Sub-basin will include all depletions and accretions upstream of the confluence with the Main Stem. The values for the Main Stem will include all depletions and accretions in stream reaches not otherwise accounted for in a Sub-basin. The values for the Main Stem will be computed separately for the reach 1) above Harlan County Dam, 2) between Harlan County Dam and Guide Rock, and 3) between Guide Rock and the Hardy gage. The Imported Water Supply Credit shall be the difference in stream flow for two runs of the model: a) the “base” run and b) the “no State import” run.

During Water-Short Year Administration years, Nebraska’s credits in the Sub-basins shall be determined as described in Section III. A. 3.

### **2. Imported Water Supply Credits Above Harlan County Dam**

Nebraska's Imported Water Supply Credits above Harlan County Dam shall be the sum of all the credits in the Sub-basins and the Main Stem above Harlan County Dam.

### **3. Imported Water Supply Credits Between Harlan County Dam and Guide Rock During the Irrigation Season**

- a. During Water-Short Year Administration years, monthly credits in the reach between Harlan County Dam and Guide Rock shall be determined as the differences in the stream flows between the two runs at Guide Rock.
- b. The irrigation season shall be defined as starting on the first day of release of water from Harlan County Lake for irrigation use and ending on the last day of release of water from Harlan County Lake for irrigation use.
- c. Credit as an offset for a State's Computed Beneficial Consumptive Use above Guide Rock will be given to all the Imported Water Supply accruing in the reach between Harlan County Dam and Guide Rock during the

irrigation season. If the period of the irrigation season does not coincide with the period of modeled flows, the amount of the Imported Water Supply credited during the irrigation season for that month shall be the total monthly modeled Imported Water Supply Credit times the number of days in the month occurring during the irrigation season divided by the total number of days in the month.

#### **4. Imported Water Supply Credits Between Harlan County Dam and Guide Rock During the Non-Irrigation Season**

- a. Imported Water Supply Credit shall be given between Harlan County Dam and Guide Rock during the period that flows are diverted to fill Lovewell Reservoir to the extent that imported water was needed to meet Lovewell Reservoir target elevations.
- b. Fall and spring fill periods shall be established during which credit shall be given for the Imported Water Supply Credit accruing in the reach. The fall period shall extend from the end of the irrigation season to December 1. The spring period shall extend from March 1 to May 31. The Lovewell target elevations for these fill periods are the projected end of November reservoir level and the projected end of May reservoir level for most probable inflow conditions as indicated in Table 4 in the current Annual Operating Plan prepared by the Bureau of Reclamation.
- c. The amount of water needed to fill Lovewell Reservoir for each period shall be calculated as the storage content of the reservoir at its target elevation at the end of the fill period minus the reservoir content at the start of the fill period plus the amount of net evaporation during this period minus White Rock Creek inflows for the same period.
- d. If the fill period as defined above does not coincide with the period of modeled flows, the amount of the Imported Water Supply Credit during the fill period for that month shall be the total monthly modeled Imported Water Supply Credit times the number of days in the month occurring during the fill season divided by the total number of days in the month.
- e. The amount of non-imported water available to fill Lovewell Reservoir to the target elevation shall be the amount of water available at Guide Rock during the fill period minus the amount of the Imported Water Supply Credit accruing in the reach during the same period.
- f. The amount of the Imported Water Supply Credit that shall be credited against a State's Consumptive Use shall be the amount of water imported by

that State that is available in the reach during the fill period or the amount of water needed to reach Lovewell Reservoir target elevations minus the amount of non-imported water available during the fill period, whichever is less.

## 5. Other Credits

Kansas and Nebraska will explore crediting Imported Water Supply that is otherwise useable by Kansas.

### J. Calculations of Compact Compliance in Water-Short Year Administration Years

During Water-Short Year Administration, using the procedures described in Subsections III.A-D, the RRCA will calculate the Annual Allocations for each State, the Computed Beneficial Consumptive Use by each State, ~~the and~~ Imported Water Supply Credit, ~~and the~~ Augmentation Water Supply Credit that a State may use to offset Computed Beneficial Consumptive Use in that year. The resulting annual and average values will be calculated as displayed in Tables 5 A-C and E.

If Nebraska is implementing an Alternative Water-Short-Year Administration Plan, data to determine Compact compliance will be shown in Table 5D. Nebraska's compliance with the Compact will be determined in the same manner as Nebraska's Above Guide Rock compliance except that compliance will be based on a three-year running average of the current year and previous two year calculations. In addition, Table 5 D. will display the sum of the previous two-year difference in Allocations above Guide Rock and Computed Beneficial Consumptive Uses above Guide Rock minus any Imported Water Credits and compare the result with the Alternative Water-Short-Year Administration Plan's expected decrease in Computed Beneficial Consumptive Use above Guide Rock. Nebraska will be within compliance with the Compact as long as the three-year running average difference in Column 8 is positive and the sum of the previous year and current year deficits above Guide Rock are not greater than the expected decrease in Computed Beneficial Consumptive Use under the plan.

## IV. Specific Formulas

### A. Computed Beneficial Consumptive Use

#### 1. Computed Beneficial Consumptive Use of Groundwater:

The Computed Beneficial Consumptive Use caused by groundwater diversion shall be determined by the RRCA Groundwater Model as described in Subsection III.D.1.

**2. Computed Beneficial Consumptive Use of Surface Water:**

The Computed Beneficial Consumptive Use of surface water shall be calculated as follows:

a) Non-Federal Canals

Computed Beneficial Consumptive Use from diversions by non- federal canals shall be 60 percent of the diversion; the return flow shall be 40 percent of the diversion

b) Individual Surface Water Pumps

Computed Beneficial Consumptive Use from small individual surface water pumps shall be 75 percent of the diversion; return flows will be 25 percent of the diversion unless a state provides data on the amount of different system types in a Sub-basin, in which case the following percentages will be used for each system type:

Gravity Flow.	30%
Center Pivot	17%
LEPA	10%

c) Federal Canals

Computed Beneficial Consumptive Use of diversions by Federal canals will be calculated as shown in Attachment 7. For each Bureau of Reclamation Canal the field deliveries shall be subtracted from the diversion from the river to determine the canal losses. The field delivery shall be multiplied by one minus an average system efficiency for the district to determine the loss of water from the field. Eighty-two percent of the sum of the field loss plus the canal loss shall be considered to be the return flow from the canal diversion. The assumed field efficiencies and the amount of the field and canal loss that reaches the stream may be reviewed by the RRCA and adjusted as appropriate to insure their accuracy.



d) Non-irrigation Uses

Any non-irrigation uses diverting or pumping more than 50 acre-feet per year will be required to measure diversions. Non-irrigation uses diverting more than 50 Acre-feet per year will be assessed a Computed Beneficial Consumptive Use of 50% of what is pumped or diverted, unless the entity presents evidence to the RRCA demonstrating a different percentage should be used.

e) Evaporation from Federal Reservoirs

Net Evaporation from Federal Reservoirs will be calculated as follows:

(1) Harlan County Lake, Evaporation Calculation

April 1 through October 31:

Evaporation from Harlan County Lake is calculated by the Corps of Engineers on a daily basis from April 1 through October 31. Daily readings are taken from a Class A evaporation pan maintained near the project office. Any precipitation recorded at the project office is added to the pan reading to obtain the actual evaporation amount. The pan value is multiplied by a pan coefficient that varies by month. These values are:

March	.56
April	.52
May	.53
June	.60
July	.68
August	.78
September	.91
October	1.01

The pan coefficients were determined by studies the Corps of Engineers conducted a number of years ago. The result is the evaporation in inches. It is divided by 12 and multiplied by the daily lake surface area in acres to obtain the evaporation in Acre-feet. The lake surface area is determined by the 8:00 a.m. elevation reading applied to the lake's area-capacity data. The area-capacity data is updated periodically through a sediment survey. The last survey was completed in December 2000.

November 1 through March 31

During the winter season, a monthly total evaporation in inches has been determined. The amount varies with the percent of ice cover. The values used are:

HARLAN COUNTY LAKE

Estimated Evaporation in Inches  
Winter Season -- Monthly Total

PERCENTAGE OF ICE COVER

	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
JAN	0.88	0.87	0.85	0.84	0.83	0.82	0.81	0.80	0.78	0.77	0.76
FEB	0.90	0.88	0.87	0.86	0.85	0.84	0.83	0.82	0.81	0.80	0.79
MAR	1.29	1.28	1.27	1.26	1.25	1.24	1.23	1.22	1.21	1.20	1.19
OCT	4.87			NO ICE							
NOV	2.81			NO ICE							
DEC	1.31	1.29	1.27	1.25	1.24	1.22	1.20	1.18	1.17	1.16	1.14

The monthly total is divided by the number of days in the month to obtain a daily evaporation value in inches. It is divided by 12 and multiplied by the daily lake surface area in acres to obtain the evaporation in Acre-feet. The lake surface area is determined by the 8:00 a.m. elevation reading applied to the lake's area-capacity data. The area-capacity data is updated periodically through a sediment survey. The last survey was completed in December 2000.

To obtain the net evaporation, the monthly precipitation on the lake is subtracted from the monthly gross evaporation. The monthly precipitation is calculated by multiplying the sum of the month's daily precipitation in inches by the average of the end of the month lake surface area for the previous month and the end of the month lake surface area for the current month in acres and dividing the result by 12 to obtain the precipitation for the month in acre feet.

The total annual net evaporation (Acre-feet) will be charged to Kansas and Nebraska in proportion to the annual diversions made by the Kansas Bostwick Irrigation District and the Nebraska Bostwick Irrigation District during the time period each year when irrigation

releases are being made from Harlan County Lake. For any year in which no irrigation releases were made from Harlan County Lake, the annual net evaporation charged to Kansas and Nebraska will be based on the average of the above calculation for the most recent three years in which irrigation releases from Harlan County Lake were made. In the event Nebraska chooses to substitute supply for the Superior Canal from Nebraska's allocation below Guide Rock in Water-Short Year Administration years, the amount of the substitute supply will be included in the calculation of the split as if it had been diverted to the Superior Canal at Guide Rock.

(2) Evaporation Computations for Bureau of Reclamation Reservoirs  
The Bureau of Reclamation computes the amount of evaporation loss on a monthly basis at Reclamation reservoirs. The following procedure is utilized in calculating the loss in Acre-feet.

An evaporation pan reading is taken each day at the dam site. This measurement is the amount of water lost from the pan over a 24-hour period in inches. The evaporation pan reading is adjusted for any precipitation recorded during the 24-hour period. Instructions for determining the daily pan evaporation are found in the "National Weather Service Observing Handbook No. 2 – Substation Observations." All dams located in the Kansas River Basin with the exception of Bonny Dam are National Weather Service Cooperative Observers. The daily evaporation pan readings are totaled at the end of each month and converted to a "free water surface" (FWS) evaporation, also referred to as "lake" evaporation. The FWS evaporation is determined by multiplying the observed pan evaporation by a coefficient of .70 at each of the reservoirs. This coefficient can be affected by several factors including water and air temperatures. The National Oceanic and Atmospheric Administration (NOAA) has published technical reports describing the determination of pan coefficients. The coefficient used is taken from the "NOAA Technical Report NWS 33, Map of coefficients to convert class A pan evaporation to free water surface evaporation". This coefficient is used for the months of April through October when evaporation pan readings are recorded at the dams. The monthly FWS evaporation is then multiplied by the average surface area of the reservoir during the month in acres. Dividing this value by twelve will result in the amount of water lost to evaporation in Acre-feet during the month.

During the winter months when the evaporation pan readings are not taken, monthly evaporation tables based on the percent of ice cover are used. The tables used were developed by the Corps of Engineers and were based on historical average evaporation rates. A separate table was developed for each of the reservoirs. The monthly evaporation rates are multiplied by the .70 coefficient for pan to free water surface adjustment, divided by twelve to convert inches to feet and multiplied by the average reservoir surface area during the month in acres to obtain the total monthly evaporation loss in Acre-feet.

To obtain the net evaporation, the monthly precipitation on the lake is subtracted from the monthly gross evaporation. The monthly precipitation is calculated by multiplying the sum of the month's daily precipitation in inches by the average of the end of the month lake surface area for the previous month and the end of the month lake surface area for the current month in acres and dividing the result by 12 to obtain the precipitation for the month in acre feet.

f) Non-Federal Reservoir Evaporation:

For Non-Federal Reservoirs with a storage capacity less than 200 Acre-feet, the presumptive average annual surface area is 25% of the area at the principal spillway elevation. Net evaporation for each such Non-Federal Reservoir will be calculated by multiplying the presumptive average annual surface area by the net evaporation from the nearest climate and evaporation station to the Non-Federal Reservoir. A State may provide actual data in lieu of the presumptive criteria.

Net evaporation from Non-Federal Reservoirs with 200 Acre-feet of storage or greater will be calculated by multiplying the average annual surface area (obtained from the area-capacity survey) and the net evaporation from the nearest evaporation and climate station to the reservoir. If the average annual surface area is not available, the Non-Federal Reservoirs with 200 Acre-feet of storage or greater will be presumed to be full at the principal spillway elevation.

**B. Specific Formulas for Each Sub-basin and the Main Stem**

All calculations shall be based on the calendar year and shall be rounded to the nearest 10 Acre-feet using the conventional rounding formula of rounding up for all numbers equal to five or higher and otherwise rounding down.

Abbreviations:

<u>AWS</u>	= Augmentation Water Supply Credit
CBCU	= Computed Beneficial Consumptive Use
CWS	= Computed Water Supply
D	= Non-Federal Canal Diversions for Irrigation
Ev	= Evaporation from Federal Reservoirs
EvNFR	= Evaporation from Non-Federal Reservoirs
FF	= Flood Flow
GW	= Groundwater Computed Beneficial Consumptive Use (includes irrigation and non-irrigation uses)
IWS	= Imported Water Supply Credit from Nebraska
M&I	= Non-Irrigation Surface Water Diversions (Municipal and Industrial)
P	= Small Individual Surface Water Pump Diversions for Irrigation
RF	= Return Flow
VWS	= Virgin Water Supply
c	= Colorado
k	= Kansas
n	= Nebraska
ΔS	= Change in Federal Reservoir Storage
%	= Average system efficiency for individual pumps in the Sub-basin
% BRF	= Percent of Diversion from Bureau Canals that returns to the stream
###	= Value expected to be zero

**3. North Fork of Republican River in Colorado <sup>2</sup>**

$$\text{CBCU Colorado} = 0.6 \times \text{Haigler Canal Diversion Colorado} + 0.6 \times D_c + \% \times P_c + 0.5 \times M\&I_c + EvNFR_c + GW_c$$

$$\text{CBCU Kansas} = GW_k$$

$$\text{CBCU Nebraska} = 0.6 \times \text{Haigler Canal Diversion Nebraska} + GW_n$$

Note: The diversion for Haigler Canal is split between Colorado and Nebraska based on the percentage of land irrigated in each state

$$\text{VWS} = \text{North Fork of the Republican River at the State Line, Stn.}$$

<sup>2</sup> The RRCA will investigate whether return flows from the Haigler Canal diversion in Colorado may return to the Arikaree River, not the North Fork of the Republican River, as indicated in the formulas. If there are return flows from the Haigler Canal to the Arikaree River, these formulas will be changed to recognize those returns.

No. 06823000 + CBCUc + CBCUk + CBCUn + Nebraska  
Haigler Canal RF- IWS

Note: The Nebraska Haigler Canal RF returns to the Main  
Stem

$$\text{CWS} = \text{VWS} - \text{FF}$$

$$\text{Allocation Colorado} = 0.224 \times \text{CWS}$$

$$\text{Allocation Nebraska} = 0.246 \times \text{CWS}$$

$$\text{Unallocated} = 0.53 \times \text{CWS}$$

**4. Arikaree River <sub>2</sub>**

$$\text{CBCU Colorado} = 0.6 \times \text{Dc} + \% \times \text{Pc} + 0.5 \times \text{M\&Ic} + \text{EvNFRc} + \text{GWc}$$

$$\text{CBCU Kansas} = 0.6 \times \text{Dk} + \% \times \text{Pk} + 0.5 \times \text{M\&Ik} + \text{EvNFRk} + \text{GWk}$$

$$\text{CBCU Nebraska} = 0.6 \times \text{Dn} + \% \times \text{Pn} + 0.5 \times \text{M\&In} + \text{EvNFRn} + \text{GWn}$$

$$\text{VWS} = \text{Arikaree Gage at Haigler Stn. No. 06821500} + \text{CBCUc} + \text{CBCUk} + \text{CBCUn} - \text{IWS}$$

$$\text{CWS} = \text{VWS} - \text{FF}$$

$$\text{Allocation Colorado} = 0.785 \times \text{CWS}$$

$$\text{Allocation Kansas} = 0.051 \times \text{CWS}$$

$$\text{Allocation Nebraska} = 0.168 \times \text{CWS}$$

$$\text{Unallocated} = -0.004 \times \text{CWS}$$

**5. Buffalo Creek**

$$\text{CBCU Colorado} = 0.6 \times \text{Dc} + \% \times \text{Pc} + 0.5 \times \text{M\&In} + \text{EvNFRc} + \text{GWc}$$

$$\text{CBCU Kansas} = \text{GWk}$$

Republican River Compact Administration

Accounting Procedures and Reporting Requirements  
Revised August 2010

CBCU Nebraska =  $0.6 \times Dn + \% \times Pn + 0.5 \times M\&In + EvNFRn + GWn$

VWS = Buffalo Creek near Haigler Gage Stn. No. 06823500 +  
CBCUc + CBCUk + CBCUn – IWS

CWS = VWS - FF

Allocation Nebraska =  $0.330 \times CWS$

Unallocated =  $0.670 \times CWS$

**6. Rock Creek**

CBCU Colorado = GWc

CBCU Kansas = GWk

CBCU Nebraska =  $0.6 \times Dn + \% \times Pn + 0.5 \times M\&In + EvNFRn + GWn$

VWS = Rock Creek at Parks Gage Stn. No. 06824000 + CBCUc +  
CBCUk + CBCUn – IWS

CWS = VWS - FF

Allocation Nebraska =  $0.400 \times CWS$

Unallocated =  $0.600 \times CWS$

**7. South Fork Republican River**

CBCU Colorado =  $0.6 \times \text{Hale Ditch Diversion} + 0.6 \times Dc + \% \times Pc + 0.5 \times$   
 $M\&Ic + EvNFRc + \text{Bonny Reservoir Ev} + GWc$

CBCU Kansas =  $0.6 \times Dk + \% \times Pk + 0.5 \times M\&Ik + EvNFRk + GWk$

CBCU Nebraska =  $0.6 \times Dn + \% \times Pn + 0.5 \times M\&In + EvNFRn + GWn$

VWS = South Fork Republican River near Benkelman Gage Stn.  
No. 06827500 + CBCUc + CBCUk + CBCUn +  $\Delta S$  Bonny  
Reservoir – IWS

$$\text{CWS} = \text{VWS} - \Delta\text{S Bonny Reservoir} - \text{FF}$$

$$\text{Allocation Colorado} = 0.444 \times \text{CWS}$$

$$\text{Allocation Kansas} = 0.402 \times \text{CWS}$$

$$\text{Allocation Nebraska} = 0.014 \times \text{CWS}$$

$$\text{Unallocated} = 0.140 \times \text{CWS}$$

**8. Frenchman Creek in Nebraska**

$$\text{CBCU Colorado} = \text{GWc}$$

$$\text{CBCU Kansas} = \text{GWk}$$

$$\begin{aligned} \text{CBCU Nebraska} = & \text{Culbertson Canal Diversions} \times (1-\% \text{BRF}) + \text{Culbertson} \\ & \text{Extension} \times (1-\% \text{BRF}) + 0.6 \times \text{Champion Canal Diversion} + \\ & 0.6 \times \text{Riverside Canal Diversion} + 0.6 \times \text{Dn} + \% \times \text{Pn} + 0.5 \times \\ & \text{M\&In} + \text{EvNFRn} + \text{Enders Reservoir Ev} + \text{GWn} \end{aligned}$$

$$\begin{aligned} \text{VWS} = & \text{Frenchman Creek in Culbertson, Nebraska Gage Stn. No.} \\ & 06835500 + \text{CBCUc} + \text{CBCUk} + \text{CBCUn} + 0.17 \times \\ & \text{Culbertson Diversion RF} + \text{Culbertson Extension RF} + 0.78 \\ & \times \text{Riverside Diversion RF} + \Delta\text{S Enders Reservoir} - \text{IWS} \end{aligned}$$

Note: 17% of the Culbertson Diversion RF and 100% of the Culbertson Extension RF return to the Main Stem

$$\text{CWS} = \text{VWS} - \Delta\text{S Enders Reservoir} - \text{FF}$$

$$\text{Allocation Nebraska} = 0.536 \times \text{CWS}$$

$$\text{Unallocated} = 0.464 \times \text{CWS}$$

**9. Driftwood Creek**

$$\text{CBCU Colorado} = \text{GWc}$$

$$\text{CBCU Kansas} = 0.6 \times \text{Dk} + \% \times \text{Pk} + 0.5 \times \text{M\&Ik} + \text{EvNFRk} + \text{GWk}$$



Republican River Compact Administration

Accounting Procedures and Reporting Requirements  
Revised August 2010

CBCU Nebraska	= $0.6 \times Dn + \% \times Pn + 0.5 \times M\&In + EvNFRn + GWn$
VWS	= Driftwood Creek near McCook Gage Stn. No. 06836500 + CBCUc + CBCUk + CBCUn – 0.24 x Meeker Driftwood Canal RF - IWS
	Note: 24 % of the Meeker Driftwood Canal RF returns to Driftwood Creek
CWS	= VWS – FF
Allocation Kansas	= $0.069 \times CWS$
Allocation Nebraska	= $0.164 \times CWS$
Unallocated	= $0.767 \times CWS$

**10. Red Willow Creek in Nebraska**

CBCU Colorado	= GWc
CBCU Kansas	= GWk
CBCU Nebraska	= $0.1 \times \text{Red Willow Canal CBCU} + 0.6 \times Dn + \% \times Pn + 0.5 \times M\&In + EvNFRn + 0.1 \times \text{Hugh Butler Lake Ev} + GWn$
	Note: Red Willow Canal CBCU = Red Willow Canal Diversion x (1- % BRF)
	90% of the Red Willow Canal CBCU and 90% of Hugh Butler Lake Ev charged to Nebraska’s CBCU in the Main Stem
VWS	= Red Willow Creek near Red Willow Gage Stn. No. 06838000 + CBCUc + CBCUk + CBCUn + 0.9 x Red Willow Canal CBCU + 0.9 x Hugh Butler Lake Ev + 0.9 x Red Willow Canal RF + $\Delta S$ Hugh Butler Lake – IWS
	Note: 90% of the Red Willow Canal RF returns to the Main Stem

CWS = VWS - ΔS Hugh Butler Lake - FF

Allocation Nebraska = 0.192 x CWS

Unallocated = 0.808 x CWS

**11. Medicine Creek**

CBCU Colorado = GWc

CBCU Kansas = GWk

CBCU Nebraska = 0.6 x Dn above and below gage + % x Pn above and below gage + 0.5 x M&In above and below gage + EvNFRn above and below gage + GWn

Note: Harry Strunk Lake Ev charged to Nebraska’s CBCU in the Main Stem.

CU from Harry Strunk releases in the Cambridge Canal is charged to the Main stem (no adjustment to the VWS formula is needed as this water shows up in the Medicine Creek gage).

VWS = Medicine Creek below Harry Strunk Lake Gage Stn. No. 06842500 + CBCUc + CBCUk + CBCUn – 0.6 x Dn below gage - % x Pn below gage – 0.5 \* M&In below gage - EvNFRn below gage + Harry Strunk Lake Ev + ΔS Harry Strunk Lake – IWS – AWS

Note: The CBCU surface water terms for Nebraska which occur below the gage are added in the VWS for the Main Stem

CWS = VWS - ΔS Harry Strunk Lake - FF

Allocation Nebraska = 0.091 x CWS

Unallocated = 0.909 x CWS

**12. Beaver Creek**

CBCU Colorado	= 0.6 x Dc + % x Pc + 0.5 x M&Ic + EvNFRc + GWc
CBCU Kansas	= 0.6 x Dk + % x Pk + 0.5 x M&Ik + EvNFRk + GWk
CBCU Nebraska	= 0.6 x Dn above and below gage + % x Pn above and below gage + 0.5 x M&In above and below gage + EvNFRn above and below gage + GWn
VWS	= Beaver Creek near Beaver City gage Stn. No. 06847000 + BCUC + CBCUK + CBCUn - 0.6 x Dn below gage - % x Pn below gage - 0.5 * M&In below gage - EvNFRn below gage - IWS

Note: The CBCU surface water terms for Nebraska which occur below the gage are added in the VWS for the Main Stem

CWS	= VWS - FF
Allocation Colorado	= 0.200 x CWS
Allocation Kansas	= 0.388 x CWS
Allocation Nebraska	= 0.406 x CWS
Unallocated	= 0.006 x CWS

**13. Sappa Creek**

CBCU Colorado	= GWc
CBCU Kansas	= 0.6 x Dk + % x Pk + 0.5 x M&Ik + EvNFRk + GWk
CBCU Nebraska	= 0.6 x Dn above and below gage + % x Pn above and below gage + 0.5 x M&In above and below gage + EvNFRn above and below gage + GWn
VWS	= Sappa Creek near Stamford gage Stn. No. 06847500 - Beaver Creek near Beaver City gage Stn. No. 06847000 + BCUC + CBCUK + CBCUn - 0.6 x Dn below gage - % x

$P_n$  below gage – 0.5 \* M&In below gage - EvNFRn below gage – IWS

Note: The CBCU surface water terms for Nebraska which occur below the gage are added in the VWS for the Main Stem

CWS = VWS - FF  
Allocation Kansas = 0.411 x CWS  
Allocation Nebraska = 0.411 x CWS  
Unallocated = 0.178 x CWS

**14. Prairie Dog Creek**

CBCU Colorado = GWc  
CBCU Kansas = Almena Canal Diversion x (1-%BRF) + 0.6 x Dk + % x Pk + 0.5 x M&Ik + EvNFRk + Keith Sebelius Lake Ev + GWk  
CBCU Nebraska = 0.6 x Dn below gage + % x Pn below gage + 0.5 x M&In below gage + EvNFRn + GWn below gage  
VWS = Prairie Dog Creek near Woodruff, Kansas USGS Stn. No. 06848500 + CBCUc + CBCUk + CBCUn - 0.6 x Dn below gage - % x Pn below gage - 0.5 x M&In below gage - EvNFRn below gage + ΔS Keith Sebelius Lake – IWS

Note: The CBCU surface water terms for Nebraska which occur below the gage are added in the VWS for the Main Stem

CWS = VWS- ΔS Keith Sebelius Lake - FF  
Allocation Kansas = 0.457 x CSW  
Allocation Nebraska = 0.076 x CWS  
Unallocated = 0.467 x CWS

**15. The North Fork of the Republican River in Nebraska and the Main Stem of the Republican River between the junction of the North Fork and the Arikaree River and the Republican River near Hardy**

CBCU Colorado = GWc

CBCU Kansas =  
 (Deliveries from the Courtland Canal to Kansas above Lovewell) x (1-%BRF)  
 + Amount of transportation loss of Courtland Canal deliveries to Lovewell that does not return to the river, charged to Kansas  
 + (Diversions of Republican River water from Lovewell Reservoir by the Courtland Canal below Lovewell) x (1-%BRF)  
 + 0.6 x Dk  
 + % x Pk  
 + 0.5 x M&Ik  
 + EvNFRk  
 + Harlan County Lake Ev charged to Kansas  
 + Lovewell Reservoir Ev charged to the Republican River  
 + GWk

CBCU Nebraska =  
 Deliveries from Courtland Canal to Nebraska lands x (1-%BRF)  
 + Superior Canal x (1- %BRF)  
 + Franklin Pump Canal x (1- %BRF)  
 + Franklin Canal x (1- %BRF)  
 + Naponee Canal x (1- %BRF)  
 + Cambridge Canal x (1- %BRF)  
 + Bartley Canal x (1- %BRF)  
 + Meeker-Driftwood Canal x (1- %BRF)  
 + 0.9 x Red Willow Canal CBCU  
 + 0.6 x Dn  
 + % x Pn  
 + 0.5 x M&In  
 + EvNFRn  
 + 0.9 x Hugh Butler Lake Ev  
 + Harry Strunk Lake Ev  
 + Swanson Lake Ev  
 + Harlan County Lake Ev charged to Nebraska  
 + GWn

Notes:

The allocation of transportation losses in the Courtland Canal above Lovewell between Kansas and Nebraska shall be done by the Bureau of Reclamation and reported in their "Courtland Canal Above Lovewell" spreadsheet. Deliveries and losses associated with deliveries to both Nebraska and Kansas above Lovewell shall be reflected in the Bureau's Monthly Water District reports. Losses associated with delivering water to Lovewell shall be separately computed.

Amount of transportation loss of the Courtland Canal deliveries to Lovewell that does not return to the river, charged to Kansas shall be 18% of the Bureau's estimate of losses associated with these deliveries.

Red Willow Canal CBCU = Red Willow Canal Diversion x (1- % BRF)

10% of the Red Willow Canal CBCU is charged to Nebraska's CBCU in Red Willow Creek sub-basin

10% of Hugh Butler Lake Ev is charged to Nebraska's CBCU in the Red Willow Creek sub-basin

None of the Harry Strunk Lake EV is charged to Nebraska's CBCU in the Medicine Creek sub-basin

VWS

=

- Republican River near Hardy Gage Stn. No. 06853500
- North Fork of the Republican River at the State Line, Stn. No. 06823000
- Arikaree Gage at Haigler Stn. No. 06821500
- Buffalo Creek near Haigler Gage Stn. No. 06823500
- Rock Creek at Parks Gage Stn. No. 06824000
- South Fork Republican River near Benkelman Gage Stn. No. 06827500
- Frenchman Creek in Culbertson Stn. No. 06835500
- Driftwood Creek near McCook Gage Stn. No. 06836500
- Red Willow Creek near Red Willow Gage Stn. No. 06838000
- Medicine Creek below Harry Strunk Lake Gage Stn. No. 06842500

- Sappa Creek near Stamford Gage Stn. No. 06847500
- Prairie Dog Creek near Woodruff, Kansas Stn. No. 68-485000
  
- + CBCUc
- + CBCUn
  
- +GWk**
- + 0.6 x Dk
- + % x Pk
- + 0.5 x M&Ik
- + EvNFRk
- + Harlan County Lake Ev charged to Kansas
- + Amount of transportation loss of the Courtland Canal above the Stateline that does not return to the river, charged to Kansas
  
- 0.9 x Red Willow Canal CBCU
- 0.9 x Hugh Butler Ev
- Harry Strunk Ev
  
- + 0.6 x Dn below Medicine Creek gage
- + % x Pn below Medicine Creek gage
- + 0.5 \* M&In below Medicine Creek gage
- + EvNFRn below Medicine Creek gage
  
- + 0.6 x Dn below Beaver Creek gage
- + % x Pn below Beaver Creek gage
- + 0.5 \* M&In below Beaver Creek gage
- + EvNFRn below Beaver Creek gage
  
- + 0.6 x Dn below Sappa Creek gage
- + % x Pn below Sappa Creek gage
- + 0.5 \* M&In below Sappa Creek gage
- + EvNFRn below Sappa Creek gage
  
- + 0.6 x Dn below Prairie Dog Creek gage
- + % x Pn below Prairie Dog Creek gage
- + 0.5 \* M&In below Prairie Dog Creek gage
- + EvNFRn below Prairie Dog Creek gage
  
- + Change in Storage Harlan County Lake
- + Change in Storage Swanson Lake

Republican River Compact Administration

Accounting Procedures and Reporting Requirements  
Revised August 2010

- Nebraska Haigler Canal RF
- 0.78 x Riverside Canal RF
- 0.17 x Culbertson Canal RF
- Culbertson Canal Extension RF to Main Stem
- + 0.24 x Meeker Driftwood Canal RF which returns to Driftwood Creek
- 0.9 x Red Willow Canal RF

+ Courtland Canal at Kansas-Nebraska State Line Gage Stn No. 06852500

- Courtland Canal RF in Kansas above Lovewell Reservoir

-IWS

Notes:

None of the Nebraska Haigler Canal RF returns to the North Fork of the Republican River

83% of the Culbertson Diversion RF and none of the Culbertson Extension RF return to Frenchman Creek

24 % of the Meeker Driftwood Canal RF returns to Driftwood Creek.

10% of the Red Willow Canal RF returns to Red Willow Creek

Courtland Canal RF in Kansas above Lovewell Reservoir = 0.015 x (Courtland Canal at Kansas-Nebraska State Line Gage Stn No. 06852500)

CWS = VWS - Change in Storage Harlan County Lake - Change in Storage Swanson Lake - FF

Allocation Kansas = 0.511 x CWS

Allocation Nebraska = 0.489 x CWS

#### **V. Annual Data/ Information Requirements, Reporting, and Verification**

The following information for the previous calendar year shall be provided to the members of the RRCA Engineering Committee by April 15<sup>th</sup> of each year, unless otherwise specified.



All information shall be provided in electronic format, if available.

Each State agrees to provide all information from their respective State that is needed for the RRCA Groundwater Model and RRCA Accounting Procedures and Reporting Requirements, including but not limited to the following:

**A. Annual Reporting**

**1. Surface water diversions and irrigated acreage:**

Each State will tabulate the canal, ditch, and other surface water diversions that are required by RRCA annual compact accounting and the RRCA Groundwater Model on a monthly format (or a procedure to distribute annual data to a monthly basis) and will forward the surface water diversions to the other States. This will include available diversion, wasteway, and farm delivery data for canals diverting from the Platte River that contribute to Imported Water Supply into the Basin. Each State will provide the water right number, type of use, system type, location, diversion amount, and acres irrigated.

**2. Groundwater pumping and irrigated acreage:**

Each State will tabulate and provide all groundwater well pumping estimates that are required for the RRCA Groundwater Model to the other States.

**Colorado** – will provide an estimate of pumping based on a county format that is based upon system type, Crop Irrigation Requirement (CIR), irrigated acreage, crop distribution, and irrigation efficiencies. Colorado will require installation of a totalizing flow meter, installation of an hours meter with a measurement of the pumping rate, or determination of a power conversion coefficient for 10% of the active wells in the Basin by December 31, 2005. Colorado will also provide an annual tabulation for each groundwater well that measures groundwater pumping by a totalizing flow meter, hours meter or power conversion coefficient that includes: the groundwater well permit number, location, reported hours, use, and irrigated acreage.

**Kansas** - will provide an annual tabulation by each groundwater well that includes: water right number, groundwater pumping determined by a meter on each well (or group of wells in a manifold system) or by reported hours of use and rate; location; system type (gravity, sprinkler, LEPA, drip, etc.); and irrigated acreage. Crop distribution will be provided on a county basis.

**Nebraska** – will provide an annual tabulation through the representative Natural Resource District (NRD) in Nebraska that includes: the well registration number or other ID number; groundwater pumping determined by a meter on each well (or group of wells in a manifold system) or by reported hours of use and rate; wells will be identified by; location; system type (gravity, sprinkler, LEPA, drip, etc.); and irrigated acreage. Crop distribution will be provided on a county basis.

**3. Climate information:**

Each State will tabulate and provide precipitation, temperature, relative humidity or dew point, and solar radiation for the following climate stations:

State	Identification	Name
Colorado		
Colorado	C050109	Akron 4 E
Colorado	C051121	Burlington
Colorado	C054413	Julesburg
Colorado	C059243	Wray
Kansas	C140439	Atwood 2 SW
Kansas	C141699	Colby 1SW
Kansas	C143153	Goodland
Kansas	C143837	Hoxie
Kansas	C145856	Norton 9 SSE
Kansas	C145906	Oberlin1 E
Kansas	C147093	Saint Francis
Kansas	C148495	Wakeeny
Nebraska	C250640	Beaver City
Nebraska	C250810	Bertrand
Nebraska	C252065	Culbertson
Nebraska	C252690	Elwood 8 S
Nebraska	C253365	Gothenburg
Nebraska	C253735	Hebron
Nebraska	C253910	Holdredge
Nebraska	C254110	Imperial
Nebraska	C255090	Madrid
Nebraska	C255310	McCook
Nebraska	C255565	Minden
Nebraska	C256480	Palisade
Nebraska	C256585	Paxton
Nebraska	C257070	Red Cloud
Nebraska	C258255	Stratton
Nebraska	C258320	Superior
Nebraska	C258735	Upland
Nebraska	C259020	Wauneta 3 NW

**4. Crop Irrigation Requirements:**

Each State will tabulate and provide estimates of crop irrigation requirement information on a county format. Each State will provide the percentage of the crop irrigation requirement met by pumping; the percentage of groundwater irrigated lands served by sprinkler or flood irrigation systems, the crop irrigation requirement; crop distribution; crop coefficients; gain in soil moisture from winter and spring precipitation, net crop irrigation requirement; and/or other information necessary to compute a soil/water balance.

**5. Streamflow Records from State-Maintained Gaging Records:**

Streamflow gaging records from the following State maintained gages will be provided:

Station No	Name
00126700	Republican River near Trenton
06831500	Frenchman Creek near Imperial
06832500	Frenchman Creek near Enders
06835000	Stinking Water Creek near Palisade
06837300	Red Willow Creek above Hugh Butler Lake
06837500	Red Willow Creek near McCook
06841000	Medicine Creek above Harry Strunk Lake
06842500	Medicine Creek below Harry Strunk Lake
06844000	Muddy Creek at Arapahoe
06844210	Turkey Creek at Edison
06847000	Beaver Creek near Beaver City
	Republican River at Riverton
06851500	Thompson Creek at Riverton
06852000	Elm Creek at Amboy
	Republican River at the Superior-Courtland Diversion Dam

**6. Platte River Reservoirs:**

The State of Nebraska will provide the end-of-month contents, inflow data, outflow data, area-capacity data, and monthly net evaporation, if available, from Johnson Lake; Elwood Reservoir; Sutherland Reservoir; Maloney Reservoir; and Jeffrey Lake.

**7. Water Administration Notification:**

The State of Nebraska will provide the following information that describes the protection of reservoir releases from Harlan County Lake and for the administration of water rights junior in priority to February 26, 1948:

Date of notification to Nebraska water right owners to curtail their diversions, the amount of curtailment, and length of time for curtailment.

The number of notices sent.

The number of diversions curtailed and amount of curtailment in the Harlan County Lake to Guide Rock reach of the Republican River.

**8. Moratorium:**

Each State will provide a description of all new Wells constructed in the Basin Upstream of Guide Rock including the owner, location (legal description), depth and diameter or dimension of the constructed water well, casing and screen information, static water level, yield of the water well in gallons per minute or gallons per hour, and intended use of the water well.

Designation whether the Well is a:

- a. Test hole;
- b. Dewatering Well with an intended use of one year or less;
- c. Well designed and constructed to pump fifty gallons per minute or less;
- d. Replacement Water Well, including a description of the Well that is replaced providing the information described above for new Wells and a description of the historic use of the Well that is replaced;
- e. Well necessary to alleviate an emergency situation involving provision of water for human consumption, including a brief description of the nature of the emergency situation and the amount of water intended to be pumped by and the length of time of operation of the new Well;
- f. Transfer Well, including a description of the Well that is transferred providing the information described above for new Wells and a description of the Historic Consumptive Use of the Well that is transferred;
- g. Well for municipal and/or industrial expansion of use;

Wells in the Basin in Northwest Kansas or Colorado. Kansas and Colorado will provide the information described above for new Wells along with copies of any other information that is required to be filed with either State or local agencies under the laws, statutes, rules and regulations in existence as of April 30, 2002, and;

Any changes in State law in the previous year relating to existing Moratorium.

**9. Non-Federal Reservoirs:**

Each State will conduct an inventory of Non Federal Reservoirs by December 31, 2004, for inclusion in the annual Compact Accounting. The inventory shall include the following information: the location, capacity (in Acre-feet) and area (in acres) at the principal spillway elevation of each Non-Federal Reservoir. The States will annually provide any updates to the initial inventory of Non-Federal Reservoirs, including enlargements that are constructed in the previous year.

Owners/operators of Non-Federal Reservoirs with 200 Acre-feet of storage capacity or greater at the principal spillway elevation will be required to provide an area-capacity survey from State-approved plans or prepared by a licensed professional engineer or land surveyor.

**10. Augmentation Plan:**

Each State will provide a description of the wells, measuring devices, conveyance structure(s), and other infrastructure to describe the physical characteristics of each augmentation plan. The States will provide necessary updates to the plan on an annual basis.

**B. RRCA Groundwater Model Data Input Files**

1. Monthly groundwater pumping, surface water recharge, groundwater recharge, and precipitation recharge provided by county and indexed to the one square mile cell size.
2. Potential Evapotranspiration rate is set as a uniform rate for all phreatophyte vegetative classes – the amount is X at Y climate stations and is interpolated spatially using kriging.

**C. Inputs to RRCA Accounting**

## 1. Surface Water Information

- a. Streamflow gaging station records: obtained as preliminary USGS or Nebraska streamflow records, with adjustments to reflect a calendar year, at the following locations:

Arikaree River at Haigler, Nebraska  
North Fork Republican River at Colorado-Nebraska state line  
Buffalo Creek near Haigler, Nebraska  
Rock Creek at Parks, Nebraska  
South Fork Republican River near Benkelman, Nebraska  
Frenchman Creek at Culbertson, Nebraska  
Red Willow Creek near Red Willow, Nebraska  
Medicine Creek below Harry Strunk Lake, Nebraska\*  
Beaver Creek near Beaver City, Nebraska\*  
Sappa Creek near Stamford, Nebraska  
Prairie Dog Creek near Woodruff, Kansas  
Courtland Canal at Nebraska-Kansas state line  
Republican River near Hardy, Nebraska  
Republican River at Superior-Courtland Diversion Dam near Guide Rock,  
Nebraska (new)\*

- b. Federal reservoir information: obtained from the United States Bureau of Reclamation:

Daily free water surface evaporation, storage, precipitation, reservoir release information, and updated area-capacity tables.

Federal Reservoirs:  
Bonny Reservoir  
Swanson Lake  
Harry Strunk Lake  
Hugh Butler Lake  
Enders Reservoir  
Keith Sebelius Lake  
Harlan County Lake  
Lovewell Reservoir

- c. Non-federal reservoirs obtained by each state: an updated inventory of reservoirs that includes the location, surface area (acres), and capacity (in Acre-feet), of each non-federal reservoir with storage capacity of fifteen (15) Acre-feet or greater at the principal spillway

elevation. Supporting data to substantiate the average surface water areas that are different than the presumptive average annual surface area may be tendered by the offering State.

d. Diversions and related data from USBR

Irrigation diversions by canal, ditch, and pumping station that irrigate more than two (2) acres  
Diversions for non-irrigation uses greater than 50 Acre-feet  
Farm Deliveries  
Wasteway measurements  
Irrigated acres

e. Diversions and related data – from each respective State

Irrigation diversions by canal, ditch, and pumping station that irrigate more than two (2) acres  
Diversions for non-irrigation uses greater than 50 Acre-feet  
Wasteway measurements, if available

**2. Groundwater Information**

(From the RRCA Groundwater model as output files as needed for the accounting procedures)

- a. Imported water - mound credits in amount and time that occur in defined streamflow points/reaches of measurement or compliance – ex: gaging stations near confluence or state lines
- b. Groundwater depletions to streamflow (above points of measurement or compliance – ex: gaging stations near confluence or state lines)

**3. Summary**

The aforementioned data will be aggregated by Sub-basin as needed for RRCA accounting.

## D. Verification

### 1. Documentation to be Available for Inspection Upon Request

- a. Well permits/ registrations database
- b. Copies of well permits/ registrations issued in calendar year
- c. Copies of surface water right permits or decrees
- d. Change in water right/ transfer historic use analyses
- e. Canal, ditch, or other surface water diversion records
- f. Canal, ditch, or other surface water measurements
- g. Reservoir storage and release records
- h. Irrigated acreage
- i. [Augmentation Plan well pumping and augmentation delivery records](#)

### 2. Site Inspection

- a. Accompanied – reasonable and mutually acceptable schedule among representative state and/or federal officials.
- b. Unaccompanied – inspection parties shall comply with all laws and regulations of the State in which the site inspection occurs.



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

Designated Drainage Basin	Col. 1: Virgin Water Supply	Col. 2: Computed Water Supply	Col. 3: Allocations				Col. 4: Computed Beneficial Consumptive Use		
			Colorado	Nebraska	Kansas	Unallocated	Colorado	Nebraska	Kansas
North Fork in Colorado									
Arikaree									
Buffalo									
Rock									
South Fork of Republican River									
Frenchman									
Driftwood									
Red Willow									
Medicine									
Beaver									
Sappa									
Prairie Dog									
North Fork of Republican River in Nebraska and Main Stem									
Total All Basins									
North Fork Of Republican River in Nebraska and Mainstem Including Unallocated Water									
Total									

Republican River Compact Administration

Accounting Procedures and Reporting Requirements  
Revised August 2010

Table 2: Original Compact Virgin Water Supply and Allocations

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

Republican River Compact Administration

Accounting Procedures and Reporting Requirements  
Revised August 2010

Table 3A: Table to Be Used to Calculate Colorado's Five-Year Running Average Allocation and Computed Beneficial Consumptive Use for Determining Compact Compliance

Colorado				
	Col. 1	Col. 2	Col. 3	Col. 4
Year	Allocation	Computed Beneficial Consumptive	Imported Water Supply Credit	Difference between Allocation and the Computed Beneficial Consumptive Use offset by Imported Water Supply Credit Col 1 – (Col 2- Col 3)
Year t= -4				
Year t= -3				
Year t= -2				
Year t= -1				
Current Year t= 0				
Average				

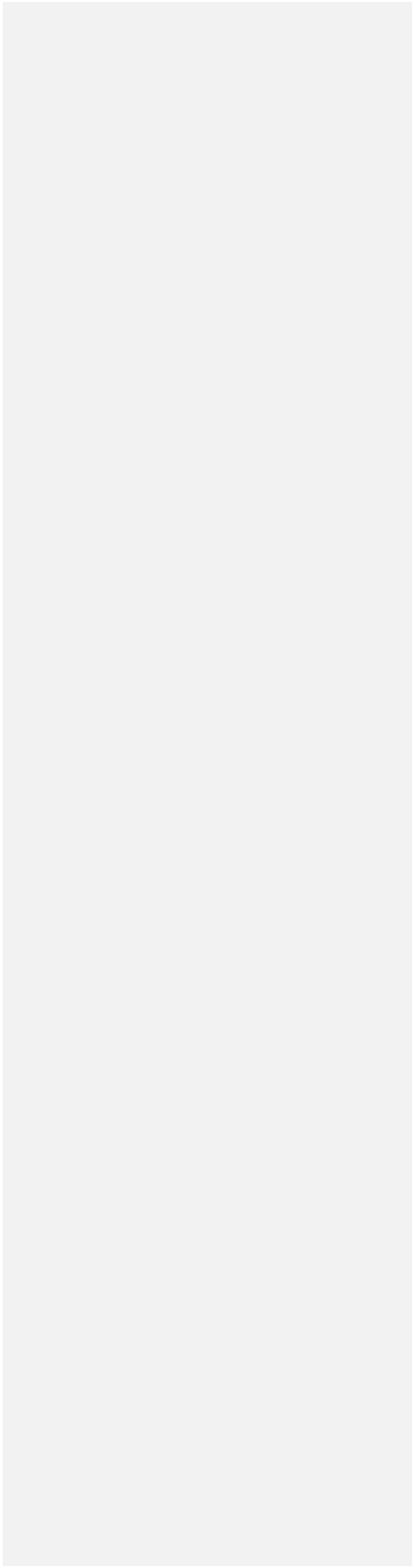
Table 3B. Table to Be Used to Calculate Kansas's Five-Year Running Average Allocation and Computed Beneficial Consumptive Use for Determining Compact Compliance

Kansas				
	Col. 1	Col. 2	Col. 3	Col. 4
Year	Allocation	Computed Beneficial Consumptive	Imported Water Supply Credit	Difference between Allocation and the Computed Beneficial Consumptive Use offset by Imported Water Supply Credit Col 1 – (Col 2- Col 3)
Year t= -4				
Year t= -3				
Year t= -2				
Year t= -1				
Current Year t= 0				
Average				

Republican River Compact Administration

Accounting Procedures and Reporting Requirements  
Revised August 2010

|



Republican River Compact Administration

Accounting Procedures and Reporting Requirements  
Revised August 2010

Table 3C. Table to Be Used to Calculate Nebraska's Five-Year Running Average Allocation and Computed Beneficial Consumptive Use for Determining Compact Compliance

Formatted: Normal

Nebraska				
	Col. 1	Col. 2	Col. 3	Col. 4
Year	Allocation	Computed Beneficial Consumptive	Imported Water Supply Credit <u>and/or</u> <u>Augmentation Water Supply Credit</u>	Difference between Allocation and the Computed Beneficial Consumptive Use offset by Imported Water Supply Credit Col 1 – (Col 2- Col 3)
Year T= -4				
Year T= -3				
Year T= -2				
Year T= -1				
Current Year T= 0				
Average				

Republican River Compact Administration

Accounting Procedures and Reporting Requirements  
Revised July 2005

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

	Col 1	Col 2	Col 3	Col 4	Col 5	Col 6
Sub-basin	Colorado Sub-basin Allocation (5-year running average)	Unallocated Supply (5-year running average)	Credits from Imported Water Supply (5-year running average)	Total Supply Available = Col 1+ Col 2 + Col 3 (5-year running average)	Colorado Computed Beneficial Consumptive Use (5-year running average)	Difference Between Available Supply and Computed Beneficial Consumptive Use = Col 4 – Col 5 (5-year running average)
North Fork Republican River Colorado						
Arikaree River						
South Fork Republican River						
Beaver Creek						

Table 4B: Kansas Compliance with the Sub-basin Non-impairment Requirement

	Col 1	Col 2	Col 3	Col 4	Col 5	Col 6	Col 7
Sub-basin	Kansas Sub-basin Allocation (5-year running average)	Unallocated Supply (5-year running average)	Unused Allocation from Colorado (5-year running average)	Credits from Imported Water Supply (5-year running average)	Total Supply Available = Col 1+ Col 2+ Col 3 + Col 4 (5-year running average)	Kansas Computed Beneficial Consumptive Use (5-year running average)	Difference Between Available Supply and Computed Beneficial Consumptive Use = Col 5 – Col 6 (5-year running average)
Arikaree River							
South Fork Republican River							
Driftwood Creek							
Beaver Creek							
Sappa Creek							
Prairie Dog Creek							

Republican River Compact Administration

Accounting Procedures and Reporting Requirements  
Revised July 2005

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

Colorado				
	Col. 1	Col. 2	Col. 3	Col 4
Year	Allocation minus Allocation for Beaver Creek	Computed Beneficial Consumptive minus Computed Beneficial Consumptive Use for Beaver Creek	Imported Water Supply Credit excluding Beaver Creek	Difference between Allocation and the Computed Beneficial Consumptive Use offset by Imported Water Supply Credit for All Basins Except Beaver Creek Col 1 – (Col 2 – Col 3)
Year T= -4				
Year T= -3				
Year T= -2				
Year T= -1				
Current Year T= 0				
Average				

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

Kansas						
Year	Allocation			Computed Beneficial Consumptive Use	Imported Water Supply Credit	Difference Between Allocation and the Computed Beneficial Consumptive Use offset by Imported Water Supply Credit
Column	1	2	3	4	5	6
	Sum Sub-basins	Kansas's Share of the Unallocated Supply	Total Col 1 + Col 2			Col 3 – (Col 4 – Col 5)
Previous Year						
Current Year						
Average						

Republican River Compact Administration

Accounting Procedures and Reporting Requirements  
Revised August 2010

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

Nebraska								
Year	Allocation			Computed Beneficial Consumptive Use			Imported Water Supply Credit <u>and/or</u> <u>Augmentation</u> <u>Water Supply</u> <u>Credit</u>	Difference Between Allocation and the Computed Beneficial Consumptive Use offset by Imported Water Supply Credit <u>and/or</u> <u>Augmentation</u> <u>Water Supply</u> <u>Credit</u> Above Guide Rock
Column	Col 1	Col 2	Col 3	Col 4	Col 5	Col 6	Col 7	Col 8
	State Wide Allocation	Allocation below Guide Rock	State Wide Allocation above Guide Rock	State Wide CBCU	CBCU below Guide Rock	State Wide CBCU above Guide Rock	Credits above Guide Rock	Col 3 – (Col 6 – Col 7)
Previous Year								
Current Year								
Average								



Republican River Compact Administration

Accounting Procedures and Reporting Requirements  
Revised August 2010

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

Year	Allocation			Computed Beneficial Consumptive Use			Imported Water Supply Credit <u>and/or</u> <u>Augmentation</u> <u>Water Supply</u> <u>Credit</u>	Difference Between Allocation and the Computed Beneficial Consumptive Use offset by Imported Water Supply Credit <u>and/or</u> <u>Augmentation</u> <u>Water Supply</u> <u>Credit</u> Above Guide Rock
	Col 1	Col 2	Col 3	Col 4	Col 5	Col 6		
Column	State Wide Allocation	Allocation below Guide Rock	State Wide Allocation above Guide Rock	State Wide CBCU	CBCU below Guide Rock	State Wide CBCU above Guide Rock	Credits above Guide Rock	Col 3 – (Col 6- Col 7)
Year = -2								
Year = -1								
Current Year								
Three-Year Average								
Sum of Previous Two-year Difference								
Expected Decrease in CBCU Under Plan								

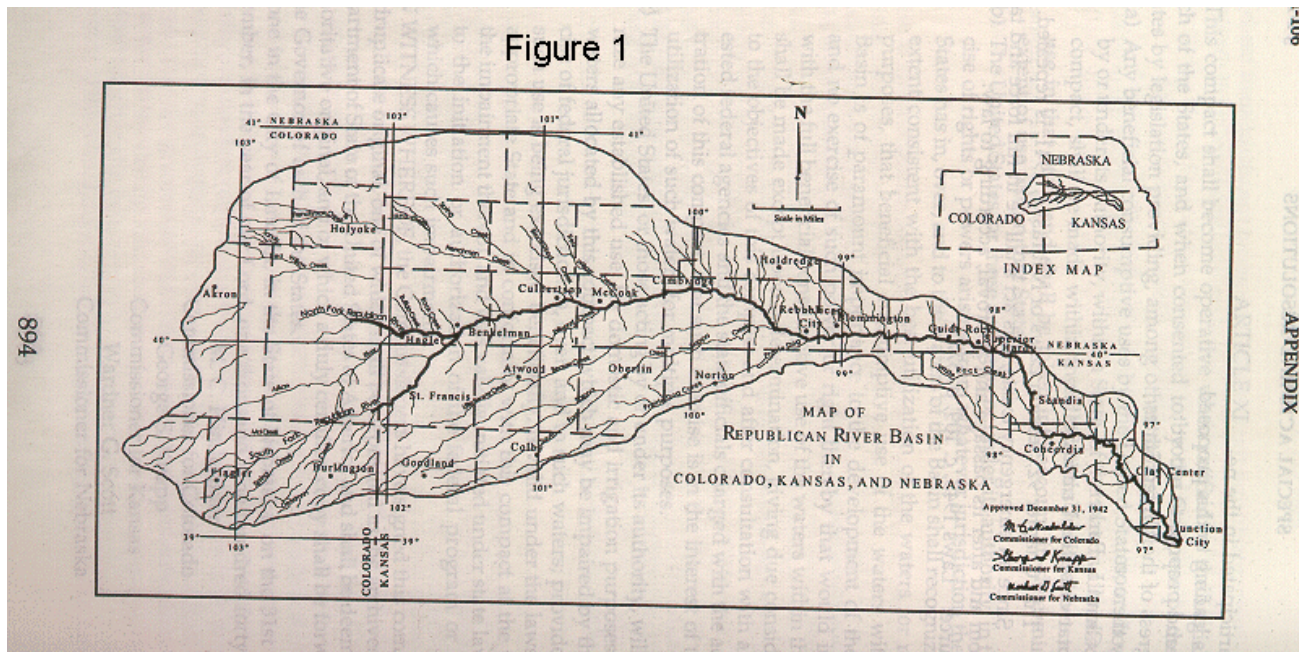
Table 5E: Nebraska Tributary Compliance During Water-Short Year Administration

Year	Sum of Nebraska Sub-basin Allocations	Sum of Nebraska's Share of Sub-basin Unallocated Supplies	Total Available Water Supply for Nebraska	Computed Beneficial Consumptive Use	Imported Water Supply Credit <u>and/or</u> <u>Augmentation</u> <u>Water Supply</u> <u>Credit</u>	Difference between Allocation And the Computed Beneficial Consumptive Use offset by Imported Water Supply Credit <u>and/or</u> <u>Augmentation</u> <u>Water Supply</u> <u>Credit</u>
	Col 1	Col 2	Col 3	Col 4	Col 5	Col 6
Previous Year						Col 3 -(Col 4-Col 5)

Republican River Compact Administration

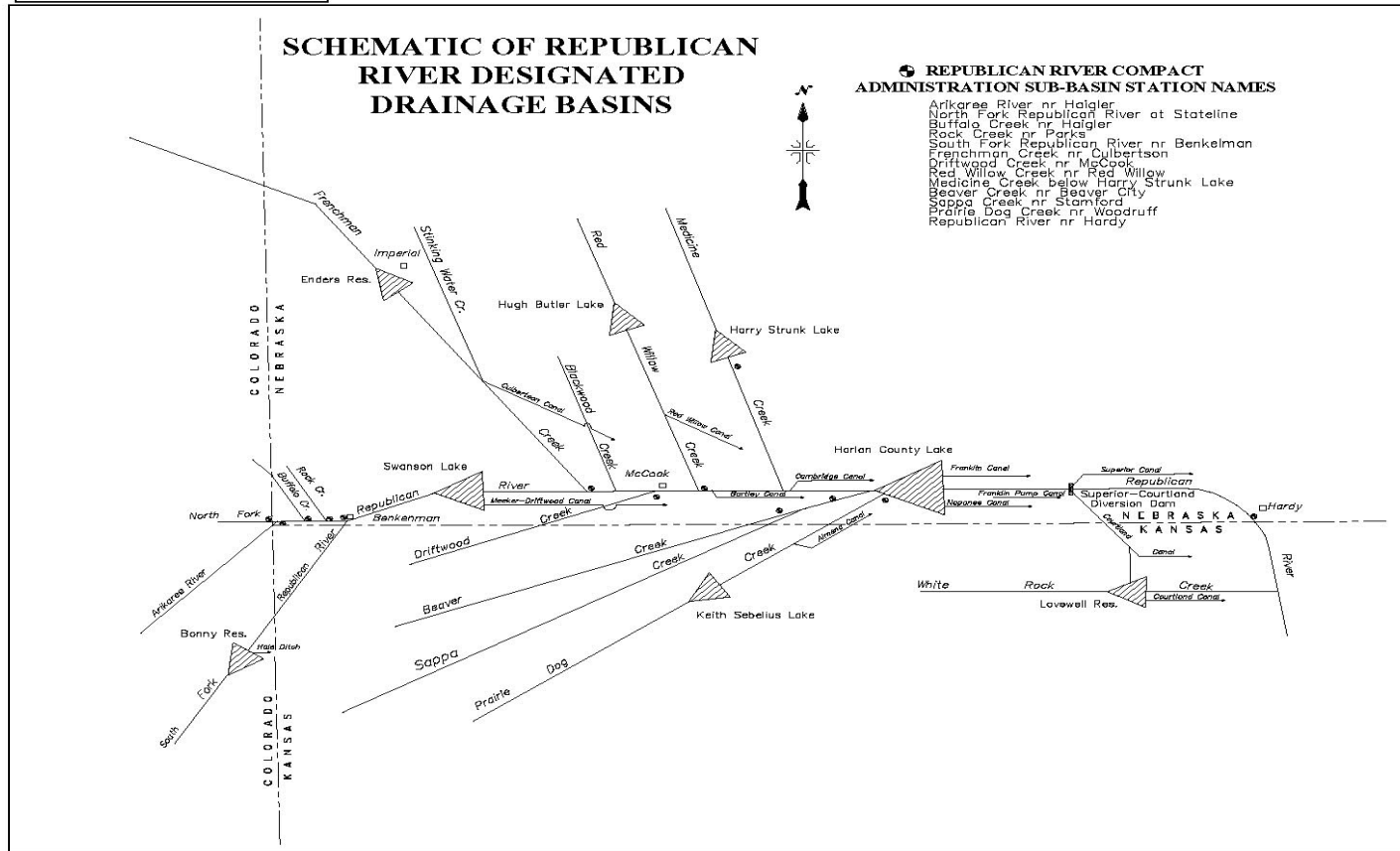
Accounting Procedures and Reporting Requirements  
Revised August 2010

Current Year						
Average						



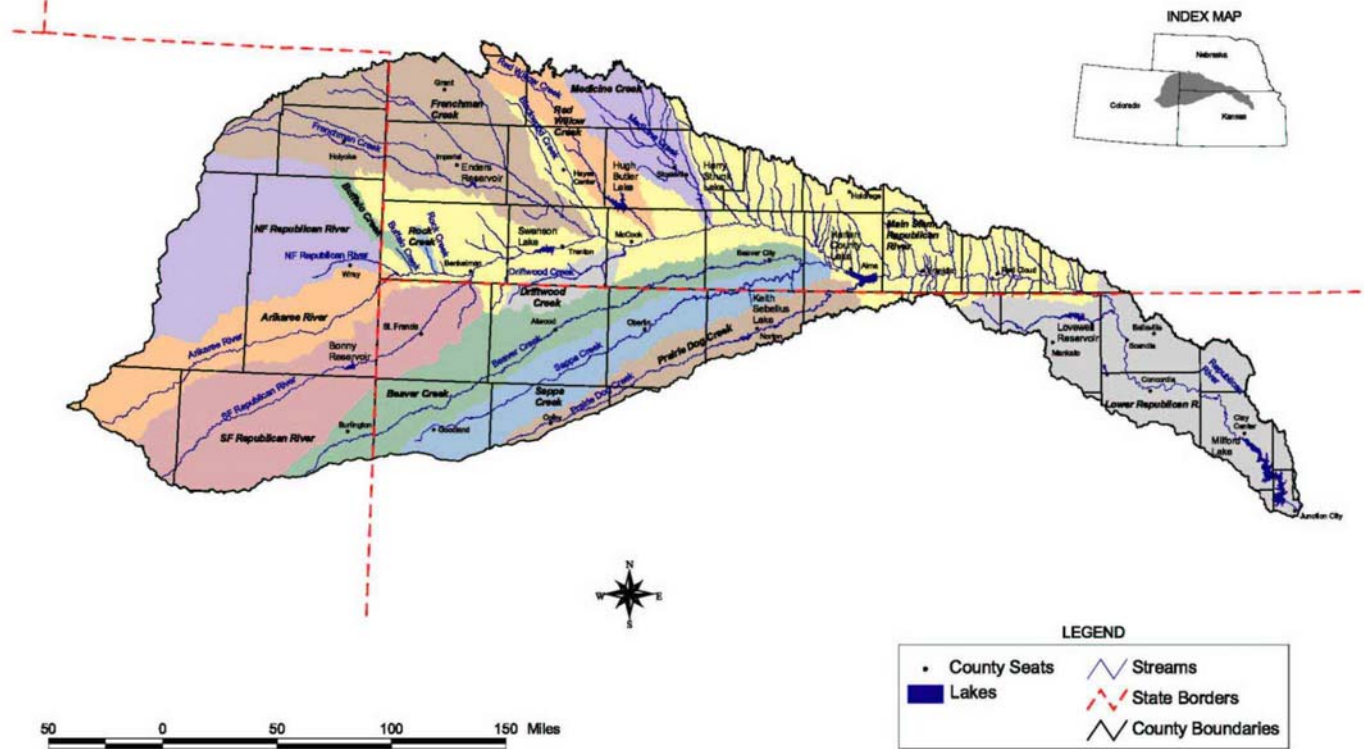
Basin Map Attached to Compact that Shows the Streams and the Basin Boundaries

Figure 2



Line Diagram of Designated Drainage Basins Showing Federal Reservoirs and Sub-basin Gaging Stations

Update of Figure 3 - Map Showing Sub-basins, Streams, and the Basin Boundaries  
RRCA Accounting Procedures and Reporting Requirements  
January 12, 2005



Map Showing Sub-basins, Streams, and the Basin Boundaries

Attachment 1: Sub-basin Flood Flow Thresholds

Sub-basin	Sub-basin Flood Flow Threshold Acre-feet per Year <sup>3</sup>
Arikaree River	16,400
North Fork of Republican River	33,900
Buffalo Creek	4,800
Rock Creek	9,800
South Fork of Republican River	30,400
Frenchman Creek	51,900
Driftwood Creek	9,400
Red Willow Creek	15,100
Medicine Creek	55,100
Beaver Creek	13,900
Sappa Creek	26,900
Prairie Dog	15,700

<sup>3</sup> Flows considered to be Flood Flows are flows in excess of the 94% flow based on a flood frequency analysis for the years 1971-2000. The Gaged Flows are measured after depletions by Beneficial Consumptive Use and change in reservoir storage. For the purpose of compliance with III.B.1, the Gaged Flows shall not include Augmentation Water Supply Credits delivered in any calendar year.

Attachment 2: Description of the Consensus Plan for Harlan County Lake

The Consensus Plan for operating Harlan County Lake was conceived after extended discussions and negotiations between Reclamation and the Corps. The agreement shaped at these meetings provides for sharing the decreasing water supply into Harlan County Lake. The agreement provides a consistent procedure for: updating the reservoir elevation/storage relationship, sharing the reduced inflow and summer evaporation, and providing a January forecast of irrigation water available for the following summer.

During the interagency discussions the two agencies found agreement in the following areas:

- The operating plan would be based on current sediment accumulation in the irrigation pool and other zones of the project.
- Evaporation from the lake affects all the various lake uses in proportion to the amount of water in storage for each use.
- During drought conditions, some water for irrigation could be withdrawn from the sediment pool.
- Water shortage would be shared between the different beneficial uses of the project, including fish, wildlife, recreation and irrigation.

To incorporate these areas of agreement into an operation plan for Harlan County Lake, a mutually acceptable procedure addressing each of these items was negotiated and accepted by both agencies.

1. Sediment Accumulation.

The most recent sedimentation survey for Harlan County project was conducted in 1988, 37 years after lake began operation. Surveys were also performed in 1962 and 1972; however, conclusions reached after the 1988 survey indicate that the previous calculations are unreliable. The 1988 survey indicates that, since closure of the dam in 1951, the accumulated sediment is distributed in each of the designated pools as follows:

Flood Pool	2,387 Acre-feet
Irrigation Pool	4,853 Acre-feet
Sedimentation Pool	33,527 Acre-feet

To insure that the irrigation pool retained 150,000 Acre-feet of storage, the bottom of the irrigation pool was lowered to 1,932.4 feet, msl, after the 1988 survey.

To estimate sediment accumulation in the lake since 1988, we assumed similar conditions have occurred at the project during the past 11 years. Assuming a consistent rate of deposition since 1988, the irrigation pool has trapped an additional 1,430 Acre-feet.

A similar calculation of the flood control pool indicates that the flood control pool has captured an additional 704 Acre-feet for a total of 3,090 Acre-feet since construction.

The lake elevations separating the different pools must be adjusted to maintain a 150,000-acre-foot irrigation pool and a 500,000-acre-foot flood control pool. Adjusting these elevations results in the following new elevations for the respective pools (using the 1988 capacity tables).

Top of Irrigation Pool	1,945.70 feet, msl
Top of Sediment Pool	1,931.75 feet, msl

Due to the variability of sediment deposition, we have determined that the elevation capacity relationship should be updated to reflect current conditions. We will complete a new sedimentation survey of Harlan County Lake this summer, and new area capacity tables should be available by early next year. The new tables may alter the pool elevations achieved in the Consensus Plan for Harlan County Lake.

2. Summer Evaporation.

Evaporation from a lake is affected by many factors including vapor pressure, wind, solar radiation, and salinity of the water. Total water loss from the lake through evaporation is also affected by the size of the lake. When the lake is lower, the surface area is smaller and less water loss occurs. Evaporation at Harlan County Lake has been estimated since the lake's construction using a Weather Service Class A pan which is 4 feet in diameter and 10 inches deep. We and Reclamation have jointly reviewed this information and assumed future conditions to determine an equitable method of distributing the evaporation loss from the project between irrigation and the other purposes.

During those years when the irrigation purpose expected a summer water yield of 119,000 Acre-feet or more, it was determined that an adequate water supply existed and no sharing of evaporation was necessary. Therefore, evaporation evaluation focused on the lower pool elevations when water was scarce. Times of water shortage would also generally be times of higher evaporation rates from the lake.

Reclamation and we agreed that evaporation from the lake during the summer (June through September) would be distributed between the irrigation and sediment pools based on their relative percentage of the total storage at the time of evaporation. If the sediment pool held 75 percent of the total storage, it would be charged 75 percent of the evaporation. If the sediment pool held 50 percent of the total storage, it would be charged 50 percent of the evaporation. At the bottom of the irrigation pool (1,931.75 feet, msl) all of the evaporation would be charged to the sediment pool.

Due to downstream water rights for summer inflow, neither the irrigation nor the sediment pool is credited with summer inflow to the lake. The summer inflows would be



assumed passed through the lake to satisfy the water right holders. Therefore, Reclamation and we did not distribute the summer inflow between the project purposes.

As a result of numerous lake operation model computer runs by Reclamation, it became apparent that total evaporation from the project during the summer averaged about 25,000 Acre-feet during times of lower lake elevations. These same models showed that about 20 percent of the evaporation should be charged to the irrigation pool, based on percentage in storage during the summer months. About 20 percent of the total lake storage is in the irrigation pool when the lake is at elevation 1,935.0 feet, msl. As a result of the joint study, Reclamation and we agreed that the irrigation pool would be credited with 20,000 Acre-feet of water during times of drought to share the summer evaporation loss.

Reclamation and we further agreed that the sediment pool would be assumed full each year. In essence, if the actual pool elevation were below 1,931.75 feet, msl, in January, the irrigation pool would contain a negative storage for the purpose of calculating available water for irrigation, regardless of the prior year's summer evaporation from sediment storage.

### 3. Irrigation withdrawal from sediment storage.

During drought conditions, occasional withdrawal of water from the sediment pool for irrigation is necessary. Such action is contemplated in the Field Working Agreement and the Harlan County Lake Regulation Manual: "Until such time as sediment fully occupies the allocated reserve capacity, it will be used for irrigation and various conservation purposes, including public health, recreation, and fish and wildlife preservation."

To implement this concept into an operation plan for Harlan County Lake, Reclamation and we agreed to estimate the net spring inflow to Harlan County Lake. The estimated inflow would be used by the Reclamation to provide a firm projection of water available for irrigation during the next season.

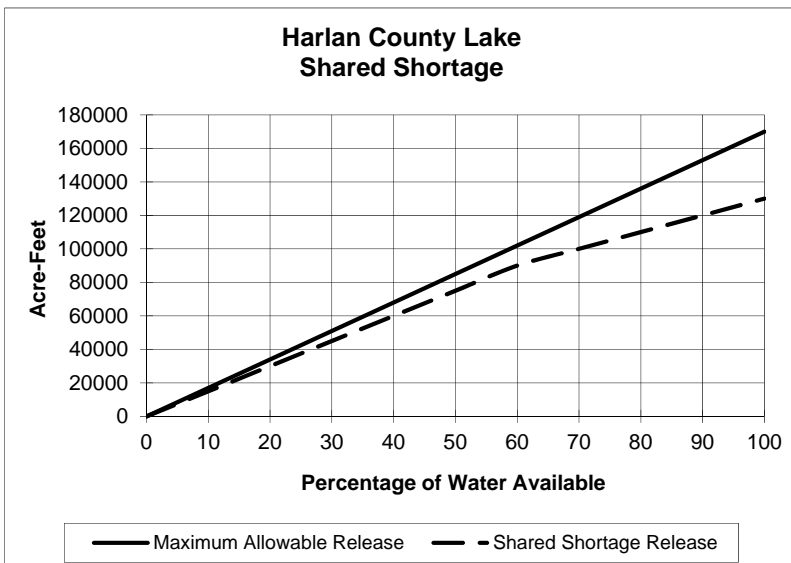
Since the construction of Harlan County Lake, inflows to the lake have been depleted by upstream irrigation wells and farming practices. Reclamation has recently completed an in-depth study of these depleted flows as a part of their contract renewal process. The study concluded that if the current conditions had existed in the basin since 1931, the average spring inflow to the project would have been 57,600 Acre-feet of water. The study further concluded that the evaporation would have been 8,800 Acre-feet of water during the same period. Reclamation and we agreed to use these values to calculate the net inflow to the project under the current conditions.

In addition, both agencies also recognized that the inflow to the project could continue to decrease with further upstream well development and water conservation farming. Due to these concerns, Reclamation and we determined that the previous 5-year inflow values would be averaged each year and compared to 57,600 Acre-feet. The inflow estimate for Harlan County Lake would be the smaller of these two values.

The estimated inflow amount would be used in January of each year to forecast the amount of water stored in the lake at the beginning of the irrigation season. Based on this forecast, the irrigation districts would be provided a firm estimate of the amount of water available for the next season. The actual storage in the lake on May 31 would be reviewed each year. When the actual water in storage is less than the January forecast, Reclamation may draw water from sediment storage to make up the difference.

4. Water Shortage Sharing.

A final component of the agreement involves a procedure for sharing the water available during times of shortage. Under the shared shortage procedure, the irrigation purpose of the project would remove less water than otherwise allowed and alleviate some of the adverse effects to the other purposes. The procedure would also extend the water supply during times of drought by “banking” some water for the next irrigation season. The following graph illustrates the shared shortage releases.



5. Calculation of Irrigation Water Available

Each January, the Reclamation would provide the Bostwick irrigation districts a firm estimate of the quantity of water available for the following season. The firm estimate of water available for irrigation would be calculated by using the following equation and shared shortage adjustment:

$\text{Storage} + \text{Summer Sediment Pool Evaporation} + \text{Inflow} - \text{Spring Evaporation} = \text{Maximum Irrigation Water Available}$
--

The variables in the equation are defined as:

- Maximum Irrigation Water Available. Maximum irrigation supply from Harlan County Lake for that irrigation season.
- Storage. Actual storage in the irrigation pool at the end of December. The sediment pool is assumed full. If the pool elevation is below the top of the sediment pool, a negative irrigation storage value would be used.
- Inflow. The inflow would be the smaller of the past 5-year average inflow to the project from January through May, or 57,600 Acre-feet.
- Spring Evaporation. Evaporation from the project would be 8,800 Acre-feet which is the average January through May evaporation.
- Summer Sediment Pool Evaporation. Summer evaporation from the sediment pool during June through September would be 20,000 Acre-feet. This is an estimate based on lower pool elevations, which characterize the times when it would be critical to the computations.

6. Shared Shortage Adjustment

To ensure that an equitable distribution of the available water occurs during short-term drought conditions, and provide for a “banking” procedure to increase the water stored for subsequent years, a shared shortage plan would be implemented. The maximum water available for irrigation according to the above equation would be reduced according to the following table. Linear interpolation of values will occur between table values.

Shared Shortage Adjustment Table

Irrigation Water Available (Acre-feet)	Irrigation Water Released (Acre-feet)
0	0
17,000	15,000
34,000	30,000
51,000	45,000
68,000	60,000
85,000	75,000
102,000	90,000
119,000	100,000
136,000	110,000
153,000	120,000
170,000	130,000

7. Annual Shutoff Elevation for Harlan County Lake

The annual shutoff elevation for Harlan County Lake would be estimated each January and finally established each June.

The annual shutoff elevation for irrigation releases will be estimated by Reclamation each January in the following manner:

1. Estimate the May 31 Irrigation Water Storage (IWS) (Maximum 150,000 Acre-feet) by taking the December 31 irrigation pool storage plus the January-May inflow estimate (57,600 Acre-feet or the average inflow for the last 5-year period, whichever is less) minus the January-May evaporation estimate (8,800 Acre-feet).
2. Calculate the estimated Irrigation Water Available, including all summer evaporation, by adding the Estimated Irrigation Water Storage (from item 1) to the estimated sediment pool summer evaporation (20,000 AF).
3. Use the above Shared Shortage Adjustment Table to determine the acceptable Irrigation Water Release from the Irrigation Water Available.
4. Subtract the Irrigation Water Release (from item 3) from the Estimated IWS (from item 1). The elevation of the lake corresponding to the resulting irrigation storage is the Estimated Shutoff Elevation. The shutoff elevation will not be below the bottom of the irrigation pool if over 119,000 AF of water is supplied to the districts, nor below 1,927.0 feet, msl. If the shutoff elevation is below the irrigation pool, the maximum irrigation release is 119,000 AF.

The annual shutoff elevation for irrigation releases would be finalized each June in accordance with the following procedure:

1. Compare the estimated May 31 IWS with the actual May 31 IWS.
2. If the actual end of May IWS is less than the estimated May IWS, lower the shutoff elevation to account for the reduced storage.
3. If the actual end of May IWS is equal to or greater than the estimated end of May IWS, the estimated shutoff elevation is the annual shutoff elevation.
4. The shutoff elevation will never be below elevation 1,927.0 feet, msl, and will not be below the bottom of the irrigation pool if more than 119,000 Acre-feet of water is supplied to the districts.

Republican River Compact Administration

Accounting Procedures and Reporting Requirements  
Revised July 2005

Attachment 3: Inflows to Harlan County Lake 1993 Level of Development

BASELINE RUN - 1993 LEVEL INFLOW TO HARLAN COUNTY RESERVOIR

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1931	10.2	10.8	13.4	5.0	18.8	15.8	4.3	1.8	1.8	0.0	0.1	0.1	82.1
1932	6.8	16.6	18.5	4.6	3.8	47.6	3.8	2.8	4.8	0.0	0.0	0.4	109.7
1933	0.4	0.0	3.9	30.2	31.0	5.4	1.8	0.0	10.4	0.0	2.6	5.5	91.2
1934	2.1	0.0	3.2	1.8	0.7	7.3	0.8	0.0	1.3	0.0	2.2	0.0	19.4
1935	0.3	0.1	0.7	4.2	0.8	389.3	6.1	19.1	26.1	2.4	5.2	0.9	455.2
1936	0.3	0.0	11.9	0.0	35.9	4.7	0.4	0.0	1.8	0.0	1.6	3.8	60.4
1937	4.8	12.9	6.0	2.5	0.0	12.6	6.3	6.9	2.4	0.0	0.0	12.4	66.8
1938	9.9	7.8	8.7	10.4	18.7	8.6	7.3	7.8	4.9	0.2	0.0	4.7	89.0
1939	2.7	7.5	9.6	12.2	6.6	13.3	5.0	4.1	0.0	0.0	0.0	0.0	61.0
1940	0.0	0.0	12.2	5.2	4.6	23.7	2.8	3.2	0.0	3.6	0.0	1.4	56.7
1941	0.0	10.6	10.6	7.7	17.2	67.1	28.9	19.7	14.9	8.3	6.7	7.1	198.8
1942	3.3	10.6	0.5	34.1	30.8	83.9	11.7	10.9	36.5	3.1	8.7	0.3	234.4
1943	1.2	11.2	14.6	31.4	4.7	28.3	4.8	0.3	0.9	0.0	0.0	11.8	109.2
1944	0.1	4.3	9.0	43.1	31.9	63.9	26.6	15.4	0.5	0.3	3.0	4.5	202.6
1945	4.3	7.8	5.7	9.5	4.1	53.5	5.0	0.9	1.5	5.0	6.0	6.3	109.6
1946	5.9	11.2	9.3	4.9	7.0	3.1	1.6	11.4	28.1	129.9	25.0	12.1	249.5
1947	1.1	3.2	10.4	8.2	11.9	195.4	22.3	5.9	2.9	0.2	0.3	0.3	262.1
1948	6.2	9.8	24.1	5.4	0.2	39.8	13.5	6.8	4.2	0.0	0.1	0.1	110.2
1949	2.0	1.5	25.2	16.3	49.0	57.4	9.2	5.5	2.1	3.0	2.8	0.3	174.3
1950	0.3	5.7	10.8	10.9	28.9	10.1	12.7	9.3	7.8	7.2	3.8	3.1	110.6
1951	3.8	3.4	7.1	5.3	42.0	39.9	42.1	10.1	36.0	15.5	14.8	8.9	228.9
1952	16.4	21.4	26.3	23.8	34.6	4.0	9.3	3.1	1.5	11.7	4.3	0.1	156.5
1953	1.8	4.6	5.3	3.3	15.1	9.5	1.8	0.2	0.0	0.0	2.8	0.1	44.5
1954	1.0	6.8	1.9	3.2	7.1	2.4	0.0	1.2	0.0	0.0	0.0	0.0	23.6
1955	0.0	4.0	6.3	4.8	2.9	6.4	2.7	0.0	1.4	0.0	0.0	0.0	28.5
1956	1.6	3.4	2.9	2.4	1.3	1.5	0.0	0.6	0.0	0.0	0.0	0.0	13.7
1957	0.0	4.1	6.2	12.8	3.5	62.4	21.3	1.2	2.0	3.4	4.5	4.7	126.1
1958	0.8	3.0	14.2	14.0	18.7	1.3	3.4	2.2	0.0	0.4	0.0	0.6	58.6
1959	1.9	15.4	16.4	8.5	13.6	4.2	1.4	1.2	0.0	4.3	1.0	4.5	72.4
1960	1.4	12.3	71.4	23.9	21.7	53.7	14.1	3.2	0.0	0.0	0.2	2.8	204.7
1961	2.3	6.4	7.7	7.4	26.5	24.0	7.2	4.9	0.0	2.3	4.8	1.7	95.2

Republican River Compact Administration

Accounting Procedures and Reporting Requirements  
Revised July 2005

Attachment 3: Inflows to Harlan County Lake 1993 Level of Development

BASELINE RUN - 1993 LEVEL INFLOW TO HARLAN COUNTY RESERVOIR													
YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1962	4.5	9.1	16.2	9.9	14.4	42.6	41.6	21.1	2.3	8.7	8.3	5.7	184.4
1963	3.4	18.2	18.2	15.0	12.7	14.7	3.4	6.1	8.7	0.8	5.3	1.8	108.3
1964	5.4	7.6	8.3	8.4	9.9	11.9	7.2	6.5	2.4	1.9	1.4	2.3	73.2
1965	6.0	8.1	11.1	12.8	32.8	40.0	22.9	6.5	37.2	53.7	19.5	11.0	261.6
1966	8.9	21.4	15.7	11.4	12.0	34.7	12.4	2.5	3.5	5.4	6.8	5.7	140.4
1967	7.2	11.5	11.5	12.9	9.1	75.3	43.7	15.3	4.4	7.3	6.9	5.4	210.5
1968	3.9	10.2	8.5	11.6	10.8	12.5	3.1	2.7	1.6	2.0	4.3	3.4	74.6
1969	4.2	10.8	24.5	15.1	18.9	17.5	17.0	12.6	16.6	9.2	11.8	9.9	168.1
1970	3.5	8.7	8.5	10.5	11.1	7.7	4.6	3.2	0.5	3.3	4.7	4.5	70.8
1971	4.1	10.3	12.4	12.8	18.3	7.2	8.4	6.2	1.9	4.2	7.3	7.1	100.2
1972	5.5	8.1	9.2	8.3	14.8	8.5	6.5	4.4	0.1	2.9	7.6	4.1	80.0
1973	11.4	14.2	19.0	16.2	17.4	20.9	9.1	1.9	8.4	19.6	11.9	13.2	163.2
1974	13.2	13.4	12.0	14.3	15.4	17.2	5.5	0.0	0.0	0.0	4.9	5.5	101.4
1975	7.2	8.2	13.6	14.8	12.0	48.1	11.6	7.4	0.1	3.0	6.2	7.3	139.5
1976	7.0	10.2	10.1	16.0	12.1	3.5	2.2	1.8	0.9	1.0	3.2	3.1	71.1
1977	4.4	9.6	12.9	21.2	31.5	12.1	5.9	1.9	10.6	4.1	5.5	5.3	125.0
1978	5.0	6.5	20.6	12.9	11.8	3.8	0.0	1.0	0.0	0.0	0.3	1.6	63.5
1979	1.3	7.6	21.5	18.8	15.9	5.4	10.4	10.6	1.6	0.9	3.6	6.2	103.8
1980	5.7	9.3	11.6	15.2	10.4	2.1	2.5	0.0	0.0	0.0	2.5	2.2	61.5
1981	5.5	6.0	11.6	14.9	22.5	6.4	11.5	16.3	4.3	2.5	6.7	6.2	114.4
1982	5.3	12.5	17.9	14.3	26.8	27.1	8.9	2.7	0.0	6.5	6.3	15.5	143.8
1983	6.5	9.7	27.2	16.4	41.4	74.2	10.7	7.6	3.8	3.1	6.7	5.2	212.5
1984	6.8	14.6	17.2	32.9	40.6	15.5	8.1	4.5	0.0	5.5	4.8	6.2	156.7
1985	6.9	14.1	13.6	11.9	27.4	9.9	10.0	2.0	6.0	8.5	5.6	5.8	121.7
1986	9.1	9.4	12.2	11.7	34.3	13.0	13.5	4.6	3.3	5.9	5.4	7.1	129.5
1987	5.9	9.2	19.7	24.1	24.3	11.7	19.0	5.7	2.3	2.7	8.2	7.0	139.8
1988	6.2	13.7	11.6	15.2	15.2	7.0	17.9	10.4	0.6	2.0	5.9	5.4	111.1
1989	5.4	5.9	10.5	9.1	11.4	11.8	14.0	6.2	0.2	3.1	3.1	3.5	84.2
1990	6.6	7.7	13.2	9.7	15.5	1.4	4.3	10.7	0.6	3.2	2.0	2.7	77.6
1991	2.4	8.0	9.0	10.6	15.2	3.9	1.9	0.5	0.0	0.0	2.7	4.8	59.0
1992	8.0	8.8	12.7	8.5	4.5	6.1	6.5	9.4	2.4	6.9	6.7	5.2	85.7
1993	5.2	14.4	71.6	22.7	21.0	17.0	68.0	37.5	23.3	16.8	30.1	17.7	345.3
Avg	4.5	8.8	14.1	13.0	17.2	30.6	11.0	6.2	5.4	6.3	5.0	4.7	126.8

Republican River Compact Administration

Accounting Procedures and Reporting Requirements  
Revised July 2005

Attachment 4: Evaporation Loss Harlan County Lake 1993 Level of Development

BASELINE - 1993 LEVEL FLOWS - HARLAN COUNTY EVAPORATION													
YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1931	0.7	0.9	1.6	2.9	4.2	7.4	6.9	5.2	2.7	2.1	1.2	0.4	36.2
1932	0.6	0.8	1.5	2.7	4.1	5.0	6.8	5.0	2.7	2.1	1.2	0.4	32.9
1933	0.6	0.8	1.4	2.5	3.8	7.8	6.1	4.2	2.7	2.1	1.2	0.4	33.6
1934	0.6	0.8	1.4	2.4	4.5	6.5	8.0	6.2	2.7	2.0	1.2	0.4	36.7
1935	0.6	0.8	1.3	2.3	2.2	3.6	9.7	6.2	3.1	2.5	1.4	0.5	34.2
1936	0.7	0.9	1.6	2.9	5.5	6.8	8.7	6.5	2.7	2.1	1.2	0.4	40.0
1937	0.6	0.8	1.4	2.5	3.6	4.0	6.2	6.5	2.7	2.1	1.2	0.4	32.0
1938	0.6	0.9	1.5	2.7	3.4	4.9	6.5	5.7	2.7	2.1	1.2	0.4	32.6
1939	0.6	0.8	1.4	2.6	4.3	4.9	6.8	4.6	2.7	2.1	1.2	0.4	32.4
1940	0.6	0.8	1.4	2.4	3.5	5.0	6.5	4.6	2.7	2.1	1.2	0.4	31.2
1941	0.6	0.8	1.4	2.5	3.9	4.2	6.7	5.3	2.8	2.1	1.3	0.5	32.1
1942	0.6	0.9	1.5	2.8	4.0	5.2	8.3	5.1	3.2	2.5	1.5	0.5	36.1
1943	0.7	1.0	1.8	3.2	4.3	5.7	7.9	6.3	2.7	2.1	1.2	0.4	37.3
1944	0.6	0.8	1.4	2.7	4.2	5.3	7.0	5.8	3.5	2.6	1.5	0.5	35.9
1945	0.7	1.0	1.8	3.1	3.8	3.0	6.7	5.7	2.9	2.2	1.3	0.5	32.7
1946	0.6	0.9	1.6	2.8	3.5	5.1	5.6	4.4	2.9	2.7	1.8	0.6	32.5
1947	1.0	1.5	2.9	3.2	3.4	-1.2	5.8	5.3	3.7	1.7	0.5	0.1	27.9
1948	0.8	0.7	1.5	3.6	3.1	2.4	4.2	4.7	3.0	2.7	0.8	0.3	27.8
1949	0.1	0.9	0.7	1.8	1.1	0.7	6.5	4.1	3.1	1.7	1.5	0.4	22.6
1950	0.7	0.1	0.8	2.8	2.0	5.6	0.8	2.8	4.5	2.3	1.6	0.6	24.6
1951	0.5	0.2	2.1	0.7	-0.1	1.9	3.5	4.1	0.4	3.1	2.2	0.9	19.5
1952	1.1	1.2	1.9	2.5	5.2	6.2	1.5	3.4	3.6	2.9	1.1	-0.1	30.5
1953	0.5	1.0	1.5	2.9	4.7	4.5	4.6	6.6	5.3	3.3	0.1	0.0	35.0
1954	0.7	0.6	2.2	3.6	0.3	4.9	6.7	1.6	3.6	1.6	1.5	0.6	27.9
1955	0.5	1.0	2.1	4.6	3.4	-0.5	7.3	6.9	2.7	2.6	1.4	0.4	32.4
1956	0.6	1.1	1.9	2.8	3.9	4.5	5.0	3.7	4.7	3.7	1.3	0.5	33.7
1957	0.7	1.0	1.3	0.5	-0.6	-1.1	6.1	3.7	2.3	1.7	1.2	0.4	17.2
1958	0.7	0.1	1.0	0.6	2.3	4.4	1.0	1.9	3.3	3.3	1.0	0.6	20.2
1959	0.4	1.0	1.1	2.1	1.0	3.5	5.0	4.8	2.3	0.7	1.5	0.6	24.0
1960	0.1	0.7	2.0	2.7	0.9	0.1	4.9	3.6	3.9	2.0	1.3	0.4	22.6
1961	0.9	1.0	1.4	2.7	-1.1	0.6	5.1	2.9	1.2	2.4	0.7	0.1	17.9

Republican River Compact Administration

Accounting Procedures and Reporting Requirements  
Revised July 2005

Attachment 4: Evaporation Loss Harlan County Lake 1993 Level of Development

BASELINE - 1993 LEVEL FLOWS - HARLAN COUNTY EVAPORATION

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1962	0.6	0.6	0.9	3.7	3.4	1.5	0.3	1.6	2.0	2.0	1.7	0.3	18.6
1963	0.7	1.4	1.3	4.5	4.6	6.3	6.1	3.1	-0.8	2.7	1.5	0.4	31.8
1964	0.8	0.8	1.7	3.2	5.6	1.2	6.9	3.0	3.0	3.3	1.2	0.6	31.3
1965	0.4	0.7	1.2	2.8	1.5	-0.5	2.0	2.8	-3.9	1.7	2.1	0.4	11.2
1966	0.9	0.8	2.9	2.7	7.5	2.8	5.8	3.7	2.7	2.8	1.5	0.4	34.5
1967	0.7	1.2	2.5	3.0	2.0	-2.9	1.6	4.5	3.5	2.0	1.6	0.4	20.1
1968	0.9	1.2	2.8	2.6	3.2	4.9	4.7	1.8	2.3	0.7	1.2	0.2	26.5
1969	0.4	0.6	2.4	3.3	0.1	3.8	-0.7	2.9	2.2	-1.0	1.5	0.4	15.9
1970	0.7	1.4	2.3	2.8	4.7	4.4	6.5	5.9	0.9	1.0	1.5	0.7	32.8
1971	0.7	0.2	2.0	2.9	0.7	5.1	3.4	4.5	1.4	1.5	0.2	0.5	23.1
1972	0.8	1.3	2.0	1.7	1.1	0.0	3.3	1.8	2.1	1.7	-0.4	0.1	15.5
1973	0.5	1.1	-0.7	2.5	3.4	6.7	-1.7	4.2	-3.0	0.2	0.2	0.2	13.6
1974	0.7	1.5	2.6	1.5	3.7	2.5	9.1	2.6	3.4	1.4	1.1	0.3	30.4
1975	0.7	0.7	2.0	2.1	0.8	1.1	4.3	2.7	3.0	3.4	0.7	0.6	22.1
1976	0.8	1.2	1.7	0.7	1.5	5.0	5.9	5.7	-0.2	1.4	1.4	0.7	25.8
1977	0.7	1.3	0.2	1.1	0.0	4.6	4.0	0.6	2.0	1.6	1.0	0.4	17.5
1978	0.5	0.7	1.2	3.4	3.9	6.2	7.1	4.5	4.5	3.0	1.1	0.5	36.6
1979	0.5	0.6	1.1	3.9	4.4	4.6	3.5	5.1	4.1	2.8	1.4	0.7	32.7
1980	0.5	0.6	1.2	3.4	3.7	4.7	6.8	6.0	3.9	2.7	1.3	0.6	35.4
1981	0.5	0.6	1.2	3.8	3.2	4.8	4.2	3.7	2.9	1.7	1.3	0.7	28.6
1982	0.5	0.7	1.2	3.9	3.8	3.9	5.1	3.8	2.9	2.2	1.4	0.8	30.2
1983	0.5	0.7	1.4	2.9	4.2	5.3	8.6	7.2	4.6	1.8	1.5	0.6	39.3
1984	0.6	0.8	1.4	2.9	4.2	5.8	7.2	5.7	4.7	1.4	1.4	0.7	36.8
1985	0.5	0.7	1.3	2.3	4.0	4.5	5.6	3.5	3.8	1.5	1.5	0.7	29.9
1986	0.6	0.7	1.3	2.8	4.4	5.8	6.7	4.0	2.7	1.3	1.4	0.7	32.4
1987	0.5	0.8	1.3	3.1	4.2	6.2	6.9	3.5	3.1	2.2	1.4	0.7	33.9
1988	0.5	0.7	1.3	3.5	4.9	6.6	4.6	4.8	3.5	2.2	1.4	0.7	34.7
1989	0.5	0.7	1.2	4.2	4.5	4.4	4.8	3.6	3.0	2.5	1.4	0.7	31.5
1990	0.5	0.7	1.2	3.0	3.5	5.6	6.4	4.0	5.0	3.4	1.4	0.6	35.3
1991	0.5	0.7	1.2	2.8	3.3	5.5	6.0	5.0	5.1	3.2	1.3	0.6	35.2
1992	0.6	0.7	1.2	1.8	3.2	2.2	4.1	3.5	4.2	2.9	1.9	1.0	27.3
1993	0.6	0.5	1.0	2.2	3.1	4.6	4.2	4.9	4.5	4.4	3.1	1.2	34.3
Avg	0.6	0.8	1.5	2.7	3.2	3.9	5.3	4.3	2.8	2.2	1.3	0.5	29.1



Republican River Compact Administration

Accounting Procedures and Reporting Requirements  
Revised July 2005

Attachment 5: Projected Water Supply Spread Sheet Calculations

<b>Trigger Calculations Based on Harlan County Lake Irrigation Supply</b>	Units-1000 Acre-feet		Irrigation Trigger		119.0		Assume that during irrigation release season HCL Inflow = Evaporation Loss						
			Total Irrigation Supply		130.0								
			Bottom Irrigation		164.1								
			Evaporation Adjust		20.0								
	<b>Oct</b>	<b>Nov</b>	<b>Dec</b>	<b>Jan</b>	<b>Feb</b>	<b>Mar</b>	<b>Apr</b>	<b>May</b>	<b>Jun</b>	<b>Jul</b>	<b>Aug</b>	<b>Sep</b>	<b>Total</b>
1993 Level AVE inflow	6.3	5	4.7	4.5	8.8	14.1	13.0	17.2	30.6	11.0	6.2	5.4	126.8
1993 Level AVE evap (1931-93)	2.2	1.3	0.5	0.6	0.8	1.5	2.7	3.2	3.9	5.3	4.3	2.8	29.1
Avg. Inflow Last 5 Years	10.8	13.0	12.3	12.9	16.6	22.4	19.4	18.1	14.8	16.5	11.0	4.7	172.6

<b>Year 2001-2002 Oct - Jun Trigger and Irrigation Supply Calculation</b>										
Calculation Month	<b>Oct</b>	<b>Nov</b>	<b>Dec</b>	<b>Jan</b>	<b>Feb</b>	<b>Mar</b>	<b>Apr</b>	<b>May</b>	<b>Jun</b>	
Previous EOM Content	236.5	235.9	238.6	242.9	248.1	255.1	263.8	269.6	276.2	
Inflow to May 31	73.6	67.3	62.3	57.6	53.1	44.3	30.2	17.2	0.0	
Last 5 Yrs Avg Inflow to May 31	125.6	114.8	101.7	89.5	76.6	59.9	37.5	18.1	0.0	
Evap to May 31	12.8	10.6	9.3	8.8	8.2	7.4	5.9	3.2	0.0	
Est. Cont May 31	297.3	292.6	291.6	291.7	293.0	292.0	288.1	283.6	276.2	
Est. Elevation May 31	1944.44	1944.08	1944.00	1944.01	1944.11	1944.03	1943.72	1943.37	1942.77	
Max. Irrigation Available	153.2	148.5	147.5	147.6	148.9	147.9	144.0	139.5	132.1	
Irrigation Release Est.	120.1	117.4	116.8	116.8	118.1	117.1	116.8	116.8	116.8	
Trigger - Yes/No	NO	YES	YES	YES	YES	YES	YES	YES	YES	
130 kAF Irrigation Supply - Yes/No	NO	NO	NO	NO	NO	NO	NO	NO	NO	

Republican River Compact Administration

Accounting Procedures and Reporting Requirements  
 Revised July 2005

Attachment 5: Projected Water Supply Spread Sheet Calculations

<b>Year 2002</b>				
<b>Jul - Sep</b>				
<b>Final Trigger and</b>				
<b>Total Irrigation Supply</b>				
<b>Calculation</b>				
Calculation Month		<b>Jul</b>	<b>Aug</b>	<b>Sep</b>
Previous EOM Irrigation Release Est.		116.8	116.0	109.7
Previous Month Inflow		5.5	0.5	1.3
Previous Month Evap		6.3	6.8	6.6
Irrigation Release Estimate		116.0	109.7	104.4
Final Trigger - Yes/No		YES		
130 kAF Irrigation Supply - Yes/No		NO	NO	NO

Republican River Compact Administration

Accounting Procedures and Reporting Requirements  
Revised July 2005

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

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
Total Main Stem VWS	Hardy gage	Superior-Courtland Diversion Dam Gage	Courtland Canal Diversions	Superior Canal Diversions	Courtland Canal Returns	Superior Canal Returns	Total Bostwick Returns Below Guide Rock	NE CBCU Below Guide Rock	KS CBCU Below Guide Rock	Total CBCU Below Guide Rock	Gain Guide Rock to Hardy	VWS Guide Rock to Hardy	Main Stem Virgin Water Supply Above Guide Rock	Nebraska Main Stem Allocation Above Hardy	Kansas Main Stem Allocation Above Hardy	Nebraska Guide Rock to Hardy Allocation	Kansas Guide Rock to Hardy Allocation
							Col F+ Col G			Col I+ Col J	+ Col B - Col C+ Col K - Col H	+ Col L + Col K	Col A - Col M	.489 x Col N	.511 x Col N	.489 x Col M	.511 x Col M

Republican River Compact Administration

Accounting Procedures and Reporting Requirements  
Revised July 2005

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

Col 1	Col 2	Col 3	Col 4	Col 5	Col 6	Col 7	Col 8	Col 9	Col 10	Col 11
Canal	Canal Diversion	Spill to Waste-way	Field Deliveries	Canal Loss	Average Field Loss Factor	Field Loss	Total Loss from District	Percent Field and Canal Loss That Returns to the Stream	Total Return to Stream from Canal and Field Loss	Return as Percent of Canal Diversion
Name Canal	Headgate Diversion	Sum of measured spills to river	Sum of deliveries to the field	+Col 2 - Col 4	1 - Weighted Average Efficiency of Application System for the District*	Col 4 x Col 6	Col 5 + Col 7	Estimated Percent Loss*	Columns 8 x Col 9	Col 10/Col 2
Example	100	5	60	40	30%	18	58	82%	48	48%
Culbertson					30%					
Culbertson Extension					30%					
Meeker-Driftwood					30%					
Red Willow					30%					
Bartley					30%					
Cambridge					30%					
Naponne					35%					
Franklin					35%					
Franklin Pump					35%					
Almena					30%					
Superior					31%					
Nebraska Courtland					23%					
Courtland Canal Above Lovewell (KS)					23%					
Courtland Canal Below Lovewell					23%					

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

## Appendix B

### Model Documentation and Model Files

The contents of Appendix B can be found at:

<ftp://ftp.dnr.ne.gov/>

login: IWM  
password Pa\$\$word123

**Exhibit B**

**Arbitration Time Frame Designation**

**(N-CORPE Augmentation Plan)**

Nebraska Formally Submits N-CORPE Proposal to RRCA for Resolution .....	June 10, 2013
Special RRCA Meeting and Vote on Resolution .....	July 10, 2013
<i>If arbitration is necessary...</i>	
Nebraska Formally Submits the Issue to Arbitration .....	July 10, 2013
Kansas and Colorado May Amend the Scope of the Dispute .....	July 24, 2013
States Exchange List of Proposed Arbitrators .....	July 24, 2013
States Meet and Confer on Arbitrator Selection .....	August 2, 2013
<i>If Necessary</i> , CDR Selects Arbitrator .....	August 2, 2013
Hold Initial Arbitrator Conference and Set Schedule .....	August 12, 2013
Final Day of Arbitration Hearings .....	December 13, 2013
Complete Arbitration / Issue Decision .....	February 14, 2014
State Accept / Reject Decision .....	March 14, 2013

**Exhibit B**

**Arbitration Time Frame Designation**

*Nebraska v. Kansas and Colorado*

**(N-CORPE Augmentation Plan)**

Nebraska Formally Submits the Issue to Arbitration .....	July 10, 2013
Kansas and Colorado May Amend the Scope of the Dispute.....	July 24, 2013
States Exchange List of Proposed Arbitrators .....	July 24, 2013
States Meet and Confer on Arbitrator Selection.....	August 2, 2013
<i>If Necessary</i> , CDR Selects Arbitrator .....	August 2, 2013
Hold Initial Arbitrator Conference and Set Schedule.....	August 12, 2013
Final Day of Arbitration Hearings .....	December 13, 2013
Complete Arbitration / Issue Decision .....	February 14, 2014
State Accept / Reject Decision.....	March 14, 2014

**Exhibit C**  
**Resolution**



**RESOLUTION  
OF  
THE REPUBLICAN RIVER COMPACT ADMINISTRATION  
REGARDING NEBRASKA'S N-CORPE AUGMENTATION PROJECT**

**Whereas**, the States of Kansas, Nebraska and Colorado entered into a Final Settlement Stipulation (FSS) as of December 15, 2002, to resolve pending litigation in the United States Supreme Court regarding the Republican River Compact (Compact) in *Kansas v. Nebraska and Colorado*, No 126 Original;

**Whereas**, the FSS was approved by the United States Supreme Court on May 19, 2003;

**Whereas**, by letter dated June 10, 2013, the State of Nebraska submitted to the State of Kansas and the State of Colorado a copy of the "N-CORPE Augmentation Project" plan (N-CORPE Plan), a copy of which is attached hereto and incorporated by reference as Exhibit A;

**Whereas**, the States held a working session of the Republican River Compact Administration (RRCA) on June 27, 2013, concerning the N-CORPE Plan;

**Whereas**, Nebraska's N-CORPE Plan has been properly presented and submitted to the RRCA pursuant to the FSS;

**Whereas**, on June 10, 2013, the State of Nebraska provided the State of Kansas and the State of Colorado notice that it wished to pursue "fast track" resolution of the issue;

**Whereas**, the N-CORPE Plan involves a project located outside of the moratorium area as specified in Subsection III.B.1.a.ii and III.B.1.b, and is therefore not subject to the provisions of III.B.1.k; however the appropriate credit for the project has been incorporated into the RRCA Accounting Procedures as an "Augmentation Credit" as indicated in Exhibit A;

**Whereas**, the measured pumping data collected in support of the N-CORPE Plan will be input into the RRCA Groundwater Model in conformance with the current RRCA Accounting Procedures for determining groundwater computed beneficial consumptive use and that same measured data will be utilized to represent the amount of discharge to Medicine Creek at the project outfall;

**Whereas**, Nebraska has developed a methodology to provide the appropriate Augmentation Credit referenced in Subsection IV.A. of the FSS, and that methodology has been submitted to the RRCA as part of the N-CORPE Plan;

**Whereas**, Section I.F of the FSS allows the RRCA to modify the RRCA Accounting Procedures in any manner consistent with the Compact and the FSS;

**Whereas**, the States agree that Nebraska’s proposed revisions to the RRCA Accounting Procedures outlined in the N-CORPE Plan are consistent with the Compact and the FSS and that the RRCA should adopt Nebraska’s proposed revisions; and

**Now, therefore**, it is hereby resolved that the RRCA approves and adopts the changes to the RRCA Accounting Procedures as presented in the State of Nebraska’s N-CORPE Plan attached as Exhibit A.

Approved by the Republican River Compact Administration this 9<sup>th</sup> day of July 2013.

\_\_\_\_\_  
David Barfield, P.E.  
Kansas Commissioner  
Chairman

\_\_\_\_\_  
Date

\_\_\_\_\_  
Brian Dunnigan, P.E.  
Nebraska Commissioner

\_\_\_\_\_  
Date

\_\_\_\_\_  
Dick Wolfe, P.E.  
Colorado Commissioner

\_\_\_\_\_  
Date