SPECIAL MEETING OF THE
REPUBLICAN RIVER COMPACT ADMINISTRATION

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PLACE: HOLIDAY INN/KCI EXPO CENTER
11730 NW AMBASSADOR DRIVE
KANSAS CITY, MISSOURI

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EXHIBITS

(attached to end of Volume I)

Sign in sheets

Agenda

Draft Agenda - proposed by Kansas

Notebook presented by Nebraska - provided to Kansas and Colorado, not attached to transcript

Nebraska-Related Documents for
Special Meeting of the
Republican River Compact Administration
March 11 and 12, 2008
Kansas City, Missouri

The purpose of this binder is to provide information related to the special meeting of the Republican River Compact Administration (RRCA) on March 11 and 12, 2008. The meeting was originally planned during an RRCA conference call for the purpose of discussing a number of accounting issues. In addition, Kansas has submitted a dispute to the RRCA (in a letter dated February 8, 2008) for consideration at this meeting as part of the fast-track resolution process. Nebraska, in its letter of February 22, 2008, also submitted additional accounting issues to the RRCA for the fast-track resolution process. Therefore, this binder includes correspondence between Colorado, Kansas, and Nebraska, a summary of Nebraska's positions on a number of accounting-related issues, and the Integrated Management Plans adopted by the primary Natural Resources Districts in the Nebraska portion of the Republican Basin.

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Calculation of Computed Beneficial Consumptive Use and Imported Water Supply Credit Using the RRCA Groundwater Model

Nebraska Department of Natural Resources
January 2008

Introduction

The state of Nebraska has raised an issue with the Republican River Compact Administration (RRCA) regarding the calculation of the Imported Water Supply Credit (Mound Credit) and groundwater Computed Beneficial Consumptive Use (CBCU) of the Virgin Water Supply (VWS) using the RRCA groundwater model. The relevant language in the Republican River Final Settlement Stipulation (FSS) can be found in Section IV.F.

> *Beneficial Consumptive Use of Imported Water Supply shall not count as Computed Beneficial Consumptive Use or Virgin Water Supply. Credit shall be given for any remaining Imported Water Supply that is reflected in increased stream flow, except as provided in Subsection V.B. Determinations of Beneficial Consumptive Use from Imported Water Supply (whether determined expressly or by implication), and any Imported Water Supply Credit shall be calculated in accordance with the RRCA Accounting Procedures and by using the RRCA Groundwater Model.*

Groundwater Modeling Scenarios

The RRCA groundwater model was developed to calculate base-flow to the Republican River. It was intended to be used to estimate impacts of changes to the ground water system on discharge of base-flow to the Republican River. Two scenarios, one in which a process (such as importation of water or groundwater pumping) is represented and another in which the process is not represented, would reveal the impact of the process on base-flow to the Republican River. The difference in calculated base-flow to the river between the two scenarios represents the magnitude of the impact. For example the following is a list of scenarios which may be used to evaluate the impacts of importing water and pumping:

Scenario (1) **Importation of Water On, Pumping On:** The recharge of Platte River water via surface water canals and irrigation is turned ON in the model, and the groundwater pumping throughout the model domain is turned ON.

Scenario (2) **Importation of Water Off, Pumping On:** The recharge of Platte River water via surface water canals and irrigation is turned OFF in the model, and the groundwater pumping throughout the model domain is turned ON

Scenario (3) **Importation of Water On, Pumping Off:** The recharge of Platte River water via surface water canals and irrigation is turned ON in the model, and the groundwater pumping throughout the model domain is turned OFF.

Scenario (4) **Importation of Water Off, Pumping Off:** The recharge of Platte River Water via surface water canals and irrigation is turned OFF in the model, and the groundwater pumping **throughout** the model domain is turned OFF.

There are several scenarios that can be selected to calculate the impact of a process on base-flow to the Republican River. Table A shows five options for scenario combinations which might be used to calculate impacts. For example: to calculate the impact of the importation of water on baseflow one could compare the difference between the importation of water on or off with the groundwater pumping on (Option 1) or with the groundwater pumping off (Option 2). Likewise, to calculate the impact of groundwater pumping on baseflow, one could compare the difference between pumping groundwater or not with the importation of water on (Option C) or with the importation of water off (Option D).

Table A - Options of calculations using groundwater modeling scenarios to calculate impacts of importation of water, groundwater pumping, or both.

Option	Calculation	Expected Results	Average Difference 1981-2000 (ac-ft/yr)	Average Difference 2001-2006 (ac-ft/yr)
A	**Scenario (1) – Scenario (2)** Importation On, Pumping On – Importation Off, Pumping On	Mound Credit	16,272	12,869
B	**Scenario (3) – Scenario (4)** Importation On, Pumping Off – Importation Off, Pumping Off	Mound Credit	21,655	28,359
C	**Scenario (1) – Scenario (3)** Importation On, Pumping On – Importation On, Pumping Off	Groundwater CBCU	210,127	251,841
D	**Scenario (2) – Scenario (4)** Importation Off, Pumping On – Importation Off, Pumping Off	Groundwater CBCU	204,740	236,352
E	**Scenario (1) – Scenario (4)** Importation On, Pumping On – Importation Off, Pumping Off	Total Impact	188,472	223,483

Both options A and B can be used to estimate the impact of importation of water on base-flow to the Republican River. There are differences, however, between the resulting estimates. Option A yields an estimate of 16,278 Acre-feet per year on average for the years 1981- 2000; option B yields an estimate of 21,655 Acre-feet per year. The difference in the estimates is substantial. They can be attributed to the fact that the model is non-linear.

Similarly options C and D can be used to estimate the impact of pumping. Option C yields an estimate of 210,127 Acre-feet per year on average for the years 1981-2000 and option D yields an estimate of 204,740 Acre-feet per year for the same period. Option E is the only choice of runs that can be used to estimate the total impact of importing water and pumping. It yields an estimate of 188,472 Acre-feet per year on average for the years 1981-2000.

The difference in estimates for impacts from importing water indicates that there is a significant error in one estimate or both. There is no reason to believe option A yields a better estimate of the impact of importing water than option B.

Obviously, a choice has to be made between the two available options for calculating the mound credit and two available methods for calculating the groundwater CBCU. The methods that are chosen should satisfy at least two criteria; (1) they should be in line with the intentions of the FSS, and (2) they should produce results for the mound credit and groundwater CBCU that when combined, are equal to (or very closely equal to) the total impacts to the Republican River base-flow (option E above, or Kansas' "virgin water supply metric"). Currently the accounting procedures use choice A and C to calculate the impacts of the imported water supply and ground water pumping on base-flow. However, the use of option B to calculate the IWS credit and option C to calculate the CBCU results in a combined impact for the IWS credit and CBCU equal to the result from method E and thus would seem to be the preferred method.

Nebraska accepted the model as the basis for allocation in spite of the fact that it was known to be non-linear. The fact that option A under-represents the mound credit during the current drought is injurious to Nebraska. According to the FSS, Section I.F, "The RRCA may modify the RRCA Accounting Procedures, or any portion thereof, in any manner consistent with the Compact and this Stipulation." The State of Nebraska continues to believe that the choice of model runs used to calculate the mound credit violates the letter and the spirit of the FSS, and should be changed within the Accounting Procedures in Appendix C.

Calculation of Computed Beneficial Consumptive Use and Imported Water Supply Credit Using the RRCA Ground Water Model

Nebraska Department of Natural Resources

March 2008

Introduction

The state of Nebraska has raised an issue with the RRCA regarding an inaccuracy in the calculation of the Imported Water Supply Credit (Mound Credit) and ground water Computed Beneficial Consumptive Use (GW CBCU) of the Virgin Water Supply using the Republican River Compact Administration (RRCA) ground water model. Nebraska first raised the concerns about this inaccuracy in June of 2007. Discussions within the RRCA Engineering Committee pointed to the need for further clarification of the issue by Nebraska. The state of Nebraska submitted a document, by email, to the states of Kansas and Colorado on January 4, 2008 further describing the issue and reflecting on explanations and potential remedies to eliminate the inaccuracy. The state of Kansas responded to that document, by email, on January 23, 2008, addressing Nebraska's reflections on explanations and potential remedies. This document is meant to further clarify the issue so that all three states can understand why the accounting procedures need to be changed to ensure that the RRCA Accounting Procedures reaches the highest possible standard of accuracy.

The RRCA ground water model was developed to calculate base-flow to the Republican River. It is able to do so for a variety of conditions including conditions that have prevailed in the past, conditions that might have prevailed in the past if stresses to the ground water flow regime --- e.g. pumping, recharge from precipitation, seepage from canals and importation of water --- had been different in magnitude and/or location, and conditions that may be expected to prevail in the future.

The model was intended to be used to estimate impacts of such stress changes to the ground water system on discharge of base-flow to the Republican River. To estimate such impacts the model represents what we call "scenarios". One scenario represents conditions without the change in stresses and the second scenario represents conditions with the change in stresses. The difference between discharge to base-flow in the first scenario and discharge to base-flow in the second scenario is an estimate of the impact of the change in stresses.

The primary application of the model was expected to be the estimation of depletion to base-flow caused by ground water pumping (GW CBCU) by a state, and, in the case of the state of Nebraska, the estimation of accretion to base-flow (Mound Credit) caused by importation of water from the Platte basin. The changes in stresses due to ground water pumping in each state were to be represented by two scenarios: one representing base-flow conditions with ground water pumping in that state turned on; the other representing base-flow conditions with no ground water pumping in that state. A secondary application is the estimation of impacts of changes in stresses within states in order to plan controls within that state to comply with the compact.

Issue

To estimate the impact of ground water pumping by each state on the base-flow, the RRCA Accounting Procedures currently compares a model run scenario with all states' ground water pumping turned on with a model run scenario with one state's ground water pumping turned off. The difference in base-flows between the two scenarios represents the depletions to base-flow caused by the state whose ground water pumping was turned off. An alternative set of scenarios that could be used to estimate a state's depletions to base-flow caused by ground water pumping would be to compare a scenario in which there is no ground water pumping by any state with a scenario in which one states' ground water pumping is turned on. Both sets of scenarios represent an equally reasonable method to determine the depletions to stream flow from each state's ground water pumping. However, the state of Nebraska has observed that the two choices of equally reasonable sets of scenarios used to estimate impacts by each state yield dramatically different results. The choice of the sets of scenarios also impacts the estimate of the Mound Credit.

Discussion

Table 1 lists scenarios that might be used to calculate the GW CBCU for each state and the Mound Credit for Nebraska. The scenarios were numbered arbitrarily merely to facilitate reference in this document. Other scenarios could be used, but those listed illustrate Nebraska's issue.

Table 2 lists choices of scenarios that might be used to calculate GW CBCU for each of the states and the Mound Credit for Nebraska's importation of water into the Republican basin from the Platte basin. The column headed "Current choice of scenarios used to calculate impacts on base-flow" shows the choice of scenarios currently used. The column headed "Alternative choice of scenarios used to calculate impacts on base-flow" shows alternative, equally reasonable choices.

Table 3 for each set of scenarios in Table 2 lists the average of values of GW CBCU for each state and Mound Credit for Nebraska using the RRCA ground water model and inputs for the period 2001-2006. Notice that with the current choice of scenarios the entry for KS GW CBCU is 10,849 acre-feet/year, whereas with the alternative choice of scenarios the entry for KS GW CBCU is 16,330 acre-feet/year. Similarly, with the current choice of scenarios, the entry for the Mound Credit is 12,869 acre-feet/year, whereas with the alternative choice of scenarios, the entry for Mound credit is 28,359 acre-feet/year.

Conclusions

The state of Nebraska believes that in the interest of the integrity and credibility of the Republican River Compact Accounting Procedures, it is imperative that the RRCA continually strive to ensure that the accounting procedures are an accurate estimate of the actual depletions to stream flow caused by each state's ground water pumping and an accurate estimate of the Mound Credit. Therefore, in accordance with the Final Settlement Stipulation, the accounting procedures must be changed to account for the disparity between estimates of impacts based on one pair of scenarios as opposed to an equally reasonable pair of scenarios.

Table 1. List of scenarios that might be used to calculate base-flow for estimates of impacts.

Scenario Number	Representation of Stresses	NE Importation On?	NE Pumping On?	KS Pumping On?	CO Pumping On?
1	Importation of water by NE and Pumping by NE, KS, and CO On	**YES**	**YES**	**YES**	**YES**
2	Pumping by NE, KS, and CO On; Importation of water by NE Off	NO	**YES**	**YES**	**YES**
3	Importation of water by NE On; Pumping by NE, KS, and CO Off	**YES**	NO	NO	NO
4	Importation of water by NE and Pumping by NE, KS, and CO Off	NO	NO	NO	NO
5	Importation of water by NE and pumping by KS and CO On; Pumping by NE Off	**YES**	NO	**YES**	**YES**
6	Importation of water by NE and pumping by NE and CO On; Pumping by KS Off	**YES**	**YES**	NO	**YES**
7	Importation of water by NE and pumping by NE and KS On; Pumping by CO Off	**YES**	**YES**	**YES**	NO
8	Pumping by NE On; Importation of water by NE and pumping by KS and CO Off	NO	**YES**	NO	NO
9	Pumping by KS On; Importation of water by NE and pumping by NE and CO Off	NO	NO	**YES**	NO
10	Pumping by CO On; Importation of water by NE and pumping by NE and KS Off	NO	NO	NO	**YES**

Table 2. Choices of scenarios that might be used to calculate impacts used in accounting procedures.

Expected Results	Current choice of scenarios used to calculate impacts on base-flow	Alternative choice of scenarios used to calculate impacts on base-flow
Nebraska GW CBCU	Scenario (5) – Scenario (1)	Scenario (4) – Scenario (8)
Kansas GW CBCU	Scenario (6) – Scenario (1)	Scenario (4) – Scenario (9)
Colorado GW CBCU	Scenario (7) – Scenario (1)	Scenario (4) – Scenario (10)
Mound Credit	Scenario (1) – Scenario (2)	Scenario (3) – Scenario (4)

Table 3. Average Results of Calculations for 2001-2006.

Expected Results	Estimates of GW CBCU and Mound Credit calculated using current choice of scenarios. (acre-feet/year)	Estimates of GW CBCU and Mound Credit calculated using alternative choice of scenarios. (acre-feet/year)
Nebraska GW CBCU	202,348	200,845
Kansas GW CBCU	10,849	16,330
Colorado GW CBCU	24,983	32,147
Mound Credit	12,869	28,359