

DRAFT

Republican River Compact Administration Compact Accounting for 2005

Spreadsheet name: RRCA Accounting for 2005.xls

Last update: 6-Aug-06

Starting workbook name: RRCA Accounting for 2004_Sept06_2005.xls By NDNR

Attachment 6 Column L formula corrected to avoid double-counting for BCU below Guide Rock
Column headings for Columns N, O, and P are corrected
Operating sign in Column N was corrected to be a minus.
Column cell reference in Column O corrected.

Table 5C Links to T1, Attachment 6, and GM_output sheets are provided.

5/1/2006 2006 Updates

Spreadsheet name: RRCA AccountingFor2005.xls
Attachment 7 updated
CourtlandAvLove updated
Reservoir Data updated
Stream Gage Data updated
NE Non-Federal reservoir Evap updated
NE Canal Diversion updated

6/14/2006

Spreadsheet name: RRCA AccountingFor2005(June14, 2006).xls
Impact 2005 Updated
Formatting according to the KS RRCA Accounting for 2005 first guess.xls
KS Surface Water Pumping data Updated

6/19/2006

Stream Flow Data Refined with USGS Data Provided by Soenksen

6/22/2006 RRCA AccountingFor2005(June22, 2006NE).xls

Reservoir Data linked to the Fed_Reservoir sheet
Lovewell Reservoir Evap charged to the Republican River updated.

6/27/2006 Megan added CO data

7/31/2006 D. Barfield added Willem's 7/31 model results

Table 1. Added to the Table 1 page results for 2003 and 2004 and provided a place for the 2005-2007 Table 1 data.
This data is used in subsequent multi-year Tables in the spreadsheet.
Table 4A, 4B page - Added detail below the existing tables to allow computation of the multi-year average based on this data.
These detail tables pull data from the Table 1 data added as referenced in the note above.

8/1/2006 NE non-federal Reservoir net evaporation data updated, the NFR above Guide Rock moved from North Fork to Mainstem subbasin
Impact 2005 updated,

8/2/2006 White Rock Creek related rows in INPUT and MAINSTEM sheets are deleted
BureauT2 sheet was also deleted, since Net Evaporation of Lovewell Lake Charged to Republican River is computed outside now.

T3 linked to T1
Courtland Canal Deliveries to Lovewell Reservoir correctly linked to CourtlandAvLove sheet, even though it is no longer used.
T5A, T5B,E updated (NOT sure if they are done correctly???)

GW Impacts 2003 and 2004 are added into the GM_Output sheet and linked to the related table.

8/6/2006 Clean up of temporary work

Table 5A - added formulas pointing to Table 1 page
Tables 5B & 5E - deleted 3 years of data so they represent 2 year averages

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

2005 Basin	Virgin Water Supply	Computed Water Supply	Allocations				Computed Beneficial Consumptive Use		
			Colorado	Kansas	Nebraska	Unallocated	Colorado	Kansas	Nebraska
North Fork	44,800	44,800	10,040	0	11,020	23,740	17,530	20	4,290
Arikaree	2,370	2,370	1,860	120	400	-10	810	160	250
Buffalo	6,050	6,050	0	0	2,000	4,050	310	0	3,510
Rock	9,360	9,360	0	0	3,740	5,620	60	0	3,830
South Fork	26,050	27,550	12,230	11,080	390	3,850	18,660	7,520	1,370
Frenchman	110,950	110,950	0	0	59,470	51,480	40	0	86,800
Driftwood	3,400	3,400	0	230	560	2,610	0	10	1,480
Red Willow	16,360	14,560	0	0	2,800	11,760	0	0	8,800
Medicine	39,990	34,390	0	0	3,130	31,260	0	0	21,320
Beaver	4,560	4,560	910	1,770	1,850	30	0	1,660	2,730
Sappa	-310	-310	0	-130	-130	-50	0	-1,180	790
Prairie Dog	11,720	11,620	0	5,310	880	5,430	0	8,180	40
Main Stem	116,560	90,960	0	46,480	44,480	0	-1,950	27,940	117,480
Total All Basins	391,860	360,260	25,040	64,860	130,590	139,770	35,460	44,310	252,690
Main Stem Including Unallocated		230,730	0	117,900	112,830				
Total	391,860	360,260	25,040	136,280	198,940	0	35,460	44,310	252,690

Table 3A: Colorado's Five-Year Average Allocation and CBCU

Year	Allocation	Computed Beneficial Consumptive Use	Imported Water Supply Credit	Allocation - (CBCU - IWS Credit)
2003	21,420	33,470	NA	(12,050)
2004	21,540	33,670	NA	(12,130)
2005	25,040	35,460	NA	(10,420)
2006			NA	
2007			NA	
Average	22,670	34,200		(11,530)

Sum (34,600)

Table 3B: Kansas's Five-Year Average Allocation and CBCU

Year	Allocation	Computed Beneficial Consumptive Use	Imported Water Supply Credit	Allocation - (CBCU - IWS Credit)
2003	167,780	48,910	NA	118,870
2004	137,450	38,120	NA	99,330
2005	136,280	44,310	NA	91,970
2006			NA	
2007			NA	
Average	147,170	43,780		103,390

Sum 310,170

Table 3C: Nebraska's Five-Year Average Allocation and CBCU

Year	Allocation	Computed Beneficial Consumptive Use	Imported Water Supply Credit	Allocation - (CBCU - IWS Credit)
2003	227,580	262,780	9,780	(25,420)
2004	205,630	252,650	10,380	(36,640)
2005	198,940	252,690	11,965	(41,785)
2006				
2007				
Average	210,720	256,040	10,710	(34,620)

Table 4A: Colorado's Sub-Basin Non-impairment Compliance

Basin	Allocation (Five-year Average)	Unallocated Supply (Five-year Average)	Imported Water Supply Credit (Five-year Average)	Total Available Supply	Computed Beneficial Consumptive Use (Five-year Average)	Available Supply - CBCU
North Fork	9,550	22,593	NA	32,143	17,190	14,953
Arikaree	1,453	-10	NA	1,443	467	977
South Fork	11,153	3,513	NA	14,667	17,183	(2,517)
Beaver	510	17	NA	527	0	527

Table 4B: Kansas's Sub-Basin Non-impairment Compliance

Basin	Allocation (Five-year Average)	Unallocated Supply (Five-year Average)	Unused Allocation from Colorado (5-year running average)	Imported Water Supply Credit (Five-year Average)	Total Available Supply (5-year running average)	Computed Beneficial Consumptive Use (Five-year Average)	Available Supply - CBCU
Arikaree	97	-10	987	NA	1,073	140	933
South Fork	10,100	3,513	0	NA	13,613	6,327	7,287
Driftwood	197	2,200	0	NA	2,397	7	2,390
Beaver	993	17	510	NA	1,520	770	750
Sappa	63	30	0	NA	93	-450	543
Prairie Dog	3,663	3,750	0	NA	7,413	6,460	953

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8/9/06

Republican River Compact Administration
Engineering Committee Report
August 10, 2006

Assignments

At the 2005 annual meeting of the Republican River Compact Administration, the Commissioners assigned the Engineering Committee the following tasks:

- 1) Develop a users' manual for the Compact Administration accounting;
- 2) Perform the annual compact accounting for 2005;
- 3) Provide a scope of work for a comprehensive study of ground water irrigation recharge within the Republican River Basin and related issues by July 1, 2006; and
- 4) Provide a draft rule, regulation, and/or procedures to the Compact Administration to address the permitting of a new water appropriation or use in one state for the eventual use in another state.

Work activities related to these assignments

The Engineering Committee and technical representatives from the States of Colorado, Kansas, and Nebraska participated in numerous collaborative work activities and phone conferences. The following assignments and work activities were completed:

1. **User's manual for the Compact Accounting** - An initial draft of the users' manual was developed by Kansas' committee representatives. The draft consists of chapters on: 1) data sources, 2) data processing including the spreadsheets used by the committee, and 3) accounting results. As the committee envisions it, the user's manual will not repeat the accounting procedures nor the content of the groundwater model documentation which includes procedures used by each state to assemble its data for the groundwater model. The committee is in conceptual agreement with the draft and recommends the assignment be continued, along with a review of the groundwater model documentation to insure it is up-to-date with respect to the states' data sources and processing.
2. **Compact accounting for 2005**
 - a. The states exchanged model data sets and supporting data as required by the accounting procedures, and collected streamflow, climatological, diversion, and reservoir evaporation of the three states and in cooperation with the U.S. Geological Survey, U.S. Bureau of Reclamation, and U.S. Army Corps of Engineers for 2005.
 - b. Refinement of the RRCA accounting spreadsheet – as the Administration moves toward the first multi-year compliance tests, the Engineering Committee completed a more detailed review of tables in the accounting spreadsheet related to these multi-year tests. Corrections and/or additional supporting information were added to Tables 4A and 4B and a correction made to Attachment 6. It was

not done

noted that Tables 5B and 5E need to more closely conform to their versions in the accounting procedures.

- c. The groundwater model run for 2005 is final and agreed to by all member of the committee.
 - d. Kansas developed a revision to its procedures to deal with wells in Nebraska that pump into Kansas, adding the wells and use to its model inputs.
 - e. The 2005 accounting of the virgin water supply, the computed water supply, and the beneficial consumptive uses in the Republican River Basin were completed, including the ground water impacts computed by the RRCA Ground Water Model in conformance with the procedures described in the RRCA Ground Water Model Users Manual and is considered final except for the following matter(s):
 - i. Non-federal reservoir evaporation below Harlan County. Nebraska believes the Final Settlement Stipulation proscribes only non-federal reservoir evaporation above Harlan County be included in the annual accounting. Kansas disagrees and believes it should be included for the entire basin.
 - ii. Negative allocation on Sappa Creek. While the groundwater model predicts negative depletions in rare instances, this year for Sappa Creek, a small negative Virgin Water Supply value resulted when the model output was combined with the accounting procedures. Willem Schreuder assisted the committee in understanding the cause of these computations. The committee will find the appropriate place to document this understanding for the benefit of others in the future and has added footnotes to the accounting spreadsheet.
3. **Irrigation return flow study scope of work** – Kansas provided the committee with its draft work plan from last year for discussion of additional elements needed to produce the requested comprehensive scope of work. Kansas does not believe detailed field investigations are warranted or needed. Nebraska expressed concern with significant adjustment to major model parameters without consideration of re-calibration of the model. Kansas provided committee members with a history of net efficiencies in the groundwater model by year by state. Nebraska suggests as a part of any proposed scope of work, the average field efficiencies for surface water irrigation district land and percent loss that returns to the stream be reviewed as indicated in the footnote on Attachment 7.
4. **Draft rule related to interstate transfers** - Kansas provided a draft for the committee's consideration along with the notice of the meeting and draft meeting agenda. Nebraska provided a re-draft on August 1.

Other matters

1. **Harlan County evaporation split in years of no irrigation release** - In last year's engineering committee report, the Engineering Committee made a recommendation related to the splitting of the annual net evaporation from Harlan County Lake between Kansas and Nebraska in years when no irrigation releases are made from Harlan County

Lake, a situation that was not previously addressed in the RRCA accounting procedures. The recommendation was to insert the language described below after the first sentence in paragraph three on page 23 that begins "The total net evaporation (Acre-feet) will be charged..,"

passed "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."

While the Administration accepted the Engineering Committee report, it took no formal action on the recommendation. Ken Knox, as last year's committee chair, produced a revised draft of the Accounting procedures just after the annual meeting, dated July 27, 2005, providing it to members of the Committee with copies to the Commissioners. The Engineering Committee recommends the Administration formally adopt this version of the Accounting Procedures. This year's accounting of the split of Harlan County is in conformity with this version as there were no irrigation deliveries from Harlan County in 2005.

2006 - on district water meeting all.

2. **Harlan County evaporation split for 2006** – Kansas offered a proposal for the split in Harlan County evaporation for years such as 2006 when only one District takes an irrigation release from Harlan County. The Committee is not yet in agreement on the proposal. The issue does not need to be resolved for the 2005 accounting but will need to be resolved for the 2006 accounting. The Committee recommends the Administration establish a plan and schedule for resolution of the issue.
3. **Supporting data related to acreage retirements.** Both Colorado and Nebraska reported reduction in irrigation acreage estimate via either field work or retirement of acreage associated with incentive-based programs. It was agreed that the States should provide documentation to the other states in the form of a GIS coverage (preferred) or a listing of track of land as a minimum. This should be added to the listing of data to be exchanged in the Accounting Procedures.

Recommended assignments for the coming year

The Engineering Committee recommends the Republican River Compact Administration assign the following tasks to be completed by the indicated dates:

1. Continue work on a user's manual for the RRCA Accounting Procedures and provide a recommendation to the Administration for adoption at next year's annual meeting.
2. In addition to providing by April 15 the information listed in Section V of the Accounting Procedures and Reporting Requirements, exchange by July 15, 2007 all finalized data required by the Republican River Compact accounting procedure, and use these data to complete the accounting of the virgin water supply, the computed water supply, and the

beneficial consumptive uses in the Basin for the calendar year 2006.

3. Continue efforts to resolve concerns related to varying methods of estimating ground and surface water irrigation recharge and return flow within the Republican River Basin and related issues.
4. Determine if changes are needed to the Accounting Procedures to address Harlan County reservoir evaporation splits when only one State is taking an irrigation release. *Nov 15*
5. Add requirements for documentation of acreage retirements.
6. Retain Principia Mathematica to perform on-going maintenance of the ground water and periodic updates requested by members of the Engineering Committee for calendar year 2007. The billable costs shall be limited to actual costs incurred, not to exceed \$12,000.00 in total and will be apportioned in equal 1/3 amounts to the States of Colorado, Kansas, and Nebraska respectively.

Legal Committee

The Engineering Report and final accounting spreadsheet will be posed on the web at www.republicanrivercompact.org.

Attachments:

Table 1, Accounting spreadsheet

Table 3A, 3B, 3C, Accounting spreadsheet

David W. Barfield
Engineer Committee Member for Kansas

Kenneth W. Knox
Engineer Committee Member for Colorado

Michael Thompson
Engineer Committee Member for Nebraska

Republican River Compact Administration

ACCOUNTING PROCEDURES

AND

REPORTING REQUIREMENTS

Revised July 27, 2005

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