PRIVILEGED AND CONFIDENTIAL – SUBJECT TO JOINT DEFENSE/COMMON INTEREST DEFENSE

No. 126, Original

In The

Supreme Court of the United States

STATE OF KANSAS,

Plaintiff,

v.

STATE OF NEBRASKA

and

STATE OF COLORADO,

Defendants.

PRIVILEGED AND CONFIDENTIAL STIPULATION

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PRIVILEGED AND CONFIDENTIAL – SUBJECT TO JOINT DEFENSE/COMMON INTEREST DEFENSE

This Stipulation is entered this 10th of April, 2012, by the State of Colorado ("Colorado") and the State of Nebraska ("Nebraska") (collectively "States") concerning certain claims in connection with the Republican River Compact.

WHEREAS: The States have a Joint Defense/Common Interest in defending certain arguments made by the State of Kansas and pursuing certain arguments against the State of Kansas concerning the Republican River Compact as set forth below;

WHEREAS: Pursuant to their Joint Defense/Common Interest, the States of Colorado and Nebraska previously entered into the *Stipulation Between the State of Colorado and the State of Nebraska to Resolve Issues Regarding Arbitration* (the "2010 Stipulation"), a copy of which is attached hereto as Exhibit No. 1 and incorporated herein by this reference;

WHEREAS: The 2010 Stipulation sets forth Colorado's and Nebraska's agreements and proposed actions concerning Colorado's Republican River Compact Compliance Pipeline ("Pipeline"), certain proposed changes to the representation of Bonny Reservoir in the Republican River Compact Administration's ("RRCA") Groundwater Model ("Model") and accompanying changes to accounting points and the Computed Beneficial Consumptive Use ("CBCU") calculation, and certain proposed changes to the RRCA Accounting Procedures concerning the calculation of Groundwater CBCU; and

NOW WHEREFORE, the States hereby agree as follows:

1. Pursuant to their continuing Joint Defense/Common Interest, the States reaffirm commitments made in the 2010 Stipulation and restate those commitments to the extent necessary to update the facts and circumstances surrounding the issues addressed in the 2010 Stipulation.

2. Nebraska shall support and not oppose, before the RRCA and in any arbitration or litigation proceedings, the Pipeline, including the ancillary changes to the RRCA Accounting Procedures attached to the 2010 Stipulation as Exhibit G, provided the Pipeline is operated substantially in conformance with the terms and conditions set forth in Paragraph 1 of the 2010 Stipulation.
3. Nebraska shall support and not oppose, before the RRCA and in any arbitration or litigation proceedings, Colorado's efforts to change the representation of Bonny Reservoir in the Model and the accompanying changes to the CBCU calculation. In particular, because water is no longer stored in Bonny Reservoir, Nebraska shall support representation of Bonny Reservoir in the Model in the manner in which the South Fork of the Republican River was represented before Bonny Reservoir was built, subject to any modification that may be necessary if water is stored in a "dead pool" in Bonny Reservoir or to address flood control storage. Although Exhibit J to the 2010 Stipulation discusses proposed changes with regard to Bonny Reservoir, the States anticipate that other changes are foreseeable, particularly with regard to the issue of elevation. If proposed by Colorado, the States shall agree to other operations or changes substantially consistent with Exhibit J to the 2010 Stipulation, including but not limited to modeling and accounting point changes.
4. Colorado shall support and not oppose, in the litigation presently ongoing before the United States Supreme Court in *Kansas v. Nebraska and Colorado*, No. 126 Orig., and all subsequent proceedings, the changes to the RRCA Accounting Procedures reflected in Exhibit No. 2 attached hereto, and incorporated herein by this reference;

5. The term "support" in the context of the RRCA means that both States shall vote in favor of any RRCA resolutions proposed by the other State relating to the Pipeline, certain proposed changes to the representation of Bonny Reservoir in the Model and accompanying changes to accounting points and the CBCU calculation, and certain proposed changes to the calculation of Groundwater CBCU that are in conformance with this agreement and the 2010 Stipulation. The term "support" in the context of any arbitration or litigation proceedings means that both States shall affirmatively represent to the tribunal that they support the Pipeline, certain proposed changes to the representation of Bonny Reservoir in the Model and accompanying changes to accounting points and the CBCU calculation, and certain proposed changes to the calculation of Groundwater CBCU that are in conformance with this agreement and the 2010 Stipulation. Nothing in this agreement or the 2010 Stipulation, however, shall require either State to initiate action on an issue within a certain time frame or assume a burden of proof or persuasion with regard to the other State's position concerning the issues addressed herein. Nothing in this Stipulation, shall require either State to propose a RRCA resolution on behalf of the other State's position concerning the issues addressed herein;
6. The States expressly reserve any and all claims they may have against each other concerning the Republican River Compact, Final Settlement Stipulation, and Consent Decree, and nothing herein shall be deemed to constitute a waiver of any such claims by either State;
7. Based upon this agreement, Nebraska withdraws its current Notices of Deposition for Jim Slattery scheduled for April 11th, 2012, Dick Wolfe scheduled for April 11th, 2012, and

Willem Schreuder scheduled for April 10th, 2012 and waives its ability to call these experts without Colorado's consent, except Willem Schreuder as a rebuttal witness, during the trial in *Kansas v. Nebraska and Colorado*, No. 126, Orig.

8. Nebraska shall file a Notice of Stipulation and request a hearing with the Special Master subsequent to Colorado's filing of dispositive motions and briefs on legal issues, which are due on May 15, 2012. The Notice of Stipulation must be finalized by mutual agreement and cooperation of the States; and

9. This Stipulation shall be and remain confidential, and neither State shall release this Stipulation, or any part thereof, unless and until compelled by an Order of a court of competent jurisdiction or by agreement of the States.

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PRIVILEGED AND CONFIDENTIAL – SUBJECT TO JOINT DEFENSE/COMMON INTEREST DEFENSE

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EXHIBIT 1

REPUBLICAN RIVER COMPACT ARBITRATION

COLORADO'S COMPACT COMPLIANCE PIPELINE ISSUE AND NEBRASKA'S CREDITING ISSUE

BEFORE MS. MARTHA PAGEL, ARBITRATOR

Pursuant to Section VII, Final Settlement Stipulation (December 15, 2002)

JOINT NOTICE OF STIPULATION

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The States of Colorado and Nebraska (the "Stipulating States") hereby notify the Arbitrator and the State of Kansas that the Stipulating States have resolved, as between the Stipulating States, all Issues presented in this Arbitration by both Nebraska and Colorado. In furtherance of the Stipulation, the States hereby inform the Arbitrator as follows:

1. Nebraska informs the Arbitrator that she supports Colorado's Compliance Pipeline (subject to the terms of the Stipulating States' agreement);
2. Nebraska withdraws the Additional Issues identified in her September 4, 2009 correspondence concerning the Colorado Compliance Pipeline (attached to the Colorado Compliance Pipeline Arbitration Agreement as Exhibit C);
3. Colorado informs the Arbitrator that she supports Nebraska's proposed resolution of the Nebraska Crediting Issue;
4. The States of Colorado and Nebraska have agreed to the following terms as part of the Stipulating States' agreement: Colorado and the RRWCD WAE shall deliver water to the North Fork of the Republican River to offset stream depletions in order to comply with Colorado's Compact Allocations as agreed upon by the two States not later than December 31 of the year preceding scheduled deliveries. Colorado and the RRWCD WAE together shall consult with Nebraska as needed to coordinate the timing and volume of deliveries to the North Fork of the Republican River. To the maximum extent possible, Colorado and the RRWCD WAE will make such deliveries per Nebraska's request consistent with the following delivery schedule:

a. For each year, except as provided in paragraph b, Colorado shall begin deliveries on January 1 and shall make the minimum annual delivery of 4,000 acre-feet provided for in the Colorado Resolution during the months of January through March. Colorado will calculate and provide notice of the Projected Delivery, as defined in the Colorado Resolution, to the Kansas and Nebraska RRCA Members by April 1 as provided in the Colorado Resolution. Unless Colorado determines by April 1 that it will not be able to deliver any remaining Projected Delivery in the months of October through December, Colorado shall stop deliveries at the end of March. If Colorado anticipates that deliveries in the months of November and December will not be sufficient for Compact compliance, Colorado shall maximize deliveries first in January, then sequentially in the months of February, March, and April. Only if there is reason to believe that additional deliveries in the months of October through December as described below in this paragraph will not be sufficient for Compact compliance will deliveries extend into the month of May. By September 1st, Colorado will gather provisional hydrologic data for the months of January through August of the year and shall estimate the amount of deliveries needed for Compact compliance for the remainder of the year after accounting for the deliveries earlier in the year. Colorado shall then maximize any

additional water deliveries first in the month of December, then sequentially in November, and October.

b. For the first year the Pipeline becomes operational, if the Pipeline becomes operational after January 1 and Colorado cannot make the minimum annual delivery of 4,000 acre-feet provided for in the Colorado Resolution during the months of January through March, Colorado and the RRWCD WAE together shall consult with Nebraska as needed to coordinate the timing and volume of deliveries to the North Fork of the Republican River and shall maximize deliveries prior to March 31 and in the months of October through December.

c. If the minimum annual delivery of 4,000 acre-feet provided for in the Colorado Resolution is modified by arbitrator's decision, RRCA action, or United States Supreme Court decision or by agreement of the States, the States agree to work together in good faith to agree upon a delivery schedule that, to the maximum extent possible, will make such deliveries per Nebraska's request consistent with the delivery schedule provided in paragraph a. In the event the States are unable to agree upon a delivery schedule pursuant to this Stipulation, and the dispute is not resolved, the States shall proceed in good faith to submit the dispute to mediation. Mediation is a process in which the parties meet with an impartial person who helps to resolve the dispute informally and confidentially. The parties to the dispute must agree

before any settlement is binding. The States will jointly appoint an acceptable mediator and will share equally in the cost of such mediation. The mediation, unless otherwise agreed, shall terminate in the event the dispute cannot be resolved within 30 calendar days of the date written notice requesting mediation is delivered by one State's RRCA Member to the other State's RRCA Member.

d. Unless otherwise requested by Nebraska, deliveries during the Irrigation Season, defined as being the months June through September, shall be avoided to the maximum extent possible and shall only be made as a last resort in order to satisfy the water deliveries called for under the Colorado Resolution; and,

5. The Stipulating States expressly reserve their right to prosecute their respective positions in this Arbitration to the fullest extent against all challenges by the State of Kansas, and nothing contained herein shall limit the Stipulating States' ability to defend any such challenge and participate in this Arbitration as set forth in Section VII of the Final Settlement Stipulation.

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PRIVILEGED AND CONFIDENTIAL
SUBJECT TO JOINT DEFENSE/COMMON INTEREST PRIVILEGE

Kansas v. Nebraska & Colorado
No. 126, Original, United States Supreme Court
Final Settlement Stipulation

STIPULATION BETWEEN THE STATE OF COLORADO AND THE STATE OF NEBRASKA TO RESOLVE ISSUES REGARDING ARBITRATION

of the

Colorado "Compact Compliance Pipeline"

and the

Nebraska "Crediting Issue"

This Stipulation is entered this __ day of April, 2010, by the State of Colorado ("Colorado") and the State of Nebraska ("Nebraska") to resolve, as between the two States, issues that have been submitted to non-binding arbitration in accordance with the Final Settlement Stipulation in *Kansas v. Nebraska and Colorado*, No. 126, Original (U.S. Supreme Court).

RECITALS

WHEREAS, the Final Settlement Stipulation ("FSS") incorporated in the May 19, 2003 Decree of the United States Supreme Court in *Kansas v. Nebraska & Colorado*, 538 U.S. 720 (2003), provides, in Subsection VII.A.7 thereof, that the Republican River Compact Administration ("RRCA") will attempt to resolve any dispute submitted to the RRCA pursuant to Section VII of the FSS and that if such a dispute cannot be resolve by the RRCA as provided therein and the State raising the dispute desires to proceed, the dispute shall be submitted to non-binding arbitration unless otherwise agreed to by all States with an Actual Interest; and

WHEREAS, the Republican River Water Conservation District is a water conservation district created by Colorado statute to assist Colorado to comply with the Compact and the Republican River Water Conservation District may be bound to this agreement by signature of the State; and

WHEREAS, the Republican River Water Conservation District, acting by and through its Water Activity Enterprise ("RRWCD WAE"), has acquired, along with certain surface water rights, wells ("Compact Compliance Wells") and groundwater rights in the Republican River Basin in Colorado for the purpose of offsetting stream depletions in order to comply with Colorado's Compact Allocations; and

WHEREAS, Colorado and the RRWCD WAE have proposed to pump the historical consumptive use of all or some of these groundwater rights from the Compact Compliance Wells

into a pipeline and deliver that water into the North Fork of the Republican River near the Colorado/Nebraska State Line to offset stream depletions in order to comply with Colorado's Compact Allocations ("Colorado Compact Compliance Pipeline") in the future; and

WHEREAS, in March 2008, Colorado and the RRWCD WAE submitted an application for approval of an augmentation plan and related accounting procedures to the RRCA for approval under Subsection III.B.1.k of the FSS to account for water delivered to the North Fork of the Republican River for the purpose of offsetting stream depletions in order to comply with Colorado's Compact Allocations; and

WHEREAS, Colorado submitted a resolution to the RRCA dated August 12, 2009, to approve a plan for augmentation and related accounting procedures under Subsection III.B.1.k of the FSS, attached hereto as Exhibit A ("Colorado Resolution"), to attempt to resolve issues regarding the proposed plan for augmentation and related accounting procedures under Subsection III.B.1.k of the FSS ("Colorado Compliance Pipeline Issues"); and

WHEREAS, the Resolution was submitted to a vote at the regular annual RRCA meeting in August 2009, but the Nebraska and Kansas members voted against the Resolution; and

WHEREAS, the Colorado Compliance Pipeline Issues were Submitted to the RRCA by Colorado as "fast-track" issues pursuant to the dispute resolution provisions of Section VII.A of the FSS; and

WHEREAS, the Colorado Compliance Pipeline Issues were Addressed by the RRCA, as defined in the FSS, but not resolved by the RRCA pursuant to Section VII.A of the FSS; and

WHEREAS, by letter of August 21, 2009, Colorado initiated non-binding arbitration ("Arbitration") of the Colorado Compliance Pipeline Issues pursuant to Section VII.B and C of the FSS, which letter is attached hereto as Exhibit B; and

WHEREAS, by letter of September 4, 2009, Nebraska identified additional issues ("Nebraska Issues Regarding the Colorado Compliance Pipeline") that Nebraska individually believed were subsumed within and necessary to properly resolve the Colorado Compact Compliance Pipeline Issues, which letter is attached hereto as Exhibit C; and

WHEREAS, on June 15, 2009, by letter from Director Dunnigan, a copy of which is attached as Exhibit D, certain issues ("Nebraska Crediting Issues") were submitted to the RRCA for resolution as "fast track" issues; and

WHEREAS, the Nebraska Crediting Issues are identified in the Resolution of the RRCA dated August 12, 2009, attached hereto as Exhibit E ("Nebraska Resolution"); and

WHEREAS, the Nebraska Crediting Issues have been Addressed by the RRCA, as defined in the FSS, but not resolved by the RRCA pursuant to Section VII.A of the FSS; and

PRIVILEGED AND CONFIDENTIAL
SUBJECT TO JOINT DEFENSE/COMMON INTEREST PRIVILEGE

WHEREAS, by letter of August 28, 2009, Nebraska initiated non-binding Arbitration on the Nebraska Crediting Issues pursuant to Section VII.B and C of the FSS, which letter is attached hereto as Exhibit F; and;

WHEREAS, Colorado and Nebraska have discussed the disputes and desire to resolve the Colorado Compliance Pipeline Issues and the Nebraska Crediting Issues.

WHEREAS, Colorado and Nebraska have a Common Interest in defending certain claims made by the State of Kansas and pursuing claims against the State of Kansas concerning the Republican River Compact;

WHEREAS, Colorado and Nebraska have concluded it is in their mutual interest to jointly defend and prosecute the claims at issue in the present Arbitration as well as certain others addressed in the prior Arbitration before Mr. Karl Dreher, and Colorado and Nebraska have determined to work cooperatively to pursue their Common Interest in developing strategies related to those issues, including in future litigation concerning the same;

WHEREAS, Colorado and Nebraska have concluded the sharing of confidential and privileged information and documents between the two States will be mutually beneficial in pursuit of their Common Interest, but no exchange of information in connection with such Common Interest is intended to waive any attorney-client or attorney work product privilege, or other protection from disclosure, to third parties which may be otherwise available;

NOW, THEREFORE, the States agree as follows:

1. With regard to the operation of the Colorado Compact Compliance Pipeline in accordance with the terms of the Colorado Resolution, Colorado and the RRWCD WAE shall deliver water to the North Fork of the Republican River to offset stream depletions in order to comply with Colorado's Compact Allocations as agreed upon by the two States not later than December 31 of the year preceding scheduled deliveries. Colorado and the RRWCD WAE together shall consult with Nebraska as needed to coordinate the timing and volume of deliveries to the North Fork of the Republican River. To the maximum extent possible, Colorado and the RRWCD WAE will make such deliveries per Nebraska's request consistent with the following delivery schedule:

    a. For each year, except as provided in paragraph 1.b, Colorado shall begin deliveries on January 1 and shall make the minimum annual delivery of 4,000 acre-feet provided for in the Colorado Resolution during the months of January through March. Colorado will calculate and provide notice of the Projected Delivery, as defined in the Colorado Resolution, to the Kansas and Nebraska RRCA Members by April 1 as provided in the Colorado Resolution. Unless Colorado determines by April 1 that it will not be able to deliver any remaining Projected Delivery in the months of October through December, Colorado shall stop deliveries at the end of March. If Colorado anticipates that deliveries in the months of November and December will not be sufficient for Compact compliance, Colorado shall maximize deliveries first in January, then sequentially

in the months of February, March, and April. Only if there is reason to believe that additional deliveries in the months of October through December as described below in this paragraph will not be sufficient for Compact compliance will deliveries extend into the month of May. By September 1, Colorado will gather provisional hydrologic data for the months of January through August of the year and shall estimate the amount of deliveries needed for Compact compliance for the remainder of the year after accounting for the deliveries earlier in the year. Colorado shall then maximize any additional water deliveries first in the month of December, then sequentially in November, and October.

b. For the first year the Pipeline becomes operational, if the Pipeline becomes operational after January 1 and Colorado cannot make the minimum annual delivery of 4,000 acre-feet provided for in the Colorado Resolution during the months of January through March, Colorado and the RRWCD WAE together shall consult with Nebraska as needed to coordinate the timing and volume of deliveries to the North Fork of the Republican River and shall maximize deliveries prior to March 31 and in the months of October through December.

c. If the minimum annual delivery of 4,000 acre-feet provided for in the Colorado Resolution is modified by arbitrator's decision, RRCA action, or United States Supreme Court decision or by agreement of the States, the States agree to work together in good faith to agree upon a delivery schedule that, to the maximum extent possible, will make such deliveries per Nebraska's request consistent with the delivery schedule provided in paragraph 1.a. In the event the States are unable to agree upon a delivery schedule pursuant to this Stipulation, and the dispute is not resolved, the States shall proceed in good faith to submit the dispute to mediation. Mediation is a process in which the parties meet with an impartial person who helps to resolve the dispute informally and confidentially. The parties to the dispute must agree before any settlement is binding. The States will jointly appoint an acceptable mediator and will share equally in the cost of such mediation. The mediation, unless otherwise agreed, shall terminate in the event the dispute cannot be resolved within 30 calendar days of the date written notice requesting mediation is delivered by one State's RRCA Member to the other State's RRCA Member.

d. Unless otherwise requested by Nebraska, deliveries during the Irrigation Season, defined as being the months June through September, shall be avoided to the maximum extent possible and shall only be made as a last resort in order to satisfy the water deliveries called for under the Colorado Resolution.

e. Augmentation Water Supply Credit: Augmentation Water Supply Credit for deliveries of water from the Colorado Compact Compliance Pipeline to offset stream depletions in order to comply with Colorado's Compact Allocations shall be credited in the Compact accounting year (currently January 1 through December 31) the deliveries are made and shall be included in the year of delivery

for the purposes of all Compact accounting done on a running average in accordance with Subsection IV.D of the FSS and the RRCA Accounting Procedures, but such deliveries shall not otherwise offset stream depletions in any year prior to the year the deliveries are made.

2. Nebraska will support approval of the Colorado Compact Compliance Pipeline in the Arbitration, including the ancillary changes to the Accounting Procedures attached hereto as Exhibit G, as clarified by this Stipulation. Nebraska will withdraw the Nebraska Issues Regarding the Colorado Compliance Pipeline from the Arbitration and agrees that its concerns have been satisfied. Nebraska, however, may continue to participate in the Arbitration to ensure compliance with this Stipulation and to defend challenges to the Nebraska Crediting Issue as may be presented by the State of Kansas ("Kansas").

3. Colorado will support Nebraska in proposing a change to the RRCA Accounting Procedures and Reporting Requirements ("RRCA Accounting Procedures") for the calculation of annual Computed Beneficial Consumptive Use of groundwater using the RRCA Groundwater Model consistent with the approach set forth in Exhibits H and I (the "Joint CBCU Accounting Proposal"). Colorado, acting through its RRCA member, will vote in favor of the Joint CBCU Accounting Proposal and, if the Joint CBCU Accounting Proposal is approved by the RRCA, Nebraska will hold in abeyance its prior proposal for the calculation of annual Computed Beneficial Consumptive Use of groundwater using the RRCA Groundwater Model using 16 runs of the RRCA groundwater model as summarized in paragraph I.A.1 of Exhibit 4 to the Arbitration Agreement of October 23, 2008. If the RRCA does not agree to the Joint CBCU Accounting Proposal, Nebraska agrees to invoke non-binding arbitration to resolve that dispute and Colorado agrees to support the Joint CBCU Accounting Proposal in the arbitration and any subsequent litigation regarding the Joint CBCU Accounting Proposal. Further, Nebraska will not pursue its 16-run proposal until the Joint CBCU Accounting Proposal has been voted on by the RRCA and, if the RRCA does not agree to the Joint CBCU Accounting Proposal, until non-binding arbitration to resolve that dispute has been completed; provided nothing in this Agreement shall prevent Nebraska from pursuing its 16-run proposal if Kansas seeks leave to file a Bill of Complaint before the United States Supreme Court in furtherance of its claims set forth in the December 19, 2007 letter from Kansas to Nebraska entitled "Remedy for Nebraska's Violation of the Decree in *Kansas v. Nebraska and Colorado*, No. 126 Original, U.S. Supreme Court."

4. Nebraska will support Colorado in proposing a change to the representation of Bonny Reservoir in the RRCA Groundwater Model if water stored in Bonny Reservoir is released and water is no longer stored in the reservoir, provided that Nebraska reserves the right to propose any modification that may be necessary if water is stored in a "dead pool" in Bonny Reservoir or to address flood control storage. Nebraska agrees that Colorado may submit such a proposal to the RRCA prior to the time water currently stored in Bonny Reservoir is actually fully released and that the representation in the model cell where Bonny Reservoir is currently simulated should be returned to the same representation in that model cell as the South Fork of the Colorado was represented

before Bonny Reservoir was built, subject to any modification that may be necessary if water is stored in a "dead pool" in Bonny Reservoir or to address flood control storage. See Exhibit J.

5. Colorado will support Nebraska's position with regard to the Nebraska Crediting Issue in the Arbitration and any subsequent litigation regarding that issue.

6. Nebraska acknowledges the RRWCD WAE's current lease of water rights on the North Fork of the Republican River is designed to address Nebraska's concerns regarding the availability of water for diversion from the North Fork of the Republican River at the Pioneer Ditch or Canal (a/k/a Haigler Canal) by the Pioneer Irrigation District of Dundy, Nebraska; but as exemplified by Exhibits K and L, Nebraska's concerns remain unresolved pending further study of the impact of the lease on long-term flows in the North Fork of the Republican River. Nebraska will await the outcome of further analysis before pursuing its concerns, but nothing in this Agreement precludes Nebraska from raising this issue in the future.

7. Nebraska expressly reserves any and all claims it may have concerning past non-compliance, if any, by Colorado with the Republican River Compact or the FSS, including claims for contribution arising from claims brought against Nebraska by Kansas, and nothing herein shall be deemed to constitute a waiver of any such claims by Nebraska.

8. This Stipulation shall be and remain confidential and neither State shall release this Stipulation, or any part thereof, unless and until compelled by an Order of a court of competent jurisdiction or by agreement of the States.

9. This Stipulation shall be executed as two identical original documents, with each State retaining one original document.

STATE OF COLORADO

By: Dick Wolfe
Dick Wolfe

Date: 4/29/10

By: Peter J. Ampe

Date: 4/29/10

STATE OF NEBRASKA

By: Brian P. Dunnigan
Brian P. Dunnigan

Date: 05/03/2010

By: Justin D. Lavene

Date: 5-3-10

EXHIBIT A

RESOLUTION BY THE REPUBLICAN RIVER COMPACT ADMINISTRATION REGARDING APPROVAL OF COLORADO'S AUGMENTATION PLAN AND RELATED ACCOUNTING PROCEDURES SUBMITTED UNDER SUBSECTION III.B.1.k OF THE FINAL SETTLEMENT STIPULATION

August 12, 2009

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 the case of *Kansas v. Nebraska and Colorado*, No. 126 Original;

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

Whereas, the State of Colorado's Computed Beneficial Consumptive Use of the waters of the Republican River Basin exceeded Colorado's Compact Allocation using the five-year running average to determine Compact compliance from 2003 through 2007, as provided in Subsection IV.D of the FSS;

Whereas, the Republican River Water Conservation District is a water conservation district created by Colorado statute to assist the State of Colorado to comply with the Compact;

Whereas, the Republican River Water Conservation District, acting by and through its Water Activity Enterprise ("RRWCD WAE"), has contracted to acquire fifteen Compact Compliance Wells in the Republican River Basin in Colorado for the sole purpose of offsetting stream depletions in order to comply with the State of Colorado's Compact Allocations;

Whereas, the RRWCD WAE has contracted to purchase groundwater rights in the Republican River Basin within Colorado and proposes to pump the historical consumptive use of all or some of these water rights from the Compact Compliance Wells into a pipeline and deliver that water into the North Fork of the Republican River near the Colorado/Nebraska State Line to offset stream depletions in order to comply with Colorado's Compact Allocations ("Colorado Compact Compliance Pipeline");

Whereas, the States of Kansas, Nebraska, and Colorado adopted a Moratorium on New Wells in Subsection III.A of the FSS, with certain exceptions set forth in subsection III.B of the FSS;

Whereas, Subsection III.B.1.k of the FSS provides that the Moratorium shall not apply to 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;

Whereas, Subsection III.B.1.k of the FSS further provides that augmentation plans and related accounting procedures submitted under this Subsection III.B.1.k shall be approved by the Republican River Compact Administration ("RRCA") prior to implementation;

Whereas, Subsection I.F of the FSS also provides that: "The RRCA may modify the RRCA Accounting Procedures, or any portion thereof, in any manner consistent with the Compact and this Stipulation;" and

Whereas, the State of Colorado and the RRWCD WAE have submitted an augmentation plan and related accounting procedures to account for water delivered to the North Fork of the Republican River for the purpose of offsetting stream depletions in order to comply with Colorado's Compact Allocations.

Now, therefore, it is hereby resolved that the RRCA approves the augmentation plan and the related accounting procedures submitted by the State of Colorado and the RRWCD WAE under Subsection III.B.1.k of the FSS, subject to the terms and conditions set forth herein. The augmentation plan is described in the application submitted by the State of Colorado and the RRWCD WAE, which is attached hereto as Exhibit 1. The related accounting procedures are included in the revised RRCA Accounting Procedures and Reporting Requirements ("revised RRCA Accounting Procedures"), which are attached hereto as Exhibit 2. This approval of the augmentation plan and the related accounting procedures shall be subject to the following terms and conditions:

1. The average annual historical consumptive use of the groundwater rights that will be diverted at the Compact Compliance Wells shall be as determined by the Colorado Ground Water Commission pursuant to its rules and regulations, provided that the average annual historical consumptive use of the groundwater rights listed on Exhibit 3 shall not exceed the 1998-2007 average annual amounts shown on Exhibit 3. Annual diversions during any calendar year under the groundwater rights included in the augmentation plan shall be limited to the total average annual historical consumptive use of the rights, except as provided in paragraph 3 below.

2. Net depletions from the Colorado Compact Compliance Wells shall be computed by the RRCA Groundwater Model and included in Colorado's Computed Beneficial Consumptive Use of groundwater pursuant to paragraph III.D.1 of the revised RRCA Accounting Procedures. Groundwater pumping from the Compact Compliance Wells shall be measured by totalizing flow meters, and the measured groundwater pumping from such wells shall be included in the base "run" of the RRCA Groundwater Model in accordance with paragraph III.D.1 of the revised RRCA Accounting Procedures.

3. Diversions from any individual Compact Compliance Well shall be limited to no more than 2,500 acre feet per year. Banking of groundwater shall be permitted in accordance with the rules and regulations of the Colorado Ground Water Commission, subject to the limit on Augmentation Water Supply Credit in paragraph 4 below.

4. The Augmentation Water Supply Credit due to deliveries from the Colorado Compact Compliance Pipeline that will be applied against the Computed Beneficial Consumptive Use of water to offset stream depletions in order to comply with Colorado's Compact Allocations during any calendar year shall be limited as follows:

   Calculation of Projected Augmentation Water Supply Delivery to Determine the Limit on Augmentation Water Supply Credit

   Each year, using the procedures described below, Colorado will determine the Projected Augmentation Water Supply Delivery ("Projected Delivery") for the upcoming accounting year (the "subject accounting year") to estimate the volume of Augmentation Water Supply that will be delivered from the Colorado Compact Compliance Pipeline during the subject accounting year, with a minimum annual delivery of 4,000 acre-feet. The RRWCD WAE will begin deliveries from the Colorado Compact Compliance Pipeline during the subject accounting year based on the Projected Delivery, but actual deliveries will be adjusted during the course of the year based on hydrologic and climatic conditions and the need to offset stream depletions in order to comply with Colorado's Compact Allocations, subject to the limit on the Augmentation Water Supply Credit set forth below.

   The steps to determine the Projected Delivery and the limit on the Augmentation Water Supply Credit are as follows:

   A. Step 1. By March 31st of each year, Colorado will calculate Colorado's total Allocation and Colorado's Computed Beneficial Consumptive Use ("CBCU") for the previous accounting year using the procedures described in the revised RRCA Accounting Procedures, but using preliminary data where necessary.

   B. Step 2. Colorado will determine the Projected Delivery, which shall be the largest annual deficit or difference between Colorado's total annual Allocation and Colorado's CBCU during the 10 accounting years immediately preceding the subject accounting year; provided, however, that accounting years in which Colorado's total annual Allocation exceeds Colorado's CBCU shall not be used in determining the Projected Delivery.

   C. Step 3. The Colorado RRCA Member shall provide notice of the Projected Delivery determination to the Kansas and Nebraska RRCA Members by April 1 of each year.

D. Step 4. The Augmentation Water Supply Credit for the subject accounting year shall be limited to the Projected Delivery plus 4,000 acre-feet, or 140% of the Projected Delivery, whichever is greater.

Examples of how this limitation shall be applied are attached as Exhibit 4.

5. The preliminary design for the Colorado Compact Compliance Pipeline is described in the application attached hereto as Exhibit 1. The State of Colorado and the RRWCD WAE shall submit the final design for the Colorado Compact Compliance Pipeline to the RRCA and any changes to the final design after the Colorado Compliance Pipeline has been constructed. If the final design or changes to the final design of the Colorado Compliance Pipeline as constructed differ from the preliminary design in a way that would materially change the location of the Compact Compliance Wells or the river outlet structure, the RRCA may modify the terms and conditions of this approval.

6. The RRWCD WAE may acquire additional groundwater rights to be pumped through the Compact Compliance Wells upon the terms and conditions of this resolution. The State of Colorado and the RRWCD WAE shall file a notice with the RRCA identifying the additional groundwater rights and the historical consumptive use of the groundwater rights. The RRCA members shall have sixty days from the date the notice is given to review the information. If no objection is made within sixty days from the date the notice is given, the additional groundwater rights may be pumped through the Compact Compliance Wells upon the terms and conditions of this resolution. If an objection is made by any RRCA member, the objection shall be shall be given in writing to the RRWCD WAE within 60 days from the date the notice is given and the notice shall be treated as an application for approval of an augmentation plan and related accounting procedures under Subsection III.B.1.k of the FSS and the State of Colorado and the RRWCD WAE may submit any additional information to address the objection.

7. The approval of this augmentation plan and the related accounting procedures shall not govern the approval of any future proposed augmentation plan and related accounting procedures submitted by any other State under Subsection III.B.1.k of the FSS.

8. The approval of this augmentation plan and the related accounting procedures shall not waive any State's rights to seek damages from any other State for violations of the Compact or the FSS subsequent to December 15, 2002.

9. Except for the approval of the augmentation plan and the related accounting procedures as provided herein, nothing in this Resolution shall relieve the State of Colorado from complying with the obligations set forth in the Compact or FSS.

Approved by the RRCA this 12th day of August, 2009.

Brian Dunnigan, P.E. Nebraska Member Chairman, RRCA	date
David Barfield, P.E. Kansas Member	date
Dick Wolfe, P.E. Colorado Member	date

EXHIBIT B

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF WATER RESOURCES

Bill Ritter, Jr.
Governor

Harris D. Sherman
Executive Director

Dick Wolfe, P.E.
Director/State Engineer

August 21, 2009

Mr. Brian Dunnigan, Director
Nebraska Commissioner, Republican River Compact Administration
Nebraska Department of Natural Resources
301 Centennial Mall South, 4th floor
P.O. Box 94676
Lincoln, Nebraska 68509-4676

Mr. David Barfield, P.E.
Kansas Commissioner, Republican River Compact Administration
Kansas Chief Engineer
Kansas Department of Agriculture
109 S.W. 9th Street
Topeka, KS 66612-1280

SUBJECT: Notice of Invocation of Non-Binding Arbitration

Dear Commissioners Dunnigan and Barfield:

Pursuant to Subsections VII.A.7, VII.B.1, and VII.C of the Final Settlement Stipulation, *Kansas v. Nebraska and Colorado*, No. 126 Original (December 15, 2002) ("FSS"), I, on behalf of the State of Colorado, hereby invoke "fast-track" non-binding arbitration regarding the dispute over the State of Colorado's proposal to offset stream depletions by introducing groundwater pumped from wells directly to the North Fork of the Republican River, including the augmentation plan and related accounting procedures submitted by the State of Colorado and the Republican River Water Conservation District, acting by and through its Water Activity Enterprise, under Subsection III.B.1.k of the FSS ("the issue").

An application for approval of a plan for augmentation and related accounting procedures for the Colorado Compact Compliance Pipeline was initially presented to the Republican River Compact Administration ("RRCA") at a March 11-12, 2008 Special Meeting. As you recall, I, as the Colorado Member of the RRCA, first raised this as a "fast-track" issue pursuant to Subsection VII.A.3 of the FSS by submitting the issue to the RRCA on April 11, 2008. The States agreed to extend the presumptive "fast-track" dispute resolution schedule to allow the States to seek a negotiated resolution of the issue. Since April 2008 the three States have engaged in substantial negotiations regarding this issue. Colorado then requested a vote by the RRCA on a resolution submitted by Colorado on this issue at the April 28, 2009 Special RRCA Meeting. The resolution submitted by Colorado was not approved at that time, but all States agreed to continue discussions regarding

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1313 Sherman Street, Suite 818 • Denver, CO 80203 • Phone: 303-866-3581 • Fax: 303-866-3589
www.water.state.co.us

DIVISION OF WATER RESOURCES

this issue and to continue extending the presumptive "fast-track" dispute resolution schedule. By letter dated July 23, 2009, I requested that this issue be added to the agenda for the August 12, 2009 Annual Meeting, and prior to the Annual Meeting Colorado submitted a revised resolution and exhibits to approve the augmentation plan and related accounting procedures for the Colorado Compact Compliance Pipeline. At that Annual Meeting, Colorado's proposed resolution was voted on by the RRCA, with the Colorado Member voting in favor of the proposal and the Kansas and Nebraska Members voting against the proposal. Thus, this matter has been Submitted to the RRCA and Addressed by the RRCA.

As required by Subsection VII.B.1, a timeframe designation is attached to this Notice as Exhibit 1 and a written description of the scope of the dispute in the form of Colorado's rejected Resolution and exhibits is attached as Exhibit 2.

Although Colorado is invoking the non-binding arbitration provisions of the FSS at this time, I will continue to work with both of you and your staffs to attempt to reach a mutually acceptable resolution of this issue that will satisfy the rights of all three States.

Sincerely,

Dick Wolfe

Dick Wolfe, P.E.
Colorado Republican River Compact Commissioner
Director/State Engineer

Attachments

cc: James J. Dubois, United States Department of Justice
John W. Suthers, Attorney General, State of Colorado
Peter J. Ampe, First Assistant Attorney General
David W. Robbins, Hill & Robbins, P.C.
Dennis Coryell, President, Republican River Water Conservation District

EXHIBIT C

STATE OF NEBRASKA
Office of the Attorney General
2115 STATE CAPITOL BUILDING
LINCOLN, NE 68509-8920
(402) 471-2682
TDD (402) 471-2682
CAPITOL FAX (402) 471-3297
TIERONE FAX (402) 471-4725

JON BRUNING
ATTORNEY GENERAL

JUSTIN D. LAVENE
SPECIAL COUNSEL TO THE
ATTORNEY GENERAL

September 4, 2009

Via Electronic Mail and United States Mail

Peter J. Ampe
First Assistant Attorney General
Federal and Interstate Water Unit
Natural Resources and Environmental Section
1525 Sherman Street, 5th Floor
Denver, CO 80203

John B. Draper
Special Assistant Attorney General
Montgomery & Andrews, P.A.
P.O. Box 2307
Santa Fe, NM 87504-2307

RE: Scope of Issues for Non-Binding Arbitration

Dear Mr. Ampe and Mr. Draper:

On August 21, 2009, the State of Colorado sent its Notice of Invocation of Non-Binding Arbitration ("Notice") to the States of Kansas and Nebraska. The Notice included the Time Frame Designation as Exhibit A. The Time Frame Designation specified September 4, 2009 as the "last date for states to amend the scope of the dispute to address additional issues." At this point in time, Nebraska does not intend to "add additional" issues to Colorado's Non-Binding Arbitration.

However, in order to make Nebraska's position clear with respect to the scope of this arbitration, Nebraska will address, as part of Colorado's Augmentation Plan, the concerns specified in the letter submitted to Colorado and Kansas on April 10, 2009. This letter is attached and fully incorporated herein as Exhibit A. In addition to the concerns specified in Exhibit A, Nebraska will also address the following:

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(1) Whether the Compact allows a state to augment a water supply in one sub-basin to make up for Compact overconsumption in another sub-basin without the consent of the downstream state(s),

(2) Whether Colorado's Augmentation Plan will protect Nebraska's entitlement to flows in the Haigler Canal/Pioneer Ditch,

(3) Whether Colorado's Augmentation Plan is sustainable or will preclude Colorado from achieving compliance in the long term, and

(4) Whether Colorado's Augmentation Plan will harm downstream states in light of the accounting issues Nebraska arbitrated in March 2009.

In addition to the issues raised above, Nebraska may raise further factual and legal issues that are responsive to Colorado's claims. Although Nebraska does not believe disclosure of these issues at this time is required pursuant to Final Settlement Stipulation, this disclosure is being offered to bring greater focus and clarity to Colorado's Non-Binding Arbitration.

As indicated by Commissioner Wolfe in his notice, Nebraska will also work with both of you and your staffs in an attempt to reach a mutually acceptable resolution to these issues as this arbitration moves forward.

Sincerely,

Justin D. Lavene
Special Counsel to the Attorney General

EXHIBIT D

STATE OF NEBRASKA

Dave Heineman
Governor

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

June 15, 2009

IN REPLY TO:

Sent Via Mail and E-Mail

David Barfield
Kansas Commissioner
Republican River Compact Administration
Kansas State Engineer
Division of Water Resources
109 SW 9th St., 2nd Floor
Topeka, KS 66612-1283

Dick Wolfe
Colorado Commissioner
Republican River Compact Commission
Colorado State Engineer
Colorado Division of Water Resources
1313 Sherman St., Room 818
Denver, CO 80203

RE: Submission of Dispute to the Republican River Compact Administration Pursuant to Section VII of the Final Settlement Stipulation

Dear Commissioners Barfield and Wolfe:

In the course of the current Republican River Arbitration, an issue has arisen which Nebraska seeks to resolve pursuant to the "Fast Track" provisions of the Final Settlement Stipulation (FSS). The issue concerns an adjustment Nebraska submits must be made to Compact accounting to properly acknowledge damages paid for past Compact violations. Nebraska attempted to address this issue in the context of the current Arbitration; however, in his January 22, 2009 Final Decision on Legal Issues, the Arbitrator concluded that the issue (identified colloquially as the "Crediting Issue") had not been submitted to the Republican River Compact Administration (RRCA) for resolution. While Nebraska maintains the Crediting Issue was properly before the Arbitrator, Nebraska hereby submits the Crediting Issue to the RRCA to ensure its speedy resolution.

Limited Applicability of the Crediting Issue

As she has made clear during recent communications, Nebraska has implemented concrete measures to remain in Compact compliance in the future. Moreover, based on the States'

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April 15, 2009 information exchange, preliminary data indicate Nebraska will be in Compact compliance for the 2004-2008 compliance period regardless of whether any credit is applied in that period. Therefore, insofar as Nebraska is concerned,[1] application of the Crediting Issue is limited to the following compliance periods:

- 2005 – 2006 Two-year average above Guide Rock;
- 2006 – 2007 Two-year average above Guide Rock; and
- 2003 – 2007 Five-year average for the Republican River Basin.

The Concept Defined

As you know, Compact compliance is determined based on averaging of multi-year annual determinations of Computed Beneficial Consumptive Use (CBCU.) Under Water Short Year Administration, annual CBCU determinations are averaged over a two-year period, while under Normal Year Administration, annual CBCU determinations are averaged over a five-year period. Running averages are employed in both cases.

Nebraska submits that when a State is found to be in violation of the Compact and pays damages based on that violation, that State should receive a credit in the Compact accounting to reflect the payment made. Specifically, the Compact accounting should be adjusted by reducing the annual CBCU calculation for the year in which payment is made by that amount of water of which the downstream state was deprived according to the official RRCA accounting spreadsheets.

The Concept as Applied to a Hypothetical Water Use Scenario

Thus, for example, if Nebraska were made to pay damages to Kansas for a shortage under 2005-2006 Water Short Year administration, the 2006 annual CBCU should be reduced on a prospective basis by the volume of water on which the damage payment was based. Table 1 illustrates the importance of providing a credit in this manner. Table 1 assumes, for illustrative purposes only, that in 2006 (a Water Short Year Administration year) Nebraska's average overuse for the 2005-2006 accounting period was 37,490 acre feet [(44,234 + 30,745) ÷ 2]. Damages theoretically could be awarded on this amount.[2] Assuming a full credit were provided

[1] Whatever rule is established in this process presumably will apply equally to the State of Colorado for any damage payments associated with any Colorado overuse.

[2] Nebraska does not concede that damages should be awarded on this amount and does not by this example waive any defense to the payment of damages in the current Arbitration or any other proceeding. Nor does Nebraska waive any argument it may make concerning the need to institute changes to the accounting on which this example is based.

Mr. David Barfield
Mr. Dick Wolfe
June 15, 2009
Page 3

for payment of an award based on that violation, the annual 2006 determination would be a positive 6,745 acre feet [37,490 – 30,745].

Proposed Compliance and Damages Flow Chart

Nebraska Dept. Natural Resources

Year	Allocation - (CBCU - IWS above Guide Rock) Two year Average 2005 - 2006	2-Year Average (Payoff to KS)	Allocation - (CBCU - IWS Credit) two year compliance test 2006 - 2007 with 2006 modified due to water short year payoff for to Kansas	Two year running average with 2006 payoff to Kansas
2003				
2004				
2005	(44,234)			
2006	(30,745)	(37,490)	6,745	
2007	17,142		17,142	11,943
2008				
2009				
2010				

Year	Allocation - (CBCU - IWS Credit) Five year compliance test 2003 - 2007	Payoff to Kansas in 2006	Allocation - (CBCU - IWS Credit) Five year compliance test 2003 - 2007 with 2006 modified due to water short year payoff for to Kansas	5-Year Average and our payoff to Kansas in 2007	Allocation - (CBCU - IWS Credit) revised due to water short year payoff for to Kansas	Allocation - (CBCU - IWS Credit) Five year compliance test 2004 - 2008 with water short year payoff for 2006 to Kansas
2003	(25,418)		(25,418)		(25,418)	
2004	(36,634)		(36,634)		(36,634)	(36,634)
2005	(42,324)		(42,324)		(42,324)	(42,324)
2006	(31,512)	(37,490)	5,978		5,978	5,978
2007	30,683		30,683	(13,543)		
2008						
2009						
2010						

Note: 2006 Numbers are adjusted for a 37,490 AF damage payoff to Kansas

All values are from estimates made using the RRCA Accounting Procedures, version July 27, 2005

Table 1: Proposed Compliance and Damages Flow Chart—illustrative example taken from Nebraska's Opening Brief Re: Issue III.A.2 As Identified In Exhibit 4 Of The Arbitration Agreement (Nov. 10, 2008).

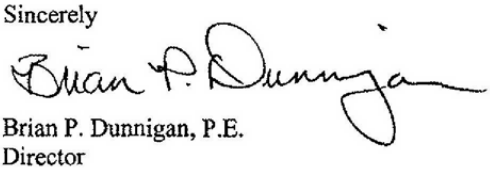
The importance of accounting for Nebraska's payment is further illustrated by calculating the two-year running average for the 2006-2007 accounting period, first with, and then without, the credit just discussed. If the credit were provided, the two-year running average for the 2006-2007 accounting period would show Nebraska remained well within her allocation, with a positive 11,943 acre feet [2006 annual determination of 6,745 plus the 2007 annual determination of 17,142 ÷ 2]. If the credit were not provided, however, the two year running average for 2006-2007 would show Nebraska still in violation (negative 6,802 acre feet). Thus, Nebraska could be required to pay both in 2006 *and* in 2007 for violations arising from overuse occurring in 2006 [2006 annual determination of negative 37,490 plus the 2007 annual determination of 17,142 ÷ 2]. This means Kansas would receive an unreasonable double recovery for the same violation that occurred in 2006.

As further shown in Table 1, providing a credit ensures a state to whom an award is made does not double recover when the Basin transitions from Water Short Year Administration accounting to Normal Year Administration accounting. Carrying the earlier analysis forward (tan columns), if a credit were provided, the 2006 annual determination under Normal Year Administration would be positive 5,978 acre feet, and the five-year running average for the 2003-2007

accounting period would show a deficit of just 13,543 acre feet.[3] If no credit were provided, the 2006 annual determination under Normal Year Administration would be negative 31,512 acre feet, and the five-year running average would show a deficit of 21,041 acre feet.[4]

Given the Crediting Issue's impact on Compact accounting, we believe you will agree that its immediate resolution is warranted. As counsel for the State of Kansas indicated at the December 10, 2008 Hearing on Legal Issues, we might not even have a dispute about the Crediting Issue. Nebraska hopes this is the case, and stands ready to resolve it with the RRCA's cooperation.

Sincerely



Brian P. Dunnigan, P.E.
Director

[3] [2003 annual determination of negative 25,418 + 2004 annual determination of negative 36,634 acre feet + 2005 annual determination of negative 42,324 + 2006 annual determination of positive 5,978 + 2007 annual determination of positive 30,683 ÷ 5]

[4] [2003 annual determination of negative 25,418 plus the 2004 annual determination of negative 36,634 acre feet plus 2005 annual determination of negative 42,324 plus the 2006 annual determination of negative 31,512 plus the 2007 annual determination of positive 30,683 divided by 5]

Attachment 1

Designated Schedule for Resolution

CREDITING ISSUE

Republican River Compact Administration
April 2, 2009

June 15, 2009	Nebraska submits Crediting Issue proposal to RRCA.
July 15, 2009	By this date, the RRCA meets to resolve the dispute.
August 15, 2009	If the RRCA fails to resolve the dispute, Nebraska invokes nonbinding arbitration.
December 31, 2009	Completion of Arbitration and decision rendered.
Thereafter	If the dispute is not resolved, Nebraska considers appropriate filings in the U.S. Supreme Court.

EXHIBIT E

RESOLUTION OF THE REPUBLICAN RIVER COMPACT ADMINISTRATION

NEBRASKA'S CREDITING ISSUE

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 15, 2009, the State of Nebraska identified a concern regarding the appropriate mechanism by which to recognize in the annual accounting a payment for damages based on a past failure to comply with the Compact;

Whereas, the States agree that Nebraska's proposed resolution of the "Crediting Issue" is acceptable and that the Republican River Compact Administration should adopt Nebraska's proposal; and

Whereas, the Crediting Issue has been properly presented and Submitted to the Republican River Compact Administration the Crediting Issue Pursuant to Section VII of the FSS.

Now, therefore, it is hereby resolved that the Republican River Compact Administration approves and adopts the proposal set forth in Nebraska's June 15, 2009 letter, a copy of which is attached hereto as Exhibit A and incorporated as if the same were set forth fully herein.

Approved by the Republican River Compact Administration this 12th day of August, 2009.

Brian Dunnigan, P.E. Nebraska Member Chairman	Date
David Barfield, P.E. Kansas Member	Date
Dick Wolfe, P.E. Colorado Member	Date

EXHIBIT F

STATE OF NEBRASKA

Dave Heineman
Governor

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

August 28, 2009

IN REPLY TO:

Sent via e-mail and mail

Mr. Dick Wolfe, P.E.
Colorado Commissioner, RRCA
Office of the State Engineer
1313 Sherman Street, Suite 818
Denver, CO 80203

Mr. David Barfield, P.E.
Kansas Commissioner, RRCA
Kansas Chief Engineer
Kansas Department of Agriculture
109 S.W. 9th Street
Topeka, KS 66612-1280

RE: Notice of Invocation of Non-Binding Arbitration

Dear Commissioners Wolfe and Barfield:

Pursuant to Subsections VII.A.7, VII.B.1, and VII.C of the Final Settlement Stipulation, *Kansas v. Nebraska and Colorado*, No. 126 Original (December 15, 2002) ("FSS"), the State of Nebraska, hereby invokes "fast-track" non-binding arbitration regarding the dispute over Nebraska's Crediting Issue as set forth in my letters to you dated June 15, 2009 and July 29, 2009, copies of which are attached hereto as Exhibit A.

The Crediting Issue arose during the course of the recently concluded Republican River Arbitration before Arbitrator Karl Dreher. In his January 22, 2009 Final Decision on Legal Issues, the Arbitrator concluded the Crediting Issue had not been properly presented to the RRCA.[1] Accordingly, Nebraska formally submitted the Crediting Issue to the RRCA on June 15, 2009, affirming its intent to pursue the Crediting Issue by letter dated July 29, 2009. Since that time, the states have attempted to resolve the Crediting Issue, but have not agreed on its resolution.

In its July 29, 2009 letter, Nebraska requested the Crediting Issue be addressed during the August 11, 2009 Working Session and be resolved during the August 12, 2009 RRCA Annual Meeting. At that Annual Meeting, Nebraska's proposed Resolution on the Crediting Issue, a

[1] Nebraska does not concede this point and does not waive its right to address the Crediting Issue in other contexts.

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copy of which is attached hereto as Exhibit B, was voted down by the RRCA. Thus, this matter has been Submitted to the RRCA and Addressed by the RRCA.

As required by Subsection VII.B.1 of the FSS, the scope of the dispute is described collectively in Exhibits A and B, and a timeframe designation is attached hereto as Exhibit C.

Sincerely,

Brian P. Dunnigan

Brian P. Dunnigan, P.E.
Nebraska Republican River Compact Commissioner
Director Nebraska Department of Natural Resources

cc: James J. Dubois, United States Department of Justice

Exhibit A

Crediting Issue Letters

STATE OF NEBRASKA

Dave Heineman
Governor

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

June 15, 2009

IN REPLY TO:

Sent Via Mail and E-Mail

David Barfield
Kansas Commissioner
Republican River Compact Administration
Kansas State Engineer
Division of Water Resources
109 SW 9th St., 2nd Floor
Topeka, KS 66612-1283

Dick Wolfe
Colorado Commissioner
Republican River Compact Commission
Colorado State Engineer
Colorado Division of Water Resources
1313 Sherman St., Room 818
Denver, CO 80203

RE: Submission of Dispute to the Republican River Compact Administration Pursuant to Section VII of the Final Settlement Stipulation

Dear Commissioners Barfield and Wolfe:

In the course of the current Republican River Arbitration, an issue has arisen which Nebraska seeks to resolve pursuant to the "Fast Track" provisions of the Final Settlement Stipulation (FSS). The issue concerns an adjustment Nebraska submits must be made to Compact accounting to properly acknowledge damages paid for past Compact violations. Nebraska attempted to address this issue in the context of the current Arbitration; however, in his January 22, 2009 Final Decision on Legal Issues, the Arbitrator concluded that the issue (identified colloquially as the "Crediting Issue") had not been submitted to the Republican River Compact Administration (RRCA) for resolution. While Nebraska maintains the Crediting Issue was properly before the Arbitrator, Nebraska hereby submits the Crediting Issue to the RRCA to ensure its speedy resolution.

Limited Applicability of the Crediting Issue

As she has made clear during recent communications, Nebraska has implemented concrete measures to remain in Compact compliance in the future. Moreover, based on the States'

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April 15, 2009 information exchange, preliminary data indicate Nebraska will be in Compact compliance for the 2004-2008 compliance period regardless of whether any credit is applied in that period. Therefore, insofar as Nebraska is concerned,[1] application of the Crediting Issue is limited to the following compliance periods:

- 2005 – 2006 Two-year average above Guide Rock;
- 2006 – 2007 Two-year average above Guide Rock; and
- 2003 – 2007 Five-year average for the Republican River Basin.

The Concept Defined

As you know, Compact compliance is determined based on averaging of multi-year annual determinations of Computed Beneficial Consumptive Use (CBCU.) Under Water Short Year Administration, annual CBCU determinations are averaged over a two-year period, while under Normal Year Administration, annual CBCU determinations are averaged over a five-year period. Running averages are employed in both cases.

Nebraska submits that when a State is found to be in violation of the Compact and pays damages based on that violation, that State should receive a credit in the Compact accounting to reflect the payment made. Specifically, the Compact accounting should be adjusted by reducing the annual CBCU calculation for the year in which payment is made by that amount of water of which the downstream state was deprived according to the official RRCA accounting spreadsheets.

The Concept as Applied to a Hypothetical Water Use Scenario

Thus, for example, if Nebraska were made to pay damages to Kansas for a shortage under 2005-2006 Water Short Year administration, the 2006 annual CBCU should be reduced on a prospective basis by the volume of water on which the damage payment was based. Table 1 illustrates the importance of providing a credit in this manner. Table 1 assumes, for illustrative purposes only, that in 2006 (a Water Short Year Administration year) Nebraska's average overuse for the 2005-2006 accounting period was 37,490 acre feet [(44,234 + 30,745) ÷ 2]. Damages theoretically could be awarded on this amount.[2] Assuming a full credit were provided

[1] Whatever rule is established in this process presumably will apply equally to the State of Colorado for any damage payments associated with any Colorado overuse.

[2] Nebraska does not concede that damages should be awarded on this amount and does not by this example waive any defense to the payment of damages in the current Arbitration or any other proceeding. Nor does Nebraska waive any argument it may make concerning the need to institute changes to the accounting on which this example is based.

Mr. David Barfield
Mr. Dick Wolfe
June 15, 2009
Page 3

for payment of an award based on that violation, the annual 2006 determination would be a positive 6,745 acre feet [37,490 – 30,745].

Proposed Compliance and Damages Flow Chart
Nebraska Dept. Natural Resources

Year	Allocation - (CBCU - IWS above Guide Rock) Two year Average 2005 - 2006	2-Year Average (Payoff to KS)	Allocation - (CBCU - IWS Credit) two year compliance test 2006 - 2007 with 2006 modified due to water short year payoff for to Kansas	Two year running average with 2006 payoff to Kansas	Allocation - (CBCU - IWS Credit) Five year compliance test 2003 - 2007	Payoff to Kansas in 2006	Allocation - (CBCU - IWS Credit) Five year compliance test 2003 - 2007 with 2006 modified due to water short year payoff for to Kansas	5-Year Average and our payoff to Kansas in 2007	Allocation - (CBCU - IWS Credit) revised due to water short year payoff for to Kansas	Allocation - (CBCU - IWS Credit) Five year compliance test 2004 - 2008 with water short year payoff for 2006 to Kansas
2003					(25,418)		(25,418)		(25,418)	
2004					(36,634)		(36,634)		(36,634)	(36,634)
2005	(44,234)				(42,324)		(42,324)		(42,324)	(42,324)
2006	(30,745)	(37,490)	6,745		(31,512)	(37,490)	5,978		5,978	5,978
2007	17,142		17,142	11,943	30,683		30,683	(13,543)	44,226	44,226
2008										28,734
2009										
2010										

Note: 2006 Numbers are adjusted for a 37,490 AF damage payoff to Kansas

Note: 2007 Numbers are adjusted for a 13,543 AF damage payoff to Kansas

Note: 2008 Estimated AF need for 2004 thru 2008 Compliance test

All values are from estimates made using the RRCA Accounting Procedures, version July 27, 2005

Table 1: Proposed Compliance and Damages Flow Chart—illustrative example taken from Nebraska's Opening Brief Re: Issue III.A.2 As Identified In Exhibit 4 Of The Arbitration Agreement (Nov. 10, 2008).

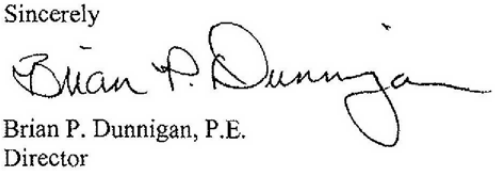
The importance of accounting for Nebraska's payment is further illustrated by calculating the two-year running average for the 2006-2007 accounting period, first with, and then without, the credit just discussed. If the credit were provided, the two-year running average for the 2006-2007 accounting period would show Nebraska remained well within her allocation, with a positive 11,943 acre feet [2006 annual determination of 6,745 plus the 2007 annual determination of 17,142 ÷ 2]. If the credit were not provided, however, the two year running average for 2006-2007 would show Nebraska still in violation (negative 6,802 acre feet). Thus, Nebraska could be required to pay both in 2006 *and* in 2007 for violations arising from overuse occurring in 2006 [2006 annual determination of negative 37,490 plus the 2007 annual determination of 17,142 ÷ 2]. This means Kansas would receive an unreasonable double recovery for the same violation that occurred in 2006.

As further shown in Table 1, providing a credit ensures a state to whom an award is made does not double recover when the Basin transitions from Water Short Year Administration accounting to Normal Year Administration accounting. Carrying the earlier analysis forward (tan columns), if a credit were provided, the 2006 annual determination under Normal Year Administration would be positive 5,978 acre feet, and the five-year running average for the 2003-2007

accounting period would show a deficit of just 13,543 acre feet.[3] If no credit were provided, the 2006 annual determination under Normal Year Administration would be negative 31,512 acre feet, and the five-year running average would show a deficit of 21,041 acre feet.[4]

Given the Crediting Issue's impact on Compact accounting, we believe you will agree that its immediate resolution is warranted. As counsel for the State of Kansas indicated at the December 10, 2008 Hearing on Legal Issues, we might not even have a dispute about the Crediting Issue. Nebraska hopes this is the case, and stands ready to resolve it with the RRCA's cooperation.

Sincerely



Brian P. Dunnigan, P.E.
Director

[3] [2003 annual determination of negative 25,418 + 2004 annual determination of negative 36,634 acre feet + 2005 annual determination of negative 42,324 + 2006 annual determination of positive 5,978 + 2007 annual determination of positive 30,683 ÷ 5]

[4] [2003 annual determination of negative 25,418 plus the 2004 annual determination of negative 36,634 acre feet plus 2005 annual determination of negative 42,324 plus the 2006 annual determination of negative 31,512 plus the 2007 annual determination of positive 30,683 divided by 5]

Attachment 1

Designated Schedule for Resolution

CREDITING ISSUE

Republican River Compact Administration
April 2, 2009

June 15, 2009	Nebraska submits Crediting Issue proposal to RRCA.
July 15, 2009	By this date, the RRCA meets to resolve the dispute.
August 15, 2009	If the RRCA fails to resolve the dispute, Nebraska invokes nonbinding arbitration.
December 31, 2009	Completion of Arbitration and decision rendered.
Thereafter	If the dispute is not resolved, Nebraska considers appropriate filings in the U.S. Supreme Court.

STATE OF NEBRASKA

Dave Heineman
Governor

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

July 29, 2009

IN REPLY TO:

Sent via Mail and E-mail

David Barfield
Kansas Commissioner
Republican River Compact Administration
Kansas State Engineer
Division of Water Resources
109 SW 9th St., 2d Floor
Topeka, KS 66612-1283

Dick Wolfe
Colorado Commissioner
Republican River Compact Commission
Colorado State Engineer
Colorado Division of Water Resources
1313 Sherman St., Rm. 818
Denver, CO 80203

RE: Dispute Submitted to the Republican River Compact Administration Pursuant to Section VII of the Final Settlement Stipulation; Modified Designated Schedule for Resolution of the Crediting Issue; Request for Meetings to Address and Resolve the Crediting Issue

Dear Commissioners Wolfe and Barfield:

In a letter dated June 15, 2009, Nebraska submitted the Crediting Issue to the Republican River Compact Administration (RRCA). The timeline that was included as Attachment 1 to Nebraska's June 15, 2009 letter assumed that the RRCA would be meeting on or prior to July 15 (by conference call) regarding Colorado's augmentation plan. Nebraska had planned to address the Crediting Issue with Kansas and Colorado at that time. As that meeting did not materialize, we now seek to schedule a meeting, as set forth below, to discuss and resolve the Crediting Issue.

In response to Commissioner Barfield's correspondence of July 1, 2009, Nebraska does intend to continue to pursue the Crediting Issue. As you will recall, Nebraska was foreclosed from fully presenting the Crediting Issue in the previous Arbitration based upon the Arbitrator's Preliminary Decision on Legal Issues of December 19, 2008, and the Arbitrator's Final Decision on Legal Issues of January 22, 2009 in which he determined Nebraska's Crediting Issue was not a proper subject for the Arbitration because the issue had not been directly and fully submitted to

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the RRCA for resolution. Nebraska has now directly and fully submitted the Crediting Issue to the RRCA for resolution.

Therefore, Nebraska amends its proposed timeline for resolution of the Crediting Issue as reflected on Attachment 1 hereto. Pursuant to FSS VIII.A.5, Nebraska requests discussion of the Crediting Issue at the Working Session of the Annual RRCA Meeting on August 11, 2009, and to have the RRCA meet and resolve the submitted Crediting Issue at the Annual Meeting on August 12, 2009.

If you have questions or suggestions regarding resolution of this disputed issue please call me at (402) 471-2366. I look forward to meeting with you at our annual meeting in Lincoln on August 12, 2009.

Sincerely,

Brian P. Dunnigan

Brian P. Dunnigan, P.E.
Director

Attachment 1

Designated Schedule for Resolution

CREDITING ISSUE

Republican River Compact Administration
Modified July 24, 2009

June 15, 2009	Nebraska submitted the Crediting Issue proposal to RRCA.
August 11, 2009	RRCA discusses crediting issue during Working Session.
August 12, 2009	RRCA meets to resolve the dispute during Annual Meeting.
September 1, 2009	If the RRCA fails to resolve the dispute, Nebraska invokes nonbinding arbitration.
December 15, 2009	Completion of Arbitration and decision rendered.

Exhibit B

RRCA Resolution Concerning the Crediting Issue

RESOLUTION OF THE REPUBLICAN RIVER COMPACT ADMINISTRATION

NEBRASKA'S CREDITING ISSUE

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 15, 2009, the State of Nebraska identified a concern regarding the appropriate mechanism by which to recognize in the annual accounting a payment for damages based on a past failure to comply with the Compact;

Whereas, the States agree that Nebraska's proposed resolution of the "Crediting Issue" is acceptable and that the Republican River Compact Administration should adopt Nebraska's proposal; and

Whereas, the Crediting Issue has been properly presented and Submitted to the Republican River Compact Administration the Crediting Issue Pursuant to Section VII of the FSS.

Now, therefore, it is hereby resolved that the Republican River Compact Administration approves and adopts the proposal set forth in Nebraska's June 15, 2009 letter, a copy of which is attached hereto as Exhibit A and incorporated as if the same were set forth fully herein.

Approved by the Republican River Compact Administration this 12th day of August, 2009.

Brian Dunnigan, P.E. Nebraska Member Chairman	Date
David Barfield, P.E. Kansas Member	Date
Dick Wolfe, P.E. Colorado Member	Date

Exhibit C

Time Frame Designation

Aug. 28, 2009. Nebraska provides written notice invoking non-binding arbitration pursuant to Subsection VII.B.1 of the FSS of dispute designated as a "fast-track" issue.

Sept. 11, 2009. Last date for States to amend the scope of the dispute to address additional issues.

Sept. 11, 2009. Last date for each State to submit the names of proposed arbitrator(s), including qualifications, to the other States.

Sept. 22, 2009. Last date for the States to meet and confer to agree an arbitrator or arbitrators.

Sept. 22, 2009. States have selected arbitrator(s), issued Joint Notice of Arbitration and/or Joint Arbitration Agreement.

Sept. 30, 2009. Initial meeting / teleconference with arbitrator(s) to set the schedule for submission and resolution of the dispute.

October 1, 2009. Commence Discovery.

Oct. 9, 2009. States shall identify legal issues suitable for resolution by briefing, if any.

Oct. 16, 2009. Submit briefs on all legal issues.

Oct. 30, 2009. Submit responsive briefs on legal issues.

Nov. 6, 2009. Submit reply briefs on legal issues.

Nov. 20, 2009. Arbitrator(s) issue decisions on legal issues.

Dec. 15, 2009. Deadline for disclosure of experts and submission of Expert Reports, including exhibits, by Nebraska (and any other State if the scope of the dispute is amended to address additional issues).

Dec. 15, 2009. Deadline for submission of Witness List by Nebraska (and any other State if the scope of the dispute is amended to address additional issues).

Jan 13, 2010. Deadline for disclosure of experts and submission of Expert Reports, including exhibits, by defending States.

Jan. 13, 2010. Deadline for submission of Witness List by defending States.

Jan. 27, 2010. Deadline for submission of Rebuttal Expert Report by Nebraska (and any other State if the scope of the dispute is amended to address additional issues).

Jan. 27, 2010. Deadline for submission of Rebuttal Witness List by Nebraska (and any other State if the scope of the dispute is amended to address additional issues).

Jan. 27, 2010. Deadline for submission of Trial Exhibit List.

Jan. 27, 2010. Close Discovery.

Feb. 8-10, 2010. Trial.

Feb. 19, 2010. Submit post-trial briefs.

March 8, 2010. Arbitrator(s) issue decision.

April 8, 2010. States give notice whether they will accept the decision.

EXHIBIT G

Republican River Compact Administration

ACCOUNTING PROCEDURES

AND

REPORTING REQUIREMENTS

Revised July 27, 2005

Updated November 7, 2008

Colorado Proposal
Updated January 26, 2009

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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: a detailed program used by a State to offset stream depletions in order to comply with its Compact Allocations. An Augmentation Plan shall be approved by the RRCA prior to implementation in accordance with Subsection III.B.1.k of the Stipulation;

Augmentation Water Supply: the water supply developed through the acquisition or construction of wells for the sole purpose of offsetting stream depletions in order to comply with a State's Compact Allocations in conformance with an Augmentation Plan;

Augmentation Water Supply Credit: the amount of water measured and discharged to the stream flow of a Designated Drainage Basin due to the acquisition or construction of wells for the purpose of offsetting stream depletions to comply with a States' Compact Allocation in conformance with an Augmentation Plan. The Augmentation Water Supply Credit of a State shall not be included in the Virgin Water Supply in the 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
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;

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 – AWS +ΔS – IWS
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:

AWS = Augmentation Water Supply Credit
CBCU = Computed Beneficial Consumptive Use
FF = Flood Flows
Gage = Gaged Flow
IWS = Imported 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 Augmentation Water Supply Credit shall be the quantity of water delivered to the stream flow of a Designated Drainage Basin and shall be measured and subtracted from the Gaged Flow of the Designated Drainage Basin to calculate the Annual Virgin Water Supply. The Augmentation Water Supply Credit of a State shall not be included in the Annual Virgin Water Supply and shall be counted as a credit/offset against the Computed Beneficial Consumptive Use of water

allocated to that State.

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[1] 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

[1] These actual stream flows reflect Gaged Flows after depletions by Beneficial Consumptive Use and change in reservoir storage above the gage.

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 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:

AWS = 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 [2]

CBCU Colorado	= 0.6 x Haigler Canal Diversion Colorado + 0.6 x Dc + % x Pc + 0.5 x M&Ic + EvNFRc + GWc
CBCU Kansas	= GWk
CBCU Nebraska	= 0.6 x Haigler Canal Diversion Nebraska + GWn Note: The diversion for Haigler Canal is split between Colorado and Nebraska based on the percentage of land irrigated in each state
VWS	= North Fork of the Republican River at the State Line, Stn. No. 06823000 + CBCUc + CBCUk + CBCUn + Nebraska Haigler Canal RF– IWS -AWS Note: The Nebraska Haigler Canal RF returns to the Main Stem
CWS	= VWS - FF
Allocation Colorado	= 0.224 x CWS
Allocation Nebraska	= 0.246 x CWS
Unallocated	= 0.53 x CWS

4. Arikaree River [2]

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 + % x Pn + 0.5 x M&In + EvNFRn + GWn
VWS	= Arikaree Gage at Haigler Stn. No. 06821500 + CBCUc + CBCUk + CBCUn – IWS

[2] 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.

CWS	= VWS - FF
Allocation Colorado	= 0.785 x CWS
Allocation Kansas	= 0.051 x CWS
Allocation Nebraska	= 0.168 x CWS
Unallocated	=-0.004 x CWS

5. Buffalo Creek

CBCU Colorado	= 0.6 x Dc + % x Pc + 0.5 x M&In + EvNFRc + GWc
CBCU Kansas	= GWk
CBCU Nebraska	= 0.6 x Dn + % x Pn + 0.5 x M&In + EvNFRn + GWn
VWS	= Buffalo Creek near Haigler Gage Stn. No. 06823500 + CBCUc + CBCUk + CBCUn – IWS
CWS	= VWS - FF
Allocation Nebraska	= 0.330 x CWS
Unallocated	= 0.670 x CWS

6. Rock Creek

CBCU Colorado	= GWc
CBCU Kansas	= GWk
CBCU Nebraska	= 0.6 x Dn + % x Pn + 0.5 x M&In + EvNFRn + GWn
VWS	= Rock Creek at Parks Gage Stn. No. 06824000 + CBCUc + CBCUk + CBCUn – IWS
CWS	= VWS - FF

Allocation Nebraska = 0.400 x CWS

Unallocated = 0.600 x CWS

7. South Fork Republican River

CBCU Colorado = 0.6 x Hale Ditch Diversion + 0.6 x Dc + % x Pc + 0.5 x M&Ic + EvNFRc + Bonny Reservoir Ev + GWc

CBCU Kansas = 0.6 x Dk + % x Pk + 0.5 x M&Ik + EvNFRk + GWk

CBCU Nebraska = 0.6 x Dn + % x Pn + 0.5 x M&In + EvNFRn + GWn

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

CWS = VWS - ΔS Bonny Reservoir - FF

Allocation Colorado = 0.444 x CWS

Allocation Kansas = 0.402 x CWS

Allocation Nebraska = 0.014 x CWS

Unallocated = 0.140 x CWS

8. Frenchman Creek in Nebraska

CBCU Colorado = GWc

CBCU Kansas = GWk

CBCU Nebraska = Culbertson Canal Diversions x (1-%BRF) + Culbertson Extension x (1-%BRF) + 0.6 x Champion Canal Diversion + 0.6 x Riverside Canal Diversion + 0.6 x Dn + % x Pn + 0.5 x M&In + EvNFRn + Enders Reservoir Ev + GWn

VWS = Frenchman Creek in Culbertson, Nebraska Gage Stn. No.

06835500 + CBCUc + CBCUk + CBCUn + 0.17 x Culbertson Diversion RF + Culbertson Extension RF + ΔS Enders Reservoir – IWS

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

CWS = VWS - ΔS Enders Reservoir – FF

Allocation Nebraska = 0.536 x CWS

Unallocated = 0.464 x CWS

9. Driftwood 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 + % x Pn + 0.5 x 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 x CWS

Allocation Nebraska = 0.164 x CWS

Unallocated = 0.767 x CWS

10. Red Willow Creek in Nebraska

CBCU Colorado = GWc

CBCU Kansas = GWk

CBCU Nebraska	= 0.1 x Red Willow Canal CBCU + 0.6 x Dn + % x Pn + 0.5 x M&In + EvNFRn + 0.1 x 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 xRed Willow Canal RF + ΔS 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

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 + CBCUc + 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 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

+ 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

- Nebraska Haigler 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 15th 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 of 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, water diversions, and consumptive use associated with each augmentation plan. The States will provide any 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									

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	Unallo-cated	% 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			

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 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 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				

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

Nebraska				
	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 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 and/or Augmentation 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							

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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 and/or Augmentation Water Supply Credit excluding Beaver Creek	Difference between Allocation and the Computed Beneficial Consumptive Use offset by Imported Water Supply Credit and/or Augmentation 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						

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

Nebraska								
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 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								

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

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 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)
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	Difference between Allocation And the Computed Beneficial Consumptive Use offset by Imported Water Supply Credit
	Col 1	Col 2	`Col 3	Col 4	Col 5	Col 6
Previous Year						Col 3 -(Col 4-Col 5)
Current Year						
Average						

Figure 1

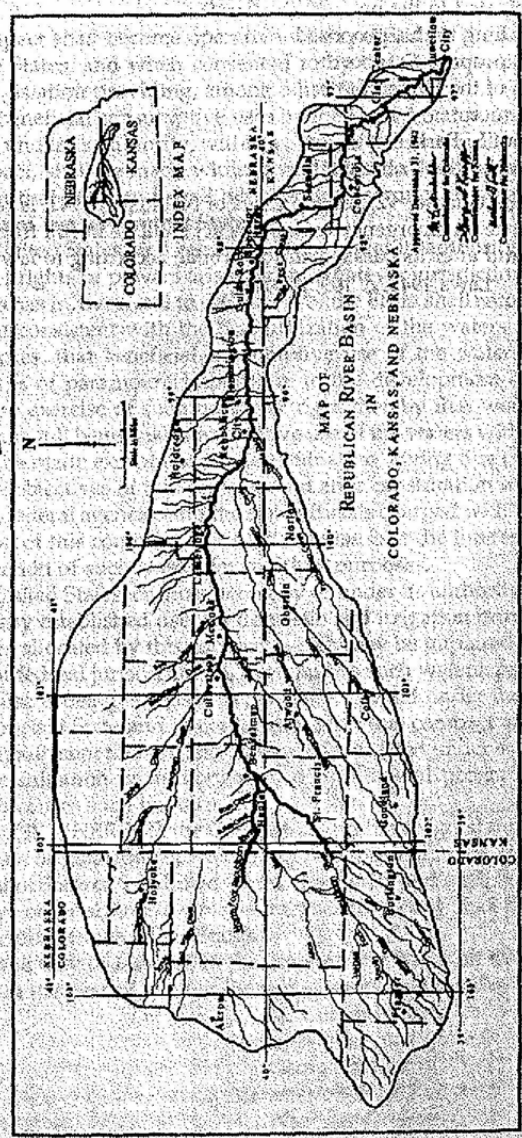
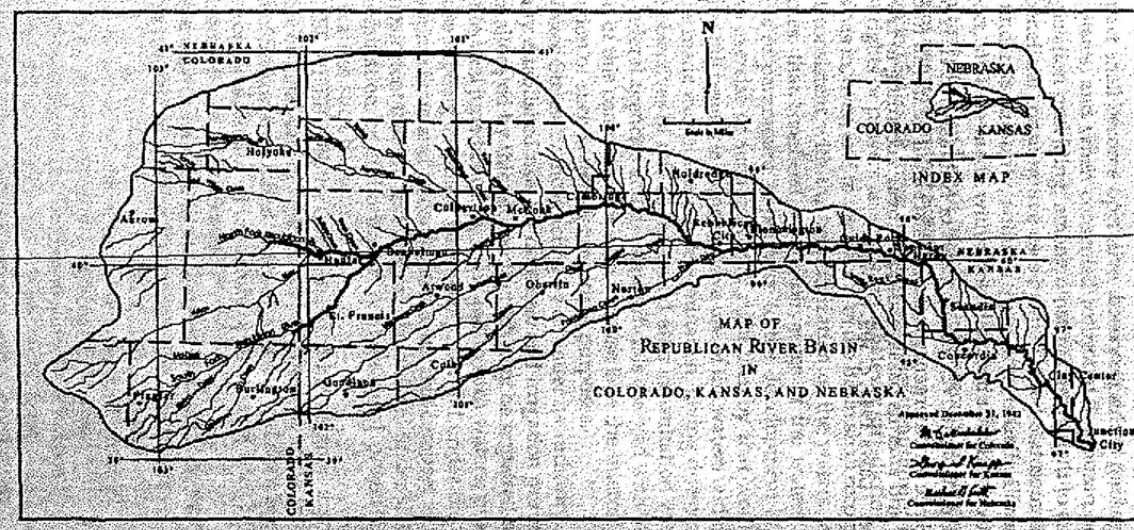

NEBRASKA
COLORADO
KANSAS
INDEX MAP
N
MAP OF
REPUBLICAN RIVER BASIN
IN
COLORADO, KANSAS, AND NEBRASKA
Junction City

Figure 1



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

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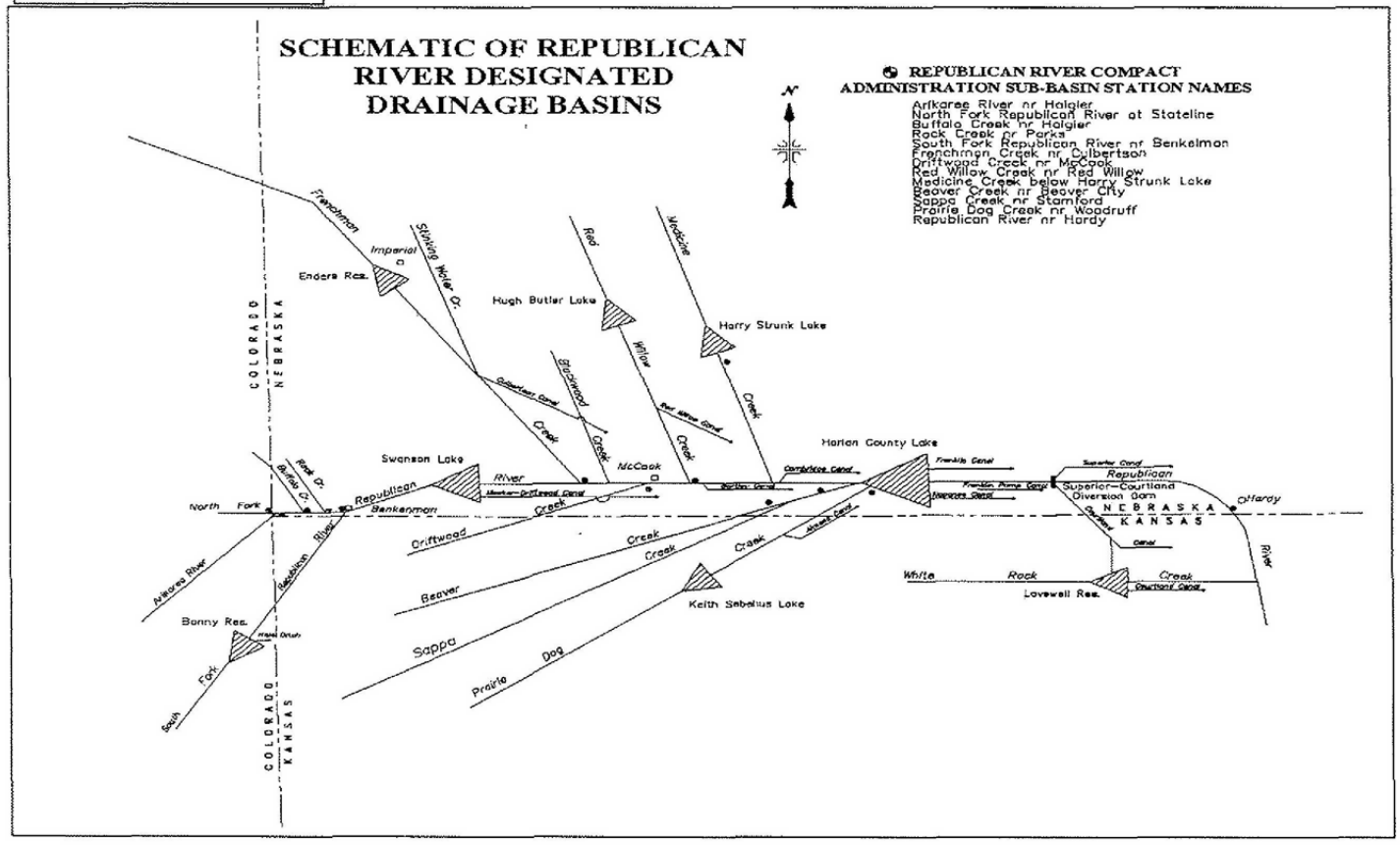
Figure 2



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

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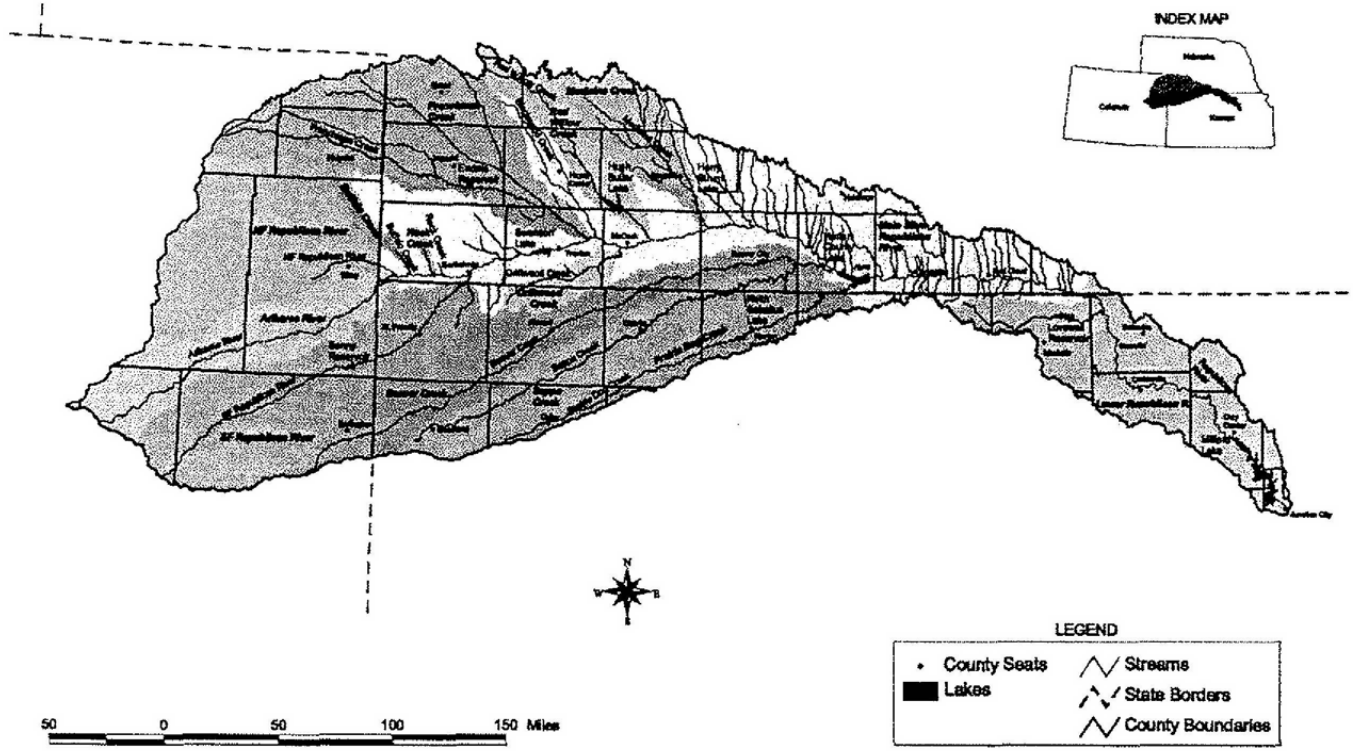
Update of Figure 3 - Map Showing Sub-basins, Streams, and the Basin Boundaries
RRCA Accounting Procedures and Reporting Requirements
January 12, 2005



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

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Attachment 1: Sub-basin Flood Flow Thresholds

Sub-basin	Sub-basin Flood Flow Threshold Acre-feet per Year[3]
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

[3] 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.

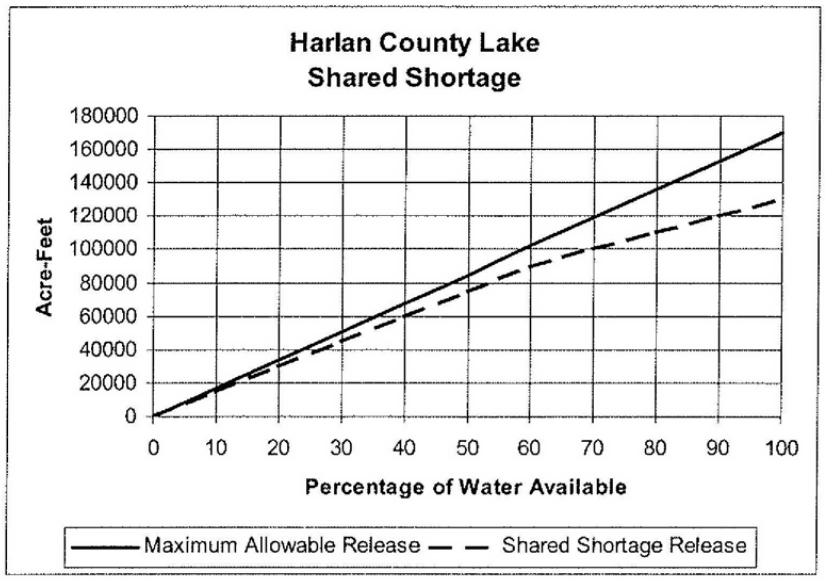
In addition, both agencies also recognized that the inflow to the project could continue to decrease with further upstream well development and water conservation farming. Due to these

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 then 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:

Storage + Summer Sediment Pool Evaporation + Inflow – Spring Evaporation=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 elevation1,927.0 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.

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

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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

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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

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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

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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

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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

Trigger Calculations Based on Harlan County Lake Irrigation Supply	Units-1000 Acre-feet		
		Irrigation Trigger	119.0
		Total Irrigation Supply	130.0
		Bottom Irrigation	164.1
		Evaporation Adjust	20.0

Assume that during irrigation release season
HCL Inflow = Evaporation Loss

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
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	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
(1931-93)													
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

Attachment 5: Projected Water Supply Spread Sheet Calculations

Year 2001-2002 Oct - Jun Trigger and Irrigation Supply Calculation									
Calculation Month	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
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

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Attachment 5: Projected Water Supply Spread Sheet Calculations

Year 2002 **Jul - Sep** **Final Trigger and** **Total Irrigation Supply** **Calculation**				
Calculation Month		**Jul**	**Aug**	**Sep**
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

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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

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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.

EXHIBIT H

Proposed Modification to the Republican River Compact Administration Accounting Procedures for Determining the Computed Beneficial Consumptive Use of Groundwater

Willem A. Schreüder
Principia Mathematica Inc.
March 1, 2010

Abstract

The Republican River Compact allocates the waters of the Republican River Basin for beneficial consumptive use in the States of Colorado, Kansas, and Nebraska. The Final Settlement Stipulation in *Kansas v. Nebraska and Colorado*, No. 126, Original, U.S. Supreme Court, provides that the States will determine Computed Beneficial Consumptive Use based on a methodology set forth in the Republican River Compact Administration (RRCA) Accounting Procedures. This report explains why the current methodology to determine the Computed Beneficial Consumptive Use of groundwater in the RRCA Accounting Procedures incorrectly includes the consumption of imported water. This report recommends a modification to the RRCA Accounting Procedures to exclude the consumption of imported water from the calculation Computed Beneficial Consumptive Use of groundwater.

Introduction

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 U.S. Supreme Court regarding the Republican River Compact, which was approved by the U.S. Supreme Court by its decree dated May 19, 2003. Subsection IV. C of the FSS provides that determination of stream flow depletions caused by well pumping and determination of Imported Water Supply Credit will be accomplished by the Republican River Compact Administration ("RRCA") Groundwater Model (the "Model") as used in the RRCA Accounting Procedures. The RRCA Accounting Procedures were attached to the FSS as Appendix C and were

subsequently adopted and revised by the RRCA.

Subsection I.F of the FSS states that the RRCA may modify the RRCA Accounting Procedures, or any portion thereof, in a manner consistent with the Compact and the FSS. Section VII of the FSS addresses resolution of disputes, and Subsection VII.A.1 provides that any matter relating to Republican River Compact administration shall first be submitted to the RRCA. Subsection VII.A.7 of the FSS provides for arbitration if a dispute cannot be resolved by the RRCA.

Section IV.A of the FSS states that 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. The capitalized terms are defined in Section II of the FSS.

Subsection IV.F of the FSS provides that "Beneficial Consumptive Use of Imported Water Supply shall not count as Computed Beneficial Consumptive Use or Virgin Water Supply." The intent to exclude imported water from the determination of Computed Beneficial Consumptive Use and Virgin Water Supply is confirmed by the definitions of Imported Water Supply and Imported Water Supply Credit in Section II of the FSS:

> *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 that State's Allocation, except as provided in Subsection V.B.2. of this Stipulation and Subsections III.I.-J. of the RRCA Accounting Procedures*[.]

The RRCA Accounting Procedures specify how the Computed Beneficial Consumptive Use of groundwater and the Imported Water Supply Credit will be calculated. Subsection III.D.1

of the RRCA Accounting Procedures states that the Computed Beneficial Consumptive Use of groundwater shall be determined as the difference between two runs of the Model -- the "base" run with all groundwater pumping, groundwater pumping recharge, and surface water recharge within the Model study boundary for the period 1940 to the current accounting year turned "on" and the "no State pumping" run with the same Model inputs as the "base" run with the exception that all groundwater pumping and pumping recharge shall be turned "off."

Subsection III.A.3 of the RRCA Accounting Procedures states that the amount of Imported Water Supply Credit shall be determined by the Model using two runs of the Model -- the same "base" run used to determine the Computed Beneficial Consumptive Use of groundwater and the "no NE import" run, which shall be run with the same Model inputs as the base run with the exception that surface water recharge associated with Nebraska's Imported Water Supply Credit shall be turned "off." Subsection III.A.3 of the RRCA Accounting Procedures states that the Imported Water Supply Credit shall be the difference in stream flows between these two Model runs.

In 2008, Nebraska initiated non-binding arbitration pursuant to Section VII.B of the FSS regarding proposed changes to the methodology in the RRCA Accounting Procedures to calculate the Virgin Water Supply, the Computed Beneficial Consumptive Use of groundwater, and the Imported Water Supply Credit. The States of Kansas and Colorado disagreed with the changes proposed by Nebraska, and I pointed out in my report that the method proposed by Nebraska to calculate the Computed Beneficial Consumptive Use of groundwater would include consumption of imported water, which is inconsistent with Subsection IV.F of the FSS because the beneficial consumptive use of imported water should not count as Computed Beneficial Consumptive Use or Virgin Water Supply. In his final decision, the Arbitrator, Karl F. Dreher, noted that the current RRCA Accounting Procedures for calculating Computed Beneficial Consumptive Use may also include consumption of imported water, since both the "base" run and the "no State pumping" run include surface water imports. He recommended that the RRCA consider reconvening the Technical Groundwater Modeling Committee to re-evaluate the existing procedures for determining Computed Beneficial Consumptive Use and the Imported Water Supply Credit.

This report explains why the methodology to calculate the Computed Beneficial Consumptive Use of groundwater in the current RRCA Accounting Procedures is inconsistent with Subsection IV.F of the FSS and proposes a modification to the RRCA Accounting Procedures to correct this deficiency.

The Current Methodology

The Model is used to determine streamflow depletions caused by well pumping and the amount of Imported Water Supply Credit, physical quantities that cannot be directly measured. The Model results are used to compute the amount of groundwater depletions to streamflow that is used in the Computed Beneficial Consumptive Use calculations. Computed Beneficial Consumptive Use is defined as the streamflow depletion within each State resulting from the activities of man. (*See* RRCA Accounting Procedures, Section II, definitions of Beneficial Consumptive Use and Computed Beneficial Consumptive Use.) Computed Beneficial Consumptive Use is not intended to, and should not, include consumption of water caused by anything other than the activities of man, such as evaporation from flowing streams or evapotranspiration from phreatophytes. In addition, Computed Beneficial Consumptive Use is not intended to, and should not, include consumption of water imported into the basin by the activities of man, since water imported into the basin is not part of the water supply of the basin allocated for consumptive use in the Compact.

The methodology to calculate the Computed Beneficial Consumptive Use of groundwater is set forth in Subsection III.D.1 of the RRCA Accounting Procedures:

> *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 stream flows 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 period 1940 to 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 [sic] 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

Subsection III.D.1 of the RRCA Accounting Procedures does not state whether Nebraska's Imported Water Supply should be included in either or both runs of the Model. Specifically, Subsection III.D.1 does not state whether surface water recharge associated with Nebraska's Imported Water Supply should be turned "on" or "off." This is addressed, however, in Subsection III.A.3 of the RRCA Accounting Procedures:

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 period 1940 to 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."* [Emphasis added.]

Subsection III.A.3.a and b thus make it clear that in the "base" run used to determine the the Imported Water Supply Credit and the Computed Beneficial Consumptive Use of groundwater, surface water recharge associated with Nebrasksa's Imported Water Supply is turned "on."

The Proposed Modification

The methodology prescribed by the RRCA Accounting Procedures for calculating the Computed Beneficial Consumptive Use of groundwater provides that surface water recharge associated with Nebraska's imports from outside the basin should be included (i.e., turned "on") in both the "base" run and the "no State pumping" run used to determine the Computed Beneficial Consumptive Use of groundwater.

The proposed modification to the methodology for calculating the Computed Beneficial Consumptive Use of groundwater is to exclude surface water recharge associated with Nebraska's imports from outside the basin (i.e., the surface water recharge associated with imported water would be turned "off") in the "base" run and the "no State pumping" run used to determine the Computed Beneficial Consumptive Use of groundwater. The effect of the proposed modification would be to determine streamflow depletions caused by well pumping in the absence of imported water. As shown below, the proposed modification is consistent with the requirement in Subsection IV.F of the FSS that the Beneficial Consumptive Use of Imported Water Supply should not count as Computed Beneficial Consumptive Use or Virgin Water Supply.

Comparison of the Current Methodology and the Proposed Modification

The current methodology to calculate the annual computed Computed Beneficial Consumptive Use of groundwater and the proposed modification differ only in one respect -- in the current methodology, when the Computed Beneficial Consumptive Use of groundwater is calculated for each State, the surface water recharge associated with Nebraska's Imported Water Supply is included in both runs, while in the proposed modification, when the Computed Beneficial Consumptive Use of groundwater is calculated for each State, the surface water recharge associated with Nebraska's Imported Water Supply would be turned "off" in both runs.

It might be expected that the current methodology and the proposed modification would yield the same result, since the calculation of the Computed Beneficial Consumptive Use of groundwater changes only one term – the groundwater pumping and associated pumping recharge for a State. However, this expectation is only realized if the system is truly linear. The groundwater-base flow system represented in the Model is not linear. As a result, the current procedure includes the consumption of some surface water recharge associated with Nebraska's Imported Water Supply in the calculation of the Computed Beneficial Consumptive Use of groundwater, which is inconsistent with Subsection IV.F of the FSS.

A linear system is a system where the outputs are directly proportional to the inputs. Therefore, for an input x that produces an output y, changing the input to $2x$ will produce an output of exactly $2y$. Groundwater flow systems are often approximately linear. Therefore, in many cases, a model that represents the groundwater flow system as linear is a good approximation of the system.

The groundwater flow system in the Republican River Basin behaves approximately like a linear system, but not exactly so. The Model therefore is approximately linear, but not exactly so. Because nonlinear features are included in the Model, inclusion of surface water recharge associated with Nebraska's Imported Water Supply in the "base" run and the "no State pumping" run to determine the Computed Beneficial Consumptive Use of groundwater

will include some consumption of imported water.

Nonlinearity in the Model results from three mechanisms: evapotranspiration, springs, and streams. Evapotranspiration in the Model is represented using a piecewise linear relationship between depth-to-water and the rate of evapotranspiration. Whenever the water levels calculated by the Model cross the extinction depth of phreatophytes or the ground surface, the Model behavior is nonlinear. For springs, the Model behavior is nonlinear when a spring dries out. Streams behave nonlinearly because the flow in the stream is used to calculate the stage in the stream using the inherently nonlinear Manning's equation. Other sources of nonlinearity in the stream calculations are that when streams go dry or the aquifer drops sufficiently that the connection with the stream is broken, there can be no change in stream leakage regardless of the aquifer head.

These nonlinear features are included in the Model because the interaction of the underlying groundwater system with evapotranspiration, phreatophytes, and streams is inherently nonlinear. The Model simply reflects these nonlinearities.

Since nonlinear features are included in the Model, the current methodology and proposed modification do not yield identical results.

Tables 1a through Table 1z show the Computed Beneficial Consumptive Use of groundwater for each State and the Imported Water Supply Credit computed using the current methodology and the proposed modification for each year from 1981 until 2006. Tables 2a, 2b, and 2c show the same values averaged for the periods 1981 to 2000, 2001 to 2006, and 1981 to 2006, respectively.

The Reason for Differences between the Current Methodology and the Proposed Modification

The average differences between the Computed Beneficial Consumptive Use of groundwater for each State calculated using the current methodology and the proposed modification for the period 2001 to 2006 are shown in Table 2b. The largest difference

observed is in the Computed Beneficial Consumptive Use of groundwater for Nebraska for the Swanson-Harlan reach, which is 33,604 acre-feet/year calculated using the current methodology and 19,726 acre-feet/year calculated using the proposed modification, a difference of 13,878 acre-feet/year. As will be shown, the difference is due to the consumption of imported water in the calculation of the Computed Beneficial Consumptive Use of groundwater using the current methodology.

The calculation of the Computed Beneficial Consumptive Use of groundwater for the Swanson-Harlan reach is complex. The baseflows for this reach are measured at a selected stream cell in the Model above Harlan County Lake. To determine the gain or loss for this reach, the baseflows from Frenchman Creek, Driftwood Creek, Medicine Creek, Red Willow Creek and Sappa Creek are subtracted from the baseflows at the selected stream cell above Harlan County Lake.

Figure 1 shows the predicted baseflows at the selected stream cell above Harlan County Lake for the period 1981-2006. The blue line represents the baseflows simulated in the "base" run of the Model using the current methodology. The purple line represents the baseflows that would have occurred in the absence of Nebraska's Imported Water Supply (i.e., with the recharge associated with Nebraska's Imported Water Supply turned "off"). The difference is shown in yellow and represents the Imported Water Supply Credit. This amount is the same in the current methodology and proposed modification.

Figures 2a and 2b show the cumulative impact on baseflows above Harlan County Lake due to groundwater pumping in Nebraska calculated using the current methodology and the proposed modification. Figure 2a shows the baseflows above Harlan County Lake calculated using the current methodology. The baseflow in the "base" run is shown as a blue line. The baseflow in the "no State pumping" run is shown as a red line. The difference is shown in yellow and represents the depletions to baseflows above Harlan County Lake due to Nebraska's groundwater pumping.

Figure 2b shows the baseflows above Harlan County Lake calculated using the proposed modification. The baseflow in the "base" run with surface water recharge associated with

Nebraska's Imported Water Supply turned "off" is shown as a purple line. The baseflow in the "no State pumping" run with surface water recharge associated with Nebraska's Imported Water turned "off" is shown as a green line. The difference is again shown in yellow and represents the depletions to baseflows above Harlan County Lake due to Nebraska's groundwater pumping in the absence of surface water recharge associated with Nebraska's Imported Water Supply.

Comparison of Figures 2a and 2b shows that greater depletions of baseflows due to Nebraska's groundwater pumping are calculated using the current methodology than the proposed modification. Consider, for example, the year 2003. During 2003 the Model showed essentially no baseflow above Harlan County Lake in the "base" run under the current methodology. The same is true in the "base" run under the proposed modification. When the "no State pumping" run of the Model is run with surface water recharge associated with Nebraska's Imported Water Supply turned "on" in the current methodology, the baseflow increases and peaks at about 167 cfs. However, when the "no State pumping" run of the Model is run with surface water recharge associated with Nebraska's Imported Water Supply turned "off" in the proposed methodology, the baseflow also increases but peaks at about 142 cfs.

This demonstrates that when Computed Beneficial Consumptive Use of groundwater for Nebraska is calculated using the current methodology, some of the change in the baseflows above Harlan County Lake is the result of consumption of imported water. The peak baseflow of 167 cfs with surface water recharge associated with Nebraska's Imported Water Supply turned "on" in both model runs, and 142 cfs when surface water recharge associated with Nebraska's Imported Water Supply is turned "off" in both model runs, indicates that about 25 cfs of baseflow calculated using the current methodology is the result of Nebraska's Imported Water Supply.

Figure 3 compares the calculated Computed Beneficial Consumptive Use of groundwater for Nebraska for the Swanson-Harlan reach (the CBCU of groundwater for Nebraska for the reach is determined after the baseflows from Frenchman Creek, Driftwood Creek, Medicine Creek, Red Willow Creek and Sappa Creek are subtracted from the baseflow above Harlan

County Lake) using the current methodology and the proposed modification. The blue line in Figure 3a shows the baseflow gain (or loss) predicted in the ”base” run using the current methodology, while the red line shows the baseflow gain (or loss) predicted in the “no State pumping” run using the current methodology. The Computed Beneficial Consumptive Use of groundwater for Nebraska for the reach calculated using the current methodology is shown in yellow. The purple line in Figure 3b shows the baseflow gain (or loss) predicted in the ”base” run using the proposed modification, while the red line shows the baseflow gain (or loss) predicted in the “no State pumping” run using the proposed modification. The Computed Beneficial Consumptive Use of groundwater for Nebraska calculated using the proposed modification is shown in yellow.

Figure 4 shows a comparison of the values of the Computed Beneficial Consumptive Use of groundwater for Nebraska for the Swanson-Harlan reach shown in yellow in Figures 3a and 3b as a line graph. The values calculated using the current methodology are shown in blue; the values calculated using the proposed modification are shown in red. A thin line is used to show the instantaneous values, while a heavy line is used to show the annual average values. Figure 4 shows that there is a significant difference between the instantaneous and the annual average values calculated for this reach using current methodology and proposed modification.

The reason the current methodology predicts greater depletions to baseflows due to Nebraska’s groundwater pumping in the Swanson-Harlan reach is that the current methodology includes some consumption of imported water in the calculation of the Computed Beneficial Consumptive Use of groundwater. Changes in baseflows predicted by the Model between the “base” run and the “no State pumping” run are assumed to be depletions to streamflows, i.e., the Computed Beneficial Consumptive Use of groundwater. As was illustrated above, the changes in baseflows are greater when surface water recharge associated with Nebraska’s Imported Water Supply is turned “on” than when it is turned “off.”

When groundwater pumping and groundwater pumping recharge are turned “on” in Model runs, there is little baseflow regardless of whether surface water recharge associated with Nebraska’s Imported Water Supply is turned “on” or “off.” When groundwater pumping and

groundwater pumping recharge are turned "off' in the "no State pumping run, however, there is more baseflow when surface water recharge from Nebraska's Imported Water Supply is turned "on" than when it is turned "off." Since the changes in baseflows predicted by the Model between the "base" run and the "no State pumping" run are assumed to be depletions to streamflows (i.e., Computed Beneficial Consumptive Use of groundwater), the Computed Beneficial Consumptive Use of groundwater is larger using the current methodology because it includes some consumption of Nebraska's Imported Water Supply. The current methodology is thus inconsistent with Subsection IV.F of the FSS and the proposed modification corrects this deficiency.

Summary

The Computed Beneficial Consumptive Use for groundwater calculated using the current methodology and the proposed modification provide similar but not identical results. As shown in Table 2a, for the period 1981-2000, the differences between the current and the proposed methods are 0.005% for the Computed Beneficial Consumptive Use of groundwater for Colorado, 0.8% for the Computed Beneficial Consumptive Use of groundwater for Kansas, and 3% for the Computed Beneficial Consumptive Use of groundwater for Nebraska. However, as shown in Table 2b, for the period 2001-2006, the differences between the current and proposed methods are 0% for the Computed Beneficial Consumptive Use of groundwater for Colorado, 4.2% for the Computed Beneficial Consumptive Use of groundwater for Kansas, and 7.9% for the Computed Beneficial Consumptive Use of groundwater for Nebraska.

The differences during the 2001-2006 period are greater than during the 1981-2000 period because during a drought period the Model behaves more nonlinearly. In particular, for the Swanson-Harlan reach, the Computed Beneficial Consumptive Use of groundwater for Nebraska is significantly greater when calculated using the current methodology, which leaves surface water recharge associated with Nebraska's Imported Water Supply turned "on" in both runs, than when calculated using the proposed modification, in which surface

water recharge from Nebraska's Imported Water Supply is turned "off" in both runs.

As shown in Tables 1 and 2, the Computed Beneficial Consumptive Use of groundwater for Colorado and Kansas calculated using the proposed modification is almost unchanged from the Computed Beneficial Consumptive Use of groundwater for Colorado and Kansas calculated using the current methodology. However, as is shown in Table 2b, the Computed Beneficial Consumptive Use of groundwater for Nebraska calculated using the proposed modification is almost 15,000 acre-feet/year less for the period 2001-2006 than the Computed Beneficial Consumptive Use of groundwater for Nebraska calculated using the current methodology. The reason the Computed Beneficial Consumptive Use of groundwater for Nebraska is less when calculated using the proposed modification than when calculated using the current methodology is that the Computed Beneficial Consumptive Use of groundwater for Nebraska calculated using the current methodology includes some consumption of Nebraska's Imported Water Supply.

The proposed modification is no more difficult to implement than the current methodology and would require only small changes to the current RRCA software programs. There would still be five runs, but the "no State pumping" runs would be run with surface water recharge associated with Nebraska's Imported Water Supply turned "off." The ***RRPP*** program would be run with the MOUND flag as well as the NOPUMP to calculate the CBCU. The ***acct*** program will need to be modified to implement the proposed modification, but this change is easily accomplished.

Based on the above analysis, it is recommended that the RRCA follow the recommendation of the Arbitrator, Karl F. Dreher, and reconvene the Technical Groundwater Modeling Committee and instruct the Committee (or in the alternative instruct the RRCA Engineering Committee) to review the RRCA Accounting Procedures and that the Technical Groundwater Modeling Committee adopt the proposed modification to the RRCA Accounting Procedures. In the alternative, it is recommended that the RRCA instruct the RRCA Engineering Committee to review the RRCA Accounting Procedures and that the Engineering Committee adopt the proposed modification to the RRCA Accounting Procedures.

Conclusion

Subsection III.D.1 of the RRCA Accounting Procedures should be modified to state that surface water recharge associated with Nebraska's Imported Water Supply should be turned "off" in the "base" run and the "no State pumping" run. Subsection III.A.3 of the RRCA Accounting Procedures should be modified to reflect this change to Subsection III.D.1. In Subsection III.A.3, the last sentence of Subsection III.A.3.a should add "with the exception that surface water recharge associated with Nebraska's Imported Water Supply shall be turned "on."

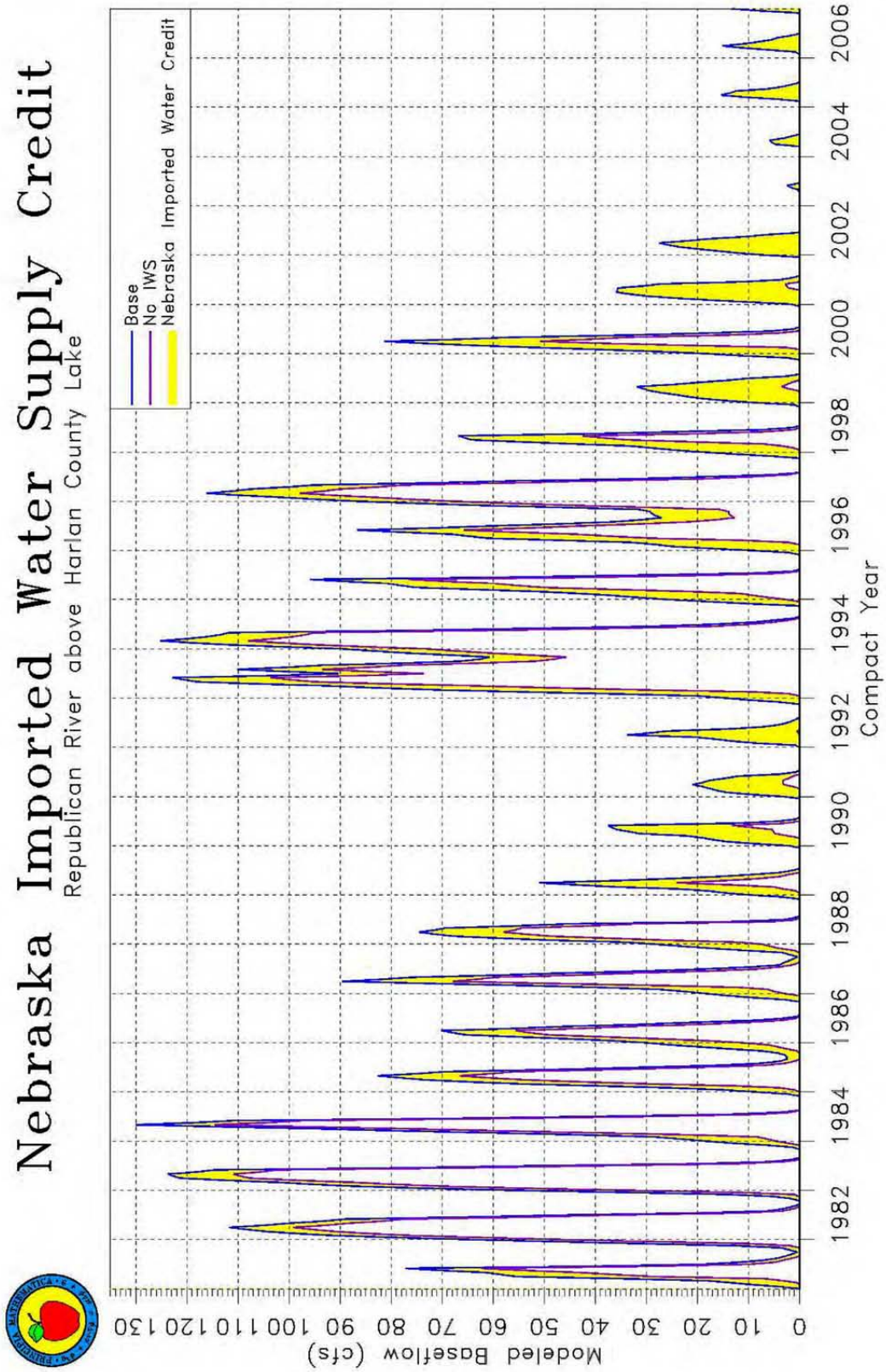

Nebraska Imported Water Supply Credit
Republican River above Harlan County Lake
Base
No IWS
Nebraska Imported Water Credit
Modeled Baseflow (cfs)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
Compact Year

Figure 1.

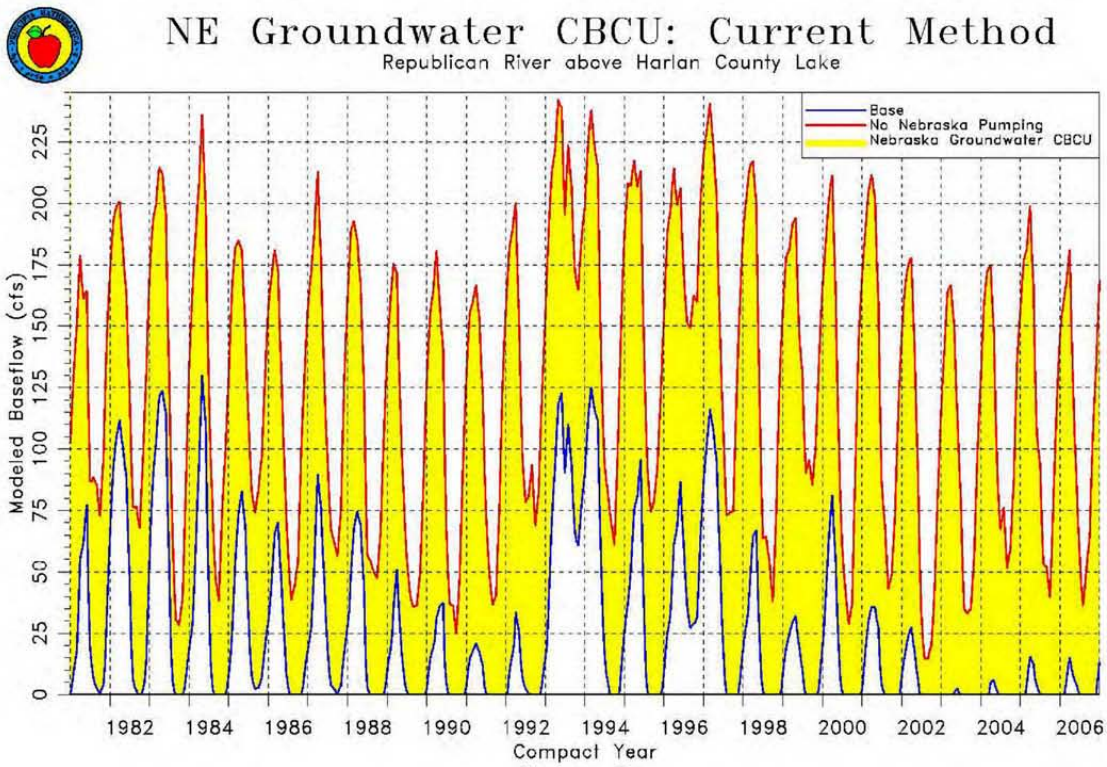


Figure 2a.

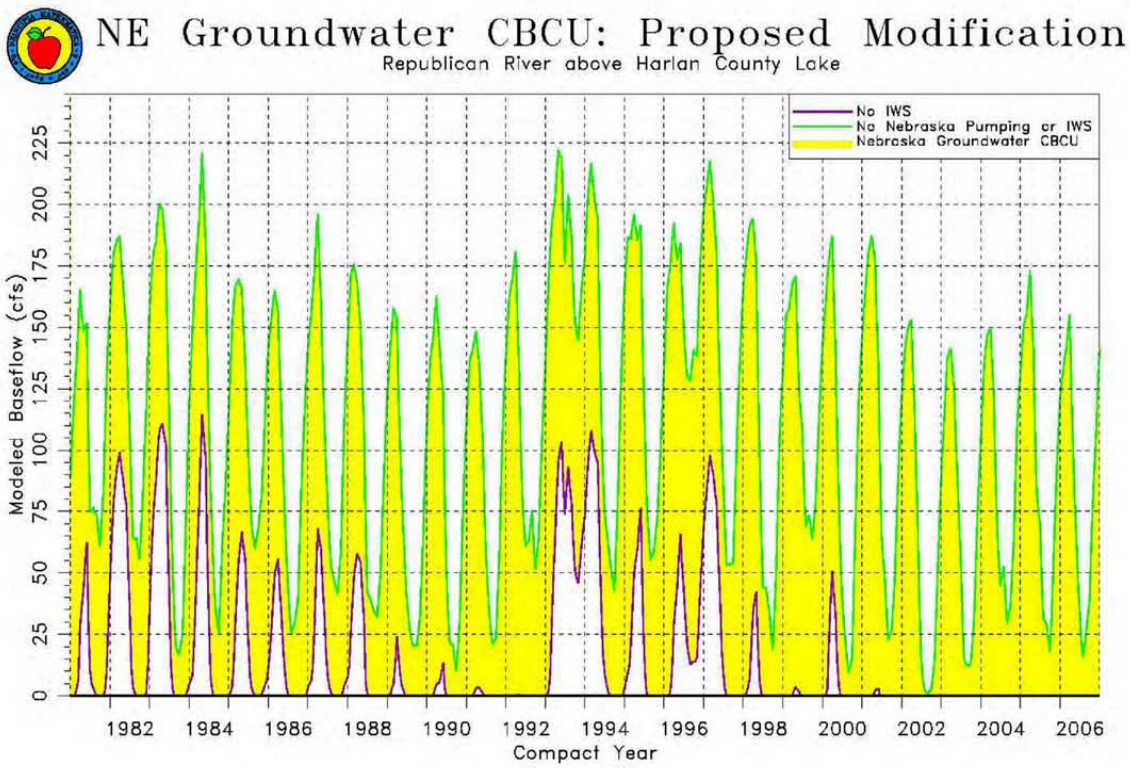


Figure 2b.

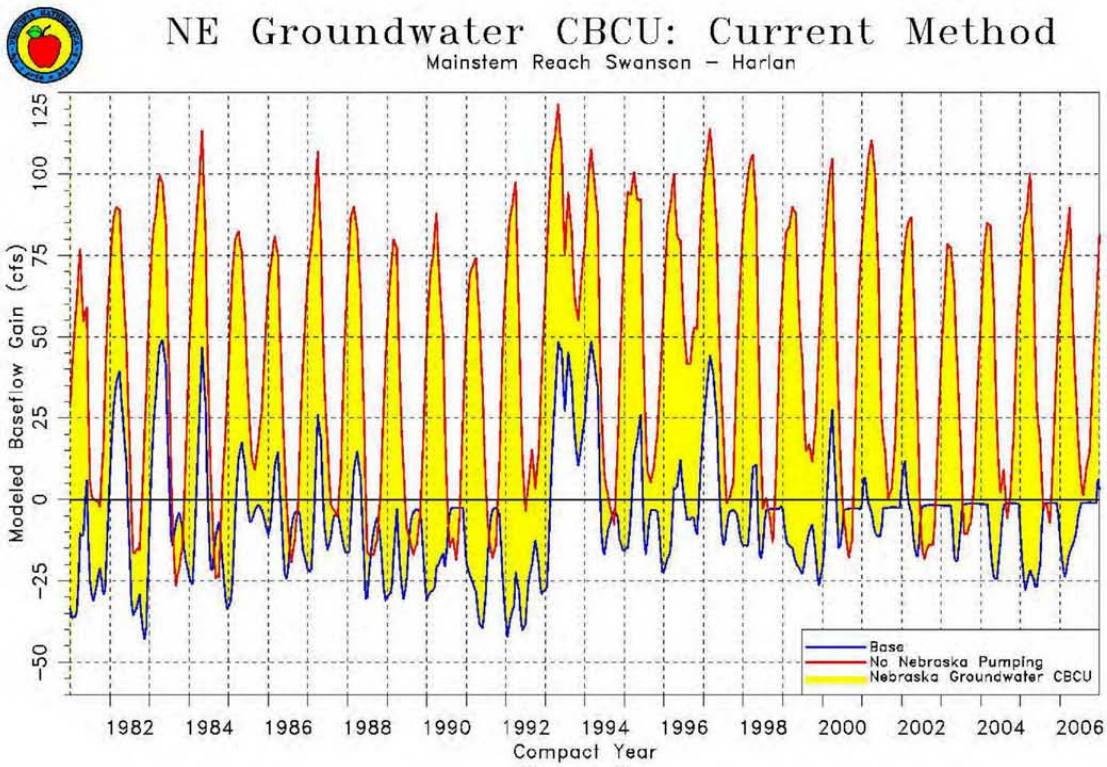


Figure 3a.

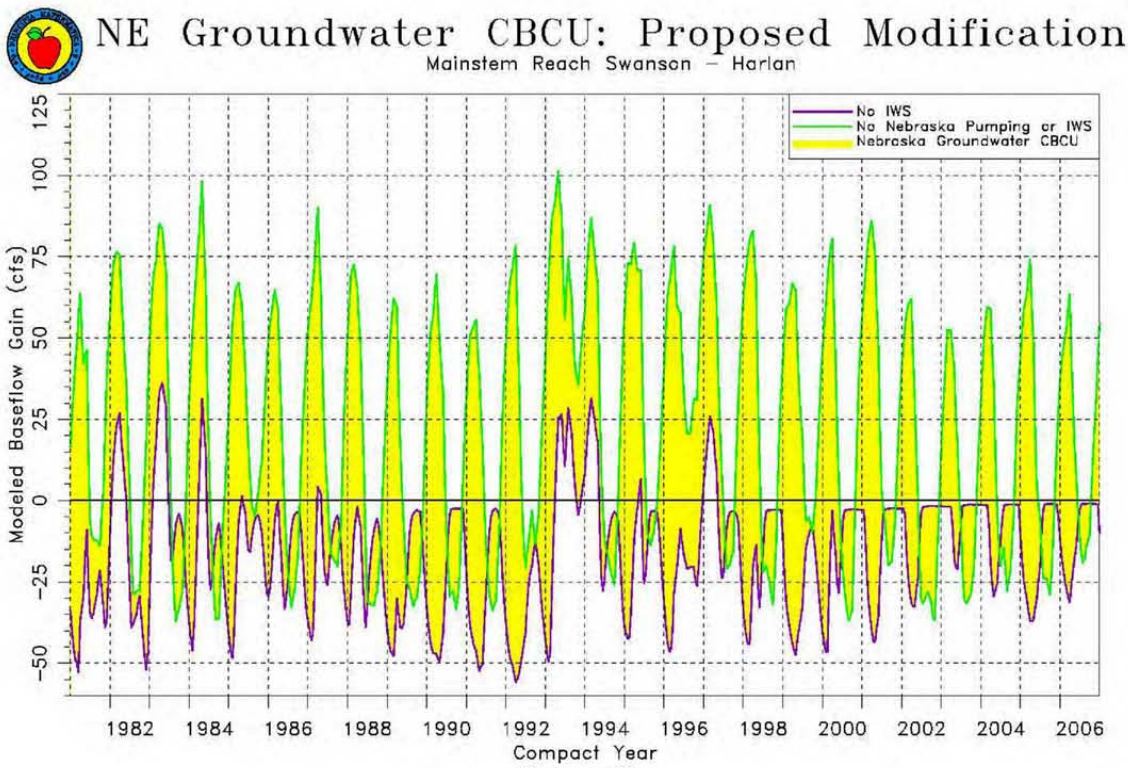


Figure 3b.

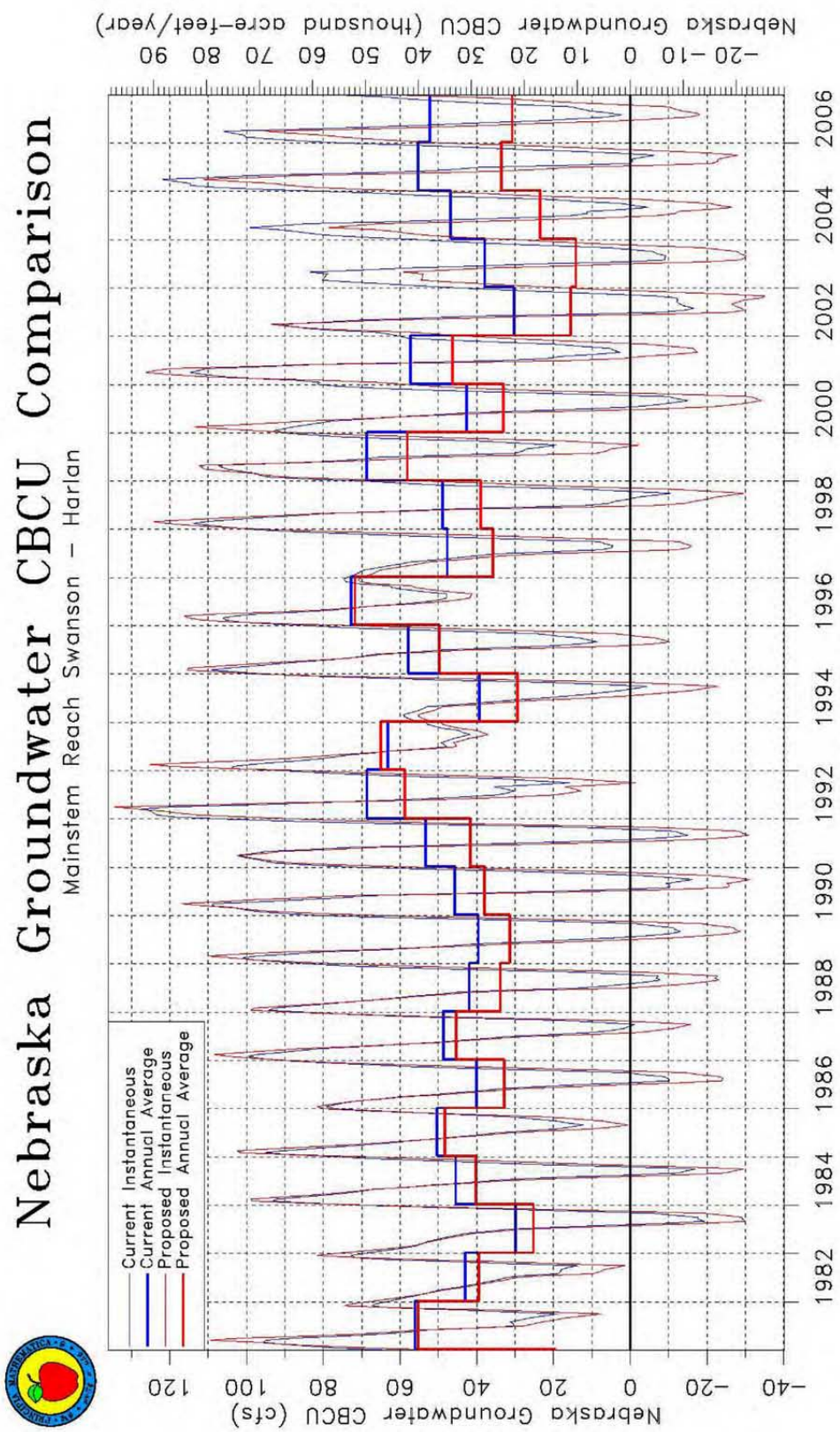

Nebraska Groundwater CBCU Comparison
Mainstem Reach Swanson - Harlan
Current Instantaneous
Current Annual Average
Proposed Instantaneous
Proposed Annual Average
Nebraska Groundwater CBCU (cfs)
120
100
80
60
40
20
0
-20
-40
Nebraska Groundwater CBCU (thousand acre-feet/year)
90
80
70
60
50
40
30
20
10
0
-10
-20
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
Compact Year

Figure 4.

Table 1a: 1981 (acre-feet/year)								
Basin	**Colorado Groundwater CBCU**		**Kansas Groundwater CBCU**		**Nebraska Groundwater CBCU**		**Nebraska IWS**	
	Current	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**
Arikaree	1049	1049	216	216	261	261	0	0
Beaver	0	0	5205	5205	5535	5535	0	0
Buffalo	33	33	0	0	1400	1400	0	0
Driftwood	0	0	0	0	835	835	0	0
Frenchman	255	255	0	0	50240	50235	0	0
North Fork	7485	7485	0	0	271	271	0	0
Above Swanson	-540	-540	298	298	9755	9755	0	0
Swanson - Harlan	0	0	214	98	40493	39932	8554	8554
Harlan - Guide Rock	0	0	0	0	12594	12579	49	49
Guide Rock - Hardy	0	0	230	230	1492	1492	0	0
Medicine	0	0	0	0	8786	8654	6639	6639
Prairie Dog	0	0	4068	4068	0	0	0	0
Red Willow	0	0	0	0	4047	4045	11	11
Rock	0	0	0	0	1101	1101	0	0
Sappa	0	0	-596	-605	1187	1184	0	0
South Fork	9654	9654	11006	11006	1004	1004	0	0
Hugh Butler	0	0	0	0	840	840	0	0
Bonny	758	758	0	0	0	0	0	0
Keith Sebelius	0	0	359	359	0	0	0	0
Enders	0	0	0	0	1695	1695	0	0
Harlan	0	0	26	26	623	623	0	0
Harry Strunk	0	0	0	0	188	188	0	0
Swanson	0	0	0	0	143	143	0	0
Mainstem	**-540**	**-540**	**741**	**626**	**64334**	**63758**	**8602**	**8602**
Total	**18705**	**18705**	**21036**	**20912**	**142490**	**141772**	**15253**	**15253**

Table 1b: 1982 (acre-feet/year)								
Basin	**Colorado Groundwater CBCU**		**Kansas Groundwater CBCU**		**Nebraska Groundwater CBCU**		**Nebraska IWS**	
	Current	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**
Arikaree	2335	2335	192	192	211	211	0	0
Beaver	0	0	5893	5893	5795	5795	0	0
Buffalo	40	40	0	0	1476	1476	0	0
Driftwood	0	0	0	0	830	830	0	0
Frenchman	305	305	0	0	51039	51032	0	0
North Fork	7822	7822	0	0	287	287	0	0
Above Swanson	-883	-883	225	225	8711	8712	0	0
Swanson - Harlan	0	0	-25	-119	31087	28553	7001	7001
Harlan - Guide Rock	0	0	0	0	12456	12440	57	57
Guide Rock - Hardy	0	0	165	165	1433	1434	0	0
Medicine	0	0	0	0	8595	8400	6722	6722
Prairie Dog	0	0	4542	4542	0	0	0	0
Red Willow	0	0	0	0	3414	3413	13	13
Rock	0	0	0	0	1282	1282	0	0
Sappa	0	0	2068	2067	2904	2905	0	0
South Fork	8566	8566	5907	5907	607	608	0	0
Hugh Butler	0	0	0	0	882	882	0	0
Bonny	760	760	0	0	0	0	0	0
Keith Sebelius	0	0	486	486	0	0	0	0
Enders	0	0	0	0	1802	1802	0	0
Harlan	0	0	24	24	672	672	0	0
Harry Strunk	0	0	0	0	207	207	0	0
Swanson	0	0	0	0	136	136	0	0
Mainstem	**-882**	**-883**	**365**	**271**	**53688**	**51138**	**7057**	**7057**
Total	**18954**	**18953**	**19488**	**19393**	**133825**	**131076**	**13798**	**13798**

Table 1c: 1983 (acre-feet/year)								
Basin	**Colorado Groundwater CBCU**		**Kansas Groundwater CBCU**		**Nebraska Groundwater CBCU**		**Nebraska IWS**	
	Current	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**
Arikaree	1678	1678	96	96	118	118	0	0
Beaver	0	0	5812	5812	5301	5301	0	0
Buffalo	46	46	0	0	1498	1498	0	0
Driftwood	0	0	0	0	922	922	0	0
Frenchman	366	366	0	0	51364	51357	0	0
North Fork	7908	7908	0	0	356	356	0	0
Above Swanson	-1775	-1775	277	277	7137	7137	0	0
Swanson - Harlan	0	0	-132	-283	21529	18106	6366	6366
Harlan - Guide Rock	0	0	0	0	13871	13853	64	64
Guide Rock - Hardy	0	0	187	187	1541	1541	0	0
Medicine	0	0	0	0	8766	8459	6708	6708
Prairie Dog	0	0	4086	4086	0	0	0	0
Red Willow	0	0	0	0	3131	3130	13	13
Rock	0	0	0	0	1364	1364	0	0
Sappa	0	0	2089	2089	2865	2866	0	0
South Fork	8193	8193	4280	4280	612	612	0	0
Hugh Butler	0	0	0	0	926	926	0	0
Bonny	780	780	0	0	0	0	0	0
Keith Sebelius	0	0	453	453	0	0	0	0
Enders	0	0	0	0	1895	1895	0	0
Harlan	0	0	21	21	681	681	0	0
Harry Strunk	0	0	0	0	226	226	0	0
Swanson	0	0	0	0	137	137	0	0
Mainstem	**-1775**	**-1775**	**332**	**181**	**44077**	**40636**	**6428**	**6428**
Total	**17208**	**17208**	**17176**	**17025**	**124237**	**120483**	**13154**	**13154**

Table 1d: 1984 (acre-feet/year)								
Basin	**Colorado Groundwater CBCU**		**Kansas Groundwater CBCU**		**Nebraska Groundwater CBCU**		**Nebraska IWS**	
	Current	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**
Arikaree	1109	1109	151	151	181	181	0	0
Beaver	0	0	5974	5974	5281	5281	0	0
Buffalo	53	53	0	0	1550	1550	0	0
Driftwood	0	0	0	0	1039	1039	0	0
Frenchman	421	421	0	0	54366	54358	0	0
North Fork	8342	8342	0	0	390	390	0	0
Above Swanson	-1391	-1391	191	191	9567	9567	0	0
Swanson - Harlan	0	0	-320	-604	32874	29068	6545	6545
Harlan - Guide Rock	0	0	0	0	14519	14499	70	70
Guide Rock - Hardy	0	0	281	281	1380	1380	0	0
Medicine	0	0	0	0	9668	9471	7124	7124
Prairie Dog	0	0	4055	4055	0	0	0	0
Red Willow	0	0	0	0	3700	3699	15	15
Rock	0	0	0	0	1426	1426	0	0
Sappa	0	0	2319	2317	2909	2910	0	0
South Fork	7822	7822	7733	7733	673	673	0	0
Hugh Butler	0	0	0	0	994	994	0	0
Bonny	835	835	0	0	0	0	0	0
Keith Sebelius	0	0	754	754	0	0	0	0
Enders	0	0	0	0	2037	2037	0	0
Harlan	0	0	20	20	774	774	0	0
Harry Strunk	0	0	0	0	245	245	0	0
Swanson	0	0	0	0	150	150	0	0
Mainstem	**-1391**	**-1391**	**152**	**-132**	**58340**	**54514**	**6613**	**6613**
Total	**17205**	**17205**	**21166**	**20881**	**143724**	**139692**	**13758**	**13758**

Table 1e: 1985 (acre-feet/year)								
Basin	**Colorado Groundwater CBCU**		**Kansas Groundwater CBCU**		**Nebraska Groundwater CBCU**		**Nebraska IWS**	
	Current	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**
Arikaree	516	516	153	153	191	191	0	0
Beaver	0	0	5960	5960	5369	5369	0	0
Buffalo	61	61	0	0	1647	1647	0	0
Driftwood	0	0	0	0	1052	1052	0	0
Frenchman	471	471	0	0	56320	56311	0	0
North Fork	8627	8627	11	11	435	435	0	0
Above Swanson	-1455	-1455	163	163	10049	10049	0	0
Swanson - Harlan	0	0	203	441	36237	34860	9482	9482
Harlan - Guide Rock	0	0	0	0	14576	14554	81	81
Guide Rock - Hardy	0	0	208	208	1552	1553	0	0
Medicine	0	0	0	0	10213	10024	7225	7225
Prairie Dog	0	0	3525	3525	0	0	0	0
Red Willow	0	0	0	0	4168	4166	16	16
Rock	0	0	0	0	1504	1504	0	0
Sappa	0	0	2719	2719	3263	3266	0	0
South Fork	9579	9579	6660	6660	727	727	0	0
Hugh Butler	0	0	0	0	1041	1041	0	0
Bonny	841	841	0	0	0	0	0	0
Keith Sebelius	0	0	654	654	0	0	0	0
Enders	0	0	0	0	2200	2200	0	0
Harlan	0	0	19	19	713	713	0	0
Harry Strunk	0	0	0	0	266	266	0	0
Swanson	0	0	0	0	157	157	0	0
Mainstem	**-1455**	**-1455**	**573**	**812**	**62414**	**61016**	**9561**	**9561**
Total	**18656**	**18656**	**20277**	**20516**	**151681**	**150086**	**16811**	**16811**

Table 1f: 1986 (acre-feet/year)								
Basin	**Colorado Groundwater CBCU**		**Kansas Groundwater CBCU**		**Nebraska Groundwater CBCU**		**Nebraska IWS**	
	Current	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**
Arikaree	455	455	126	126	178	178	0	0
Beaver	0	0	4994	4994	4546	4546	0	0
Buffalo	69	69	0	0	1729	1729	0	0
Driftwood	0	0	0	0	1073	1073	0	0
Frenchman	532	532	0	0	57393	57383	0	0
North Fork	8757	8757	0	0	453	453	0	0
Above Swanson	-1572	-1572	198	198	9138	9139	0	0
Swanson - Harlan	0	0	-201	-534	28874	23594	5865	5865
Harlan - Guide Rock	0	0	0	0	14815	14790	88	88
Guide Rock - Hardy	0	0	238	238	1368	1368	0	0
Medicine	0	0	0	0	10678	10400	7198	7198
Prairie Dog	0	0	2195	2195	0	0	0	0
Red Willow	0	0	0	0	4039	4037	16	16
Rock	0	0	0	0	1590	1590	0	0
Sappa	0	0	905	901	2126	2126	0	0
South Fork	7544	7544	6038	6038	722	722	0	0
Hugh Butler	0	0	0	0	1109	1109	0	0
Bonny	860	860	0	0	0	0	0	0
Keith Sebelius	0	0	616	616	0	0	0	0
Enders	0	0	0	0	2342	2342	0	0
Harlan	0	0	18	18	790	790	0	0
Harry Strunk	0	0	0	0	288	288	0	0
Swanson	0	0	0	0	155	155	0	0
Mainstem	**-1572**	**-1572**	**235**	**-97**	**54195**	**48891**	**5952**	**5952**
Total	**16661**	**16661**	**15141**	**14806**	**143406**	**137813**	**13170**	**13170**

Table 1g: 1987 (acre-feet/year)								
Basin	**Colorado Groundwater CBCU**		**Kansas Groundwater CBCU**		**Nebraska Groundwater CBCU**		**Nebraska IWS**	
	Current	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**
Arikaree	511	511	170	170	190	190	0	0
Beaver	0	0	5169	5169	4736	4736	0	0
Buffalo	78	78	0	0	1799	1799	0	0
Driftwood	0	0	0	0	1103	1103	0	0
Frenchman	604	604	0	0	58503	58491	0	0
North Fork	9256	9256	13	13	516	516	0	0
Above Swanson	-1699	-1699	168	168	9262	9262	0	0
Swanson - Harlan	0	0	76	177	35060	32652	9224	9224
Harlan - Guide Rock	0	0	0	0	15649	15623	100	100
Guide Rock - Hardy	0	0	213	213	1398	1399	0	0
Medicine	0	0	0	0	11095	10825	7441	7441
Prairie Dog	0	0	4496	4496	0	0	0	0
Red Willow	0	0	0	0	4227	4224	18	18
Rock	11	11	0	0	1705	1705	0	0
Sappa	0	0	244	237	1461	1458	0	0
South Fork	9783	9783	8101	8101	730	730	0	0
Hugh Butler	0	0	0	0	1123	1123	0	0
Bonny	900	900	0	0	0	0	0	0
Keith Sebelius	0	0	551	551	0	0	0	0
Enders	0	0	0	0	2440	2440	0	0
Harlan	0	0	17	18	715	715	0	0
Harry Strunk	0	0	0	0	308	308	0	0
Swanson	0	0	0	0	154	154	0	0
Mainstem	**-1699**	**-1699**	**458**	**559**	**61370**	**58936**	**9322**	**9322**
Total	**19451**	**19451**	**19221**	**19316**	**152176**	**149453**	**16784**	**16784**

Table 1h: 1988 (acre-feet/year)								
Basin	**Colorado Groundwater CBCU**		**Kansas Groundwater CBCU**		**Nebraska Groundwater CBCU**		**Nebraska IWS**	
	Current	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**
Arikaree	955	955	154	154	170	170	0	0
Beaver	0	0	4567	4567	4097	4097	0	0
Buffalo	89	89	0	0	1874	1874	0	0
Driftwood	0	0	0	0	1098	1098	0	0
Frenchman	676	676	0	0	59767	59753	0	0
North Fork	9684	9684	13	13	568	568	0	0
Above Swanson	-1978	-1978	261	261	9340	9339	0	0
Swanson - Harlan	0	0	-315	-737	30341	24485	6094	6094
Harlan - Guide Rock	0	0	0	0	18179	18149	108	108
Guide Rock - Hardy	0	0	271	271	1572	1572	0	0
Medicine	0	0	0	0	11387	11130	7607	7607
Prairie Dog	0	0	2498	2498	0	0	0	0
Red Willow	0	0	0	0	4174	4171	20	20
Rock	12	12	0	0	1833	1833	0	0
Sappa	0	0	-112	-119	1269	1266	0	0
South Fork	7770	7770	7218	7218	728	727	0	0
Hugh Butler	0	0	0	0	1171	1171	0	0
Bonny	950	950	0	0	0	0	0	0
Keith Sebelius	0	0	612	612	0	0	0	0
Enders	0	0	0	0	2547	2547	0	0
Harlan	0	0	16	16	821	821	0	0
Harry Strunk	0	0	0	0	325	325	0	0
Swanson	0	0	0	0	160	160	0	0
Mainstem	**-1978**	**-1978**	**217**	**-205**	**59432**	**53545**	**6198**	**6198**
Total	**18167**	**18167**	**15187**	**14758**	**151420**	**145257**	**13829**	**13829**

Table 1i: 1989 (acre-feet/year)								
Basin	**Colorado Groundwater CBCU**		**Kansas Groundwater CBCU**		**Nebraska Groundwater CBCU**		**Nebraska IWS**	
	Current	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**
Arikaree	245	245	156	156	164	164	0	0
Beaver	0	0	2321	2321	2155	2154	0	0
Buffalo	98	98	0	0	1940	1940	0	0
Driftwood	0	0	0	0	1101	1101	0	0
Frenchman	724	724	0	0	60367	60353	0	0
North Fork	9766	9766	15	15	603	603	0	0
Above Swanson	-1957	-1957	185	185	9010	9010	0	0
Swanson - Harlan	0	0	190	426	28409	22491	6194	6194
Harlan - Guide Rock	0	0	0	0	17745	17707	114	114
Guide Rock - Hardy	0	0	213	213	1691	1691	0	0
Medicine	0	0	0	0	11889	11541	7541	7541
Prairie Dog	0	0	751	751	0	0	0	0
Red Willow	0	0	0	0	4153	4148	18	18
Rock	13	13	0	0	1915	1915	0	0
Sappa	0	0	-803	-809	687	684	0	0
South Fork	8552	8552	6683	6683	422	422	0	0
Hugh Butler	0	0	0	0	1263	1263	0	0
Bonny	968	968	0	0	0	0	0	0
Keith Sebelius	0	0	682	682	0	0	0	0
Enders	0	0	0	0	2661	2661	0	0
Harlan	0	0	17	17	896	896	0	0
Harry Strunk	0	0	0	0	342	342	0	0
Swanson	0	0	0	0	160	160	0	0
Mainstem	**-1957**	**-1958**	**589**	**825**	**56855**	**50900**	**6306**	**6306**
Total	**18417**	**18417**	**10414**	**10643**	**147573**	**141248**	**13868**	**13868**

Table 1j: 1990 (acre-feet/year)								
Basin	**Colorado Groundwater CBCU**		**Kansas Groundwater CBCU**		**Nebraska Groundwater CBCU**		**Nebraska IWS**	
	Current	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**
Arikaree	589	589	211	211	204	204	0	0
Beaver	0	0	1150	1150	1119	1119	0	0
Buffalo	109	109	0	0	2056	2056	0	0
Driftwood	0	0	0	0	1122	1122	0	0
Frenchman	713	713	0	0	63991	63973	0	0
North Fork	10426	10426	14	14	692	692	0	0
Above Swanson	-2114	-2114	-27	-27	10898	10898	0	0
Swanson - Harlan	0	0	123	82	32804	27346	7037	7037
Harlan - Guide Rock	0	0	0	0	18139	18086	115	115
Guide Rock - Hardy	0	0	233	233	1603	1604	0	0
Medicine	0	0	0	0	12775	12342	7665	7665
Prairie Dog	0	0	780	780	0	0	0	0
Red Willow	0	0	0	0	4550	4544	19	19
Rock	15	15	0	0	2037	2037	0	0
Sappa	0	0	-758	-768	615	611	0	0
South Fork	9811	9811	9655	9655	794	793	0	0
Hugh Butler	0	0	0	0	1336	1336	0	0
Bonny	985	985	0	0	0	0	0	0
Keith Sebelius	0	0	641	641	0	0	0	0
Enders	0	0	0	0	2795	2795	0	0
Harlan	0	0	18	18	909	909	0	0
Harry Strunk	0	0	0	0	364	364	0	0
Swanson	0	0	0	0	173	173	0	0
Mainstem	**-2114**	**-2114**	**330**	**289**	**63445**	**57934**	**7150**	**7150**
Total	**20543**	**20543**	**12046**	**11995**	**158975**	**153005**	**14836**	**14836**

Table 1k: 1991 (acre-feet/year)								
Basin	**Colorado Groundwater CBCU**		**Kansas Groundwater CBCU**		**Nebraska Groundwater CBCU**		**Nebraska IWS**	
	Current	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**
Arikaree	1462	1462	276	276	298	298	0	0
Beaver	0	0	1223	1223	1446	1446	0	0
Buffalo	121	121	0	0	2221	2221	0	0
Driftwood	0	0	0	0	1150	1150	0	0
Frenchman	738	738	0	0	67075	67056	0	0
North Fork	10837	10837	21	21	693	693	0	0
Above Swanson	-1181	-1181	163	163	12258	12258	0	0
Swanson - Harlan	0	0	20	-108	38384	30031	4525	4525
Harlan - Guide Rock	0	0	0	0	20759	20690	113	113
Guide Rock - Hardy	0	0	252	252	1985	1986	0	0
Medicine	0	0	0	0	13916	13591	8042	8042
Prairie Dog	0	0	2180	2180	0	0	0	0
Red Willow	0	0	0	0	5185	5175	20	20
Rock	17	17	0	0	2224	2224	0	0
Sappa	0	0	-1024	-1031	576	573	0	0
South Fork	10622	10622	10674	10674	976	976	0	0
Hugh Butler	0	0	0	0	1421	1421	0	0
Bonny	975	975	0	0	0	0	0	0
Keith Sebelius	0	0	658	658	0	0	0	0
Enders	0	0	0	0	2933	2933	0	0
Harlan	0	0	19	19	995	995	0	0
Harry Strunk	0	0	0	0	385	385	0	0
Swanson	0	0	0	0	166	166	0	0
Mainstem	**-1182**	**-1182**	**436**	**308**	**73386**	**64965**	**4635**	**4635**
Total	**23598**	**23598**	**14468**	**14334**	**175046**	**166270**	**12701**	**12701**

Table 1l: 1992 (acre-feet/year)								
Basin	**Colorado Groundwater CBCU**		**Kansas Groundwater CBCU**		**Nebraska Groundwater CBCU**		**Nebraska IWS**	
	Current	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**
Arikaree	2233	2233	178	178	210	210	0	0
Beaver	0	0	2904	2904	3120	3120	0	0
Buffalo	134	134	0	0	2297	2297	0	0
Driftwood	0	0	0	0	1153	1153	0	0
Frenchman	745	745	0	0	64303	64282	0	0
North Fork	11199	11199	12	12	689	689	0	0
Above Swanson	-1052	-1052	426	426	10270	10270	0	0
Swanson - Harlan	0	0	-50	-1018	49739	42620	6179	6179
Harlan - Guide Rock	0	0	0	0	18849	18748	100	100
Guide Rock - Hardy	0	0	50	50	1723	1725	0	0
Medicine	0	0	0	0	13628	13411	8375	8375
Prairie Dog	0	0	4455	4455	0	0	0	0
Red Willow	0	0	0	0	5476	5468	24	24
Rock	19	19	0	0	2373	2373	0	0
Sappa	0	0	-1726	-1751	710	707	0	0
South Fork	10355	10355	6603	6603	933	933	0	0
Hugh Butler	0	0	0	0	1307	1307	0	0
Bonny	994	994	0	0	0	0	0	0
Keith Sebelius	0	0	425	425	0	0	0	0
Enders	0	0	0	0	3040	3040	0	0
Harlan	0	0	17	17	844	844	0	0
Harry Strunk	0	0	0	0	404	404	0	0
Swanson	0	0	0	0	147	147	0	0
Mainstem	**-1053**	**-1054**	**428**	**-540**	**80581**	**73362**	**6276**	**6276**
Total	**24633**	**24633**	**13302**	**12309**	**181215**	**173748**	**14680**	**14680**

Table 1m: 1993 (acre-feet/year)								
Basin	**Colorado Groundwater CBCU**		**Kansas Groundwater CBCU**		**Nebraska Groundwater CBCU**		**Nebraska IWS**	
	Current	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**
Arikaree	2018	2018	223	223	192	192	0	0
Beaver	0	0	7614	7614	7110	7110	0	0
Buffalo	146	146	0	0	2286	2286	0	0
Driftwood	0	0	0	0	1076	1076	0	0
Frenchman	1000	1000	0	0	63516	63492	0	0
North Fork	11400	11400	0	0	693	693	0	0
Above Swanson	-1067	-1067	236	236	8532	8532	0	0
Swanson - Harlan	0	0	124	785	45586	46885	15534	15534
Harlan - Guide Rock	0	0	-14	-14	16874	16838	191	191
Guide Rock - Hardy	0	0	18	18	1404	1402	0	0
Medicine	0	0	0	0	12098	11990	8883	8883
Prairie Dog	0	0	14166	14166	0	0	0	0
Red Willow	0	0	0	0	5083	5085	40	40
Rock	21	21	0	0	2501	2501	0	0
Sappa	0	0	2795	2793	4354	4365	14	14
South Fork	9497	9497	8378	8379	806	806	0	0
Hugh Butler	0	0	0	0	1114	1114	0	0
Bonny	1005	1005	0	0	0	0	0	0
Keith Sebelius	0	0	404	404	0	0	0	0
Enders	0	0	0	0	3081	3081	0	0
Harlan	0	0	66	66	642	643	0	0
Harry Strunk	0	0	0	0	409	409	0	0
Swanson	0	0	0	0	131	131	0	0
Mainstem	**-1067**	**-1066**	**364**	**1025**	**72396**	**73657**	**15720**	**15720**
Total	**24025**	**24026**	**34024**	**34683**	**177488**	**178631**	**24663**	**24663**

Table 1n: 1994 (acre-feet/year)								
Basin	**Colorado Groundwater CBCU**		**Kansas Groundwater CBCU**		**Nebraska Groundwater CBCU**		**Nebraska IWS**	
	Current	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**
Arikaree	1149	1149	101	101	117	117	0	0
Beaver	0	0	7570	7570	6727	6727	0	0
Buffalo	157	157	0	0	2296	2296	0	0
Driftwood	0	0	0	0	1044	1044	0	0
Frenchman	901	901	0	0	67838	67812	0	0
North Fork	11607	11607	0	0	792	792	0	0
Above Swanson	-2716	-2715	236	236	9125	9125	0	0
Swanson - Harlan	0	0	-221	-495	28337	21192	7273	7273
Harlan - Guide Rock	0	0	0	0	18763	18717	189	189
Guide Rock - Hardy	0	0	188	188	1399	1399	0	0
Medicine	0	0	0	0	12198	11924	8471	8471
Prairie Dog	0	0	6357	6357	0	0	0	0
Red Willow	0	0	0	0	4383	4377	30	30
Rock	23	23	0	0	2563	2563	0	0
Sappa	0	0	3782	3789	4897	4910	17	17
South Fork	8999	8999	3327	3327	603	603	0	0
Hugh Butler	0	0	0	0	1349	1349	0	0
Bonny	1044	1044	0	0	0	0	0	0
Keith Sebelius	0	0	475	475	0	0	0	0
Enders	0	0	0	0	3165	3165	0	0
Harlan	0	0	114	115	868	868	0	0
Harry Strunk	0	0	0	0	417	417	0	0
Swanson	0	0	0	0	157	157	0	0
Mainstem	**-2717**	**-2716**	**213**	**-61**	**57624**	**50433**	**7457**	**7457**
Total	**21171**	**21172**	**21949**	**21683**	**167037**	**159555**	**15981**	**15981**

Table 1o: 1995 (acre-feet/year)								
Basin	**Colorado Groundwater CBCU**		**Kansas Groundwater CBCU**		**Nebraska Groundwater CBCU**		**Nebraska IWS**	
	Current	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**
Arikaree	1870	1870	202	202	233	233	0	0
Beaver	0	0	6882	6882	6402	6403	0	0
Buffalo	171	171	0	0	2413	2413	0	0
Driftwood	0	0	0	0	1117	1117	0	0
Frenchman	814	814	0	0	70355	70327	0	0
North Fork	12011	12011	12	12	848	848	0	0
Above Swanson	-2056	-2056	19	19	10632	10632	0	0
Swanson - Harlan	0	0	-369	-861	41753	35855	8938	8938
Harlan - Guide Rock	0	0	0	0	22113	22045	189	189
Guide Rock - Hardy	0	0	218	218	1905	1907	0	0
Medicine	0	0	0	0	13695	13441	8775	8775
Prairie Dog	0	0	3689	3689	0	0	0	0
Red Willow	0	0	0	0	5471	5465	35	35
Rock	26	26	0	0	2642	2642	0	0
Sappa	0	0	2176	2172	3552	3558	0	0
South Fork	12038	12038	8931	8931	889	889	0	0
Hugh Butler	0	0	0	0	1449	1449	0	0
Bonny	1053	1053	0	0	0	0	0	0
Keith Sebelius	0	0	485	485	0	0	0	0
Enders	0	0	0	0	3300	3300	0	0
Harlan	0	0	83	83	957	957	0	0
Harry Strunk	0	0	0	0	436	436	0	0
Swanson	0	0	0	0	155	155	0	0
Mainstem	**-2058**	**-2057**	**-130**	**-622**	**76403**	**70439**	**9125**	**9125**
Total	**25935**	**25936**	**22336**	**21841**	**190318**	**184073**	**17951**	**17951**

Table 1p: 1996 (acre-feet/year)								
Basin	**Colorado Groundwater CBCU**		**Kansas Groundwater CBCU**		**Nebraska Groundwater CBCU**		**Nebraska IWS**	
	Current	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**
Arikaree	1774	1774	211	211	239	239	0	0
Beaver	0	0	7005	7005	6270	6270	0	0
Buffalo	184	184	0	0	2503	2503	0	0
Driftwood	0	0	0	0	1146	1146	0	0
Frenchman	946	953	0	0	70624	70593	0	0
North Fork	12257	12257	16	16	860	860	0	0
Above Swanson	-847	-850	326	326	11074	11073	0	0
Swanson - Harlan	-20	0	328	875	52670	52105	15010	15010
Harlan - Guide Rock	0	0	0	0	20709	20649	219	219
Guide Rock - Hardy	0	0	218	218	1876	1875	0	0
Medicine	0	0	0	0	13687	13569	9158	9158
Prairie Dog	0	0	5919	5919	0	0	0	0
Red Willow	0	0	0	0	5934	5927	39	39
Rock	29	29	0	0	2775	2775	0	0
Sappa	0	0	3011	3013	4117	4128	15	15
South Fork	11006	11003	7546	7546	934	933	0	0
Hugh Butler	0	0	0	0	1363	1363	0	0
Bonny	1054	1054	0	0	0	0	0	0
Keith Sebelius	0	0	334	334	0	0	0	0
Enders	0	0	0	0	3386	3386	0	0
Harlan	0	0	65	65	770	770	0	0
Harry Strunk	0	0	0	0	452	452	0	0
Swanson	0	0	0	0	143	143	0	0
Mainstem	**-867**	**-849**	**875**	**1422**	**86330**	**85702**	**15223**	**15223**
Total	**26391**	**26413**	**24988**	**25537**	**201533**	**200759**	**24443**	**24443**

Table 1q: 1997 (acre-feet/year)								
Basin	**Colorado Groundwater CBCU**		**Kansas Groundwater CBCU**		**Nebraska Groundwater CBCU**		**Nebraska IWS**	
	Current	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**
Arikaree	1687	1687	141	141	164	164	0	0
Beaver	0	0	6815	6815	5964	5964	0	0
Buffalo	197	197	0	0	2568	2568	0	0
Driftwood	0	0	0	0	1150	1150	0	0
Frenchman	981	981	0	0	72910	72878	0	0
North Fork	12307	12307	14	14	970	970	0	0
Above Swanson	-2563	-2563	232	232	10951	10951	0	0
Swanson - Harlan	0	0	-395	-1142	34408	25931	7195	7195
Harlan - Guide Rock	0	0	0	0	22506	22414	205	205
Guide Rock - Hardy	0	0	178	178	1830	1834	0	0
Medicine	0	0	0	0	13892	13639	9025	9025
Prairie Dog	0	0	4121	4121	0	0	0	0
Red Willow	0	0	0	0	5313	5305	39	39
Rock	32	32	0	0	2839	2839	0	0
Sappa	0	0	2476	2471	3495	3498	0	0
South Fork	9123	9122	5911	5911	853	853	0	0
Hugh Butler	0	0	0	0	1480	1480	0	0
Bonny	1078	1078	0	0	0	0	0	0
Keith Sebelius	0	0	427	427	0	0	0	0
Enders	0	0	0	0	3464	3464	0	0
Harlan	0	0	54	54	963	964	0	0
Harry Strunk	0	0	0	0	464	464	0	0
Swanson	0	0	0	0	162	162	0	0
Mainstem	**-2566**	**-2566**	**19**	**-729**	**69695**	**61130**	**7398**	**7398**
Total	**22847**	**22847**	**19984**	**19232**	**186346**	**177492**	**16477**	**16477**

Table 1r: 1998 (acre-feet/year)								
Basin	**Colorado Groundwater CBCU**		**Kansas Groundwater CBCU**		**Nebraska Groundwater CBCU**		**Nebraska IWS**	
	Current	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**
Arikaree	1239	1239	167	167	206	206	0	0
Beaver	0	0	5618	5618	4978	4978	0	0
Buffalo	207	207	0	0	2690	2690	0	0
Driftwood	0	0	0	0	1196	1196	0	0
Frenchman	717	718	0	0	73764	73729	0	0
North Fork	12521	12521	12	12	1045	1045	0	0
Above Swanson	-3330	-3329	39	39	10150	10150	0	0
Swanson - Harlan	0	0	-386	-738	35058	27919	8601	8601
Harlan - Guide Rock	0	0	0	0	21914	21770	173	173
Guide Rock - Hardy	0	0	168	168	1726	1730	0	0
Medicine	0	0	0	0	14510	14134	8896	8896
Prairie Dog	0	0	2543	2543	0	0	0	0
Red Willow	0	0	0	0	5338	5326	34	34
Rock	35	35	0	0	2894	2894	0	0
Sappa	0	0	837	827	2419	2424	0	0
South Fork	11280	11281	7752	7752	806	805	0	0
Hugh Butler	0	0	0	0	1549	1549	0	0
Bonny	1121	1121	0	0	0	0	0	0
Keith Sebelius	0	0	404	404	0	0	0	0
Enders	0	0	0	0	3606	3606	0	0
Harlan	0	0	48	48	949	950	0	0
Harry Strunk	0	0	0	0	483	483	0	0
Swanson	0	0	0	0	180	180	0	0
Mainstem	**-3333**	**-3330**	**-176**	**-529**	**68849**	**61570**	**8772**	**8772**
Total	**23799**	**23804**	**17212**	**16851**	**185461**	**177765**	**17721**	**17721**

Table 1s: 1999 (acre-feet/year)								
Basin	**Colorado Groundwater CBCU**		**Kansas Groundwater CBCU**		**Nebraska Groundwater CBCU**		**Nebraska IWS**	
	Current	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**
Arikaree	981	981	239	239	313	313	0	0
Beaver	0	0	5686	5686	4870	4870	0	0
Buffalo	220	220	0	0	2799	2799	0	0
Driftwood	0	0	0	0	1171	1171	0	0
Frenchman	1010	1010	0	0	75119	75081	0	0
North Fork	13004	13004	15	15	1030	1030	0	0
Above Swanson	-761	-761	352	352	12815	12815	0	0
Swanson - Harlan	0	0	-32	-1065	49574	42027	8775	8775
Harlan - Guide Rock	0	0	0	0	21936	21762	166	166
Guide Rock - Hardy	0	0	201	201	1793	1796	0	0
Medicine	0	0	0	0	13913	13826	9488	9488
Prairie Dog	0	0	2479	2479	0	0	0	0
Red Willow	0	0	0	0	6346	6328	33	33
Rock	38	38	0	0	3023	3023	0	0
Sappa	0	0	-198	-222	1149	1145	0	0
South Fork	12429	12429	8864	8864	1048	1048	0	0
Hugh Butler	0	0	0	0	1345	1345	0	0
Bonny	1116	1116	0	0	0	0	0	0
Keith Sebelius	0	0	356	356	0	0	0	0
Enders	0	0	0	0	3711	3711	0	0
Harlan	0	0	45	45	862	863	0	0
Harry Strunk	0	0	0	0	494	494	0	0
Swanson	14	14	0	0	179	179	0	0
Mainstem	**-765**	**-766**	**524**	**-509**	**86117**	**78399**	**8937**	**8937**
Total	**28050**	**28048**	**18019**	**16962**	**203490**	**195625**	**18468**	**18468**

Table 1t: 2000 (acre-feet/year)								
Basin	**Colorado Groundwater CBCU**		**Kansas Groundwater CBCU**		**Nebraska Groundwater CBCU**		**Nebraska IWS**	
	Current	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**
Arikaree	1918	1918	128	128	196	196	0	0
Beaver	0	0	4560	4560	3568	3568	0	0
Buffalo	234	234	0	0	2912	2912	0	0
Driftwood	0	0	0	0	1153	1153	0	0
Frenchman	599	599	0	0	74876	74835	0	0
North Fork	13173	13173	15	15	1156	1156	0	0
Above Swanson	-4253	-4253	159	159	10260	10260	0	0
Swanson - Harlan	0	0	-224	475	30832	23924	9446	9446
Harlan - Guide Rock	0	0	0	0	25316	25112	156	156
Guide Rock - Hardy	0	0	257	257	1926	1929	0	0
Medicine	0	0	0	0	14585	14159	9063	9063
Prairie Dog	0	0	1392	1392	0	0	0	0
Red Willow	0	0	0	0	5179	5163	31	31
Rock	42	42	0	0	3125	3125	0	0
Sappa	0	0	-670	-693	792	788	0	0
South Fork	9280	9280	6320	6320	982	982	0	0
Hugh Butler	0	0	0	0	1601	1601	0	0
Bonny	1170	1170	0	0	0	0	0	0
Keith Sebelius	0	0	407	407	0	0	0	0
Enders	0	0	0	0	3848	3848	0	0
Harlan	0	0	42	43	989	990	0	0
Harry Strunk	0	0	0	0	505	505	0	0
Swanson	11	11	0	0	220	220	0	0
Mainstem	**-4252**	**-4251**	**196**	**895**	**68335**	**61225**	**9598**	**9598**
Total	**22178**	**22179**	**12398**	**13074**	**184022**	**176427**	**18703**	**18703**

Table 1u: 2001 (acre-feet/year)								
Basin	**Colorado Groundwater CBCU**		**Kansas Groundwater CBCU**		**Nebraska Groundwater CBCU**		**Nebraska IWS**	
	Current	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**
Arikaree	1288	1288	190	190	341	341	0	0
Beaver	0	0	3553	3553	3075	3075	0	0
Buffalo	247	247	0	0	3099	3099	0	0
Driftwood	0	0	0	0	1221	1221	0	0
Frenchman	569	569	0	0	78286	78244	0	0
North Fork	13534	13534	18	18	1676	1676	0	0
Above Swanson	-4176	-4176	-98	-98	11690	11690	0	0
Swanson - Harlan	0	0	147	-655	41325	33411	8850	8850
Harlan - Guide Rock	0	0	0	0	24322	24101	170	170
Guide Rock - Hardy	0	0	50	50	2008	2012	0	0
Medicine	0	0	0	0	27908	27507	9202	9202
Prairie Dog	0	0	3029	3029	0	0	0	0
Red Willow	0	0	0	0	6175	6152	29	29
Rock	46	46	0	0	3216	3216	0	0
Sappa	0	0	-970	-1000	873	869	0	0
South Fork	9748	9748	7449	7449	641	641	0	0
Hugh Butler	0	0	0	0	1594	1594	0	0
Bonny	1216	1216	0	0	0	0	0	0
Keith Sebelius	0	0	377	377	0	0	0	0
Enders	0	0	0	0	3996	3996	0	0
Harlan	0	0	42	42	828	829	10	10
Harry Strunk	0	0	0	0	350	351	0	0
Swanson	10	10	0	0	246	246	0	0
Mainstem	**-4181**	**-4181**	**103**	**-699**	**79345**	**71214**	**9017**	**9017**
Total	**22481**	**22481**	**13800**	**12968**	**212869**	**204269**	**18264**	**18264**

Table 1v: 2002 (acre-feet/year)								
Basin	**Colorado Groundwater CBCU**		**Kansas Groundwater CBCU**		**Nebraska Groundwater CBCU**		**Nebraska IWS**	
	Current	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**
Arikaree	401	401	114	114	351	351	0	0
Beaver	0	0	1684	1684	1842	1842	0	0
Buffalo	244	244	0	0	3226	3226	0	0
Driftwood	0	0	0	0	1272	1272	0	0
Frenchman	619	619	0	0	74134	74089	0	0
North Fork	13562	13562	14	14	1936	1936	0	0
Above Swanson	-6155	-6155	381	381	10120	10120	0	0
Swanson - Harlan	0	0	184	-238	21718	11090	5435	5435
Harlan - Guide Rock	0	0	0	0	26247	26016	172	172
Guide Rock - Hardy	0	0	58	58	1835	1839	0	0
Medicine	0	0	0	0	19914	18826	8359	8359
Prairie Dog	0	0	2294	2294	0	0	0	0
Red Willow	0	0	0	0	5193	5170	24	24
Rock	54	54	0	0	3296	3296	0	0
Sappa	0	0	-442	-455	695	691	0	0
South Fork	9498	9498	4892	4892	1282	1282	0	0
Hugh Butler	0	0	0	0	1748	1748	0	0
Bonny	1267	1267	0	0	0	0	0	0
Keith Sebelius	0	0	512	512	0	0	0	0
Enders	0	0	0	0	4129	4129	0	0
Harlan	0	0	42	42	896	897	11	11
Harry Strunk	0	0	0	0	320	321	0	0
Swanson	0	0	0	0	284	284	0	0
Mainstem	**-6159**	**-6159**	**627**	**205**	**59920**	**49065**	**5601**	**5601**
Total	**19498**	**19498**	**9745**	**9309**	**180438**	**168425**	**14002**	**14002**

Table 1w: 2003 (acre-feet/year)								
Basin	**Colorado Groundwater CBCU**		**Kansas Groundwater CBCU**		**Nebraska Groundwater CBCU**		**Nebraska IWS**	
	Current	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**
Arikaree	242	242	100	100	507	507	0	0
Beaver	0	0	274	274	777	777	0	0
Buffalo	265	265	0	0	3338	3338	0	0
Driftwood	0	0	0	0	1391	1391	0	0
Frenchman	37	37	0	0	81210	81160	0	0
North Fork	14023	14023	17	17	1402	1402	0	0
Above Swanson	112	112	-40	-40	17979	17979	0	0
Swanson - Harlan	0	0	53	0	27271	10229	144	144
Harlan - Guide Rock	0	0	0	0	27709	27459	182	182
Guide Rock - Hardy	0	0	59	59	2559	2562	0	0
Medicine	0	0	0	0	20684	20220	9429	9429
Prairie Dog	0	0	1137	1137	0	0	0	0
Red Willow	0	0	0	0	6056	6018	20	20
Rock	59	59	0	0	3419	3419	0	0
Sappa	0	0	-274	-274	500	495	0	0
South Fork	10790	10790	5351	5351	1347	1347	0	0
Hugh Butler	0	0	0	0	1759	1759	0	0
Bonny	1325	1325	0	0	0	0	0	0
Keith Sebelius	0	0	542	542	0	0	0	0
Enders	0	0	0	0	4437	4437	0	0
Harlan	0	0	38	39	881	883	12	12
Harry Strunk	0	0	0	0	455	456	0	0
Swanson	20	20	0	0	483	483	0	0
Mainstem	**108**	**108**	**77**	**23**	**75517**	**58229**	**320**	**320**
Total	**26872**	**26872**	**7274**	**7221**	**204164**	**186323**	**9789**	**9789**

Table 1x: 2004 (acre-feet/year)								
Basin	**Colorado Groundwater CBCU**		**Kansas Groundwater CBCU**		**Nebraska Groundwater CBCU**		**Nebraska IWS**	
	Current	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**
Arikaree	353	353	116	116	431	431	0	0
Beaver	0	0	206	205	1278	1278	0	0
Buffalo	290	290	0	0	3333	3333	0	0
Driftwood	0	0	0	0	1479	1479	0	0
Frenchman	39	39	0	0	85199	85146	0	0
North Fork	14373	14373	16	16	1446	1446	0	0
Above Swanson	-1287	-1287	201	201	13809	13809	0	0
Swanson - Harlan	0	0	91	0	33956	17109	622	622
Harlan - Guide Rock	0	0	0	0	29155	28892	198	198
Guide Rock - Hardy	0	0	71	71	2382	2386	0	0
Medicine	0	0	0	0	20898	20391	9527	9527
Prairie Dog	0	0	1328	1328	0	0	0	0
Red Willow	0	0	0	0	6448	6414	25	25
Rock	58	58	0	0	3581	3581	0	0
Sappa	0	0	-206	-205	556	552	0	0
South Fork	11532	11532	5781	5781	1202	1203	0	0
Hugh Butler	0	0	0	0	1773	1773	0	0
Bonny	1342	1342	0	0	0	0	0	0
Keith Sebelius	0	0	496	496	0	0	0	0
Enders	0	0	0	0	4528	4528	0	0
Harlan	0	0	36	37	776	779	15	15
Harry Strunk	0	0	0	0	398	399	0	0
Swanson	18	18	0	0	487	487	0	0
Mainstem	**-1294**	**-1294**	**368**	**276**	**79303**	**62196**	**816**	**816**
Total	**26715**	**26715**	**8150**	**8059**	**213115**	**195416**	**10391**	**10391**

Table 1y: 2005 (acre-feet/year)								
Basin	**Colorado Groundwater CBCU**		**Kansas Groundwater CBCU**		**Nebraska Groundwater CBCU**		**Nebraska IWS**	
	Current	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**
Arikaree	811	811	122	122	250	250	0	0
Beaver	0	0	1519	1519	2685	2684	0	0
Buffalo	306	306	0	0	3357	3357	0	0
Driftwood	0	0	0	0	1481	1481	0	0
Frenchman	42	42	0	0	78069	78014	0	0
North Fork	14359	14359	17	17	1443	1443	0	0
Above Swanson	-1967	-1967	103	103	10992	10992	0	0
Swanson - Harlan	0	0	70	-19	39772	24233	2061	2061
Harlan - Guide Rock	0	0	0	0	29058	28790	220	220
Guide Rock - Hardy	0	0	64	64	2956	2960	0	0
Medicine	0	0	0	0	20414	19904	9641	9641
Prairie Dog	0	0	5265	5265	0	0	0	0
Red Willow	0	0	0	0	6596	6569	35	35
Rock	61	61	0	0	3744	3744	0	0
Sappa	0	0	-1462	-1500	702	697	0	0
South Fork	13679	13679	7227	7227	1372	1372	0	0
Hugh Butler	0	0	0	0	1709	1709	0	0
Bonny	1273	1273	0	0	0	0	0	0
Keith Sebelius	0	0	510	510	0	0	0	0
Enders	0	0	0	0	4650	4650	0	0
Harlan	0	0	34	35	857	862	17	17
Harry Strunk	0	0	0	0	352	353	0	0
Swanson	13	13	0	0	421	421	0	0
Mainstem	**-1975**	**-1975**	**242**	**153**	**82778**	**66975**	**2275**	**2275**
Total	**28571**	**28571**	**13483**	**13357**	**210881**	**194487**	**11975**	**11975**

Table 1z: 2006 (acre-feet/year)								
Basin	**Colorado Groundwater CBCU**		**Kansas Groundwater CBCU**		**Nebraska Groundwater CBCU**		**Nebraska IWS**	
	Current	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**
Arikaree	1116	1116	84	84	125	125	0	0
Beaver	0	0	3028	3028	3517	3517	0	0
Buffalo	319	319	0	0	3335	3335	0	0
Driftwood	0	0	0	0	1422	1422	0	0
Frenchman	43	43	0	0	73700	73641	0	0
North Fork	14301	14301	12	12	1366	1366	0	0
Above Swanson	-3023	-3023	214	214	8934	8934	0	0
Swanson - Harlan	0	0	-96	-969	37580	22282	2536	2536
Harlan - Guide Rock	0	0	0	0	26657	26384	238	238
Guide Rock - Hardy	0	0	54	54	2419	2425	0	0
Medicine	0	0	0	0	19564	18876	9404	9404
Prairie Dog	0	0	4979	4979	0	0	0	0
Red Willow	0	0	0	0	6099	6065	25	25
Rock	64	64	0	0	3845	3845	0	0
Sappa	0	0	-1910	-2060	1028	1023	0	0
South Fork	10495	10494	4398	4398	1040	1040	0	0
Hugh Butler	0	0	0	0	1647	1647	0	0
Bonny	1262	1262	0	0	0	0	0	0
Keith Sebelius	0	0	531	531	0	0	0	0
Enders	0	0	0	0	4624	4624	0	0
Harlan	0	0	33	34	810	816	18	18
Harry Strunk	0	0	0	0	326	327	0	0
Swanson	14	14	0	0	374	374	0	0
Mainstem	**-3030**	**-3030**	**178**	**-695**	**75590**	**60025**	**2769**	**2769**
Total	**24586**	**24586**	**11343**	**10320**	**198411**	**182068**	**12225**	**12225**

Table 2a: Average 1981- 2000 (acre-feet/year)								
Basin	**Colorado Groundwater CBCU**		**Kansas Groundwater CBCU**		**Nebraska Groundwater CBCU**		**Nebraska IWS**	
	Current	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**
Arikaree	1289	1289	175	175	202	202	0	0
Beaver	0	0	5146	5146	4720	4720	0	0
Buffalo	122	122	0	0	2098	2098	0	0
Driftwood	0	0	0	0	1077	1077	0	0
Frenchman	676	676	0	0	63186	63167	0	0
North Fork	10419	10419	12	12	667	667	0	0
Above Swanson	-1759	-1760	206	206	9947	9947	0	0
Swanson - Harlan	0	0	-70	-217	36203	31479	8192	8192
Harlan - Guide Rock	0	0	0	0	18114	18051	127	127
Guide Rock - Hardy	0	0	199	199	1630	1631	0	0
Medicine	0	0	0	0	11999	11747	8002	8002
Prairie Dog	0	0	3915	3915	0	0	0	0
Red Willow	0	0	0	0	4666	4660	24	24
Rock	19	19	0	0	2136	2136	0	0
Sappa	0	0	977	970	2267	2269	0	0
South Fork	9595	9595	7379	7379	792	792	0	0
Hugh Butler	0	0	0	0	1233	1233	0	0
Bonny	962	962	0	0	0	0	0	0
Keith Sebelius	0	0	509	509	0	0	0	0
Enders	0	0	0	0	2797	2797	0	0
Harlan	0	0	37	38	822	822	0	0
Harry Strunk	0	0	0	0	360	360	0	0
Swanson	0	0	0	0	158	158	0	0
Mainstem	**-1761**	**-1760**	**337**	**189**	**65893**	**61108**	**8316**	**8316**
Total	**21330**	**21331**	**18492**	**18338**	**165073**	**160011**	**16353**	**16353**

Table 2b: Average 2001- 2006 (acre-feet/year)								
Basin	**Colorado Groundwater CBCU**		**Kansas Groundwater CBCU**		**Nebraska Groundwater CBCU**		**Nebraska IWS**	
	Current	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**
Arikaree	702	702	121	121	334	334	0	0
Beaver	0	0	1711	1711	2196	2196	0	0
Buffalo	279	279	0	0	3281	3281	0	0
Driftwood	0	0	0	0	1378	1378	0	0
Frenchman	225	225	0	0	78433	78382	0	0
North Fork	14025	14025	16	16	1545	1545	0	0
Above Swanson	-2749	-2749	127	127	12254	12254	0	0
Swanson - Harlan	0	0	75	-313	33604	19726	3275	3275
Harlan - Guide Rock	0	0	0	0	27191	26940	197	197
Guide Rock - Hardy	0	0	59	59	2360	2364	0	0
Medicine	0	0	0	0	21564	20954	9260	9260
Prairie Dog	0	0	3005	3005	0	0	0	0
Red Willow	0	0	0	0	6094	6065	26	26
Rock	57	57	0	0	3517	3517	0	0
Sappa	0	0	-877	-916	726	721	0	0
South Fork	10957	10957	5850	5850	1148	1148	0	0
Hugh Butler	0	0	0	0	1705	1705	0	0
Bonny	1281	1281	0	0	0	0	0	0
Keith Sebelius	0	0	495	495	0	0	0	0
Enders	0	0	0	0	4394	4394	0	0
Harlan	0	0	38	38	841	844	14	14
Harry Strunk	0	0	0	0	367	368	0	0
Swanson	14	14	0	0	382	382	0	0
Mainstem	**-2755**	**-2755**	**266**	**-123**	**75409**	**61284**	**3466**	**3466**
Total	**24787**	**24787**	**10632**	**10206**	**203313**	**188498**	**12774**	**12774**

Table 2c: Average 1981- 2006 (acre-feet/year)								
Basin	**Colorado Groundwater CBCU**		**Kansas Groundwater CBCU**		**Nebraska Groundwater CBCU**		**Nebraska IWS**	
	Current	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**	**Current**	**Alternate**
Arikaree	1153	1153	162	162	232	232	0	0
Beaver	0	0	4353	4353	4137	4137	0	0
Buffalo	158	158	0	0	2371	2371	0	0
Driftwood	0	0	0	0	1146	1146	0	0
Frenchman	572	572	0	0	66705	66678	0	0
North Fork	11251	11251	12	12	870	870	0	0
Above Swanson	-1988	-1988	188	188	10479	10479	0	0
Swanson - Harlan	0	0	-36	-239	35603	28767	7057	7057
Harlan - Guide Rock	0	0	0	0	20209	20103	143	143
Guide Rock - Hardy	0	0	167	167	1798	1800	0	0
Medicine	0	0	0	0	14206	13871	8293	8293
Prairie Dog	0	0	3705	3705	0	0	0	0
Red Willow	0	0	0	0	4995	4984	25	25
Rock	28	28	0	0	2454	2454	0	0
Sappa	0	0	549	535	1911	1912	0	0
South Fork	9909	9909	7026	7026	874	874	0	0
Hugh Butler	0	0	0	0	1342	1342	0	0
Bonny	1036	1036	0	0	0	0	0	0
Keith Sebelius	0	0	506	506	0	0	0	0
Enders	0	0	0	0	3166	3166	0	0
Harlan	0	0	37	38	826	827	0	0
Harry Strunk	0	0	0	0	362	362	0	0
Swanson	0	0	0	0	210	210	0	0
Mainstem	**-1991**	**-1990**	**321**	**117**	**68089**	**61148**	**7197**	**7197**
Total	**22128**	**22129**	**16678**	**16461**	**173898**	**166585**	**15527**	**15527**

EXHIBIT I

Privileged and Confidential Settlement Discussions
April 2010

Privileged and Confidential Settlement Discussions

Response to Willem A. Schreüder's March 1, 2010, Proposed Modification to the Republican River Compact Administration Accounting Procedures for Determining the Computed Beneficial Consumptive Use of Groundwater

James Schneider
Nebraska Department of Natural Resources
April 2010

Introduction

The State of Colorado has provided a paper titled "Proposed Modification to the Republican River Compact Administration Accounting Procedures for Determining the Computed Beneficial Consumptive Use of Groundwater" by Willem Schreüder, dated March 1, 2010. This issue has been studied extensively by the Department and our consultants, and the current proposal from Colorado is essentially identical to the first proposal that Nebraska presented to the Republican River Compact Administration (RRCA) in 2007. Following objections to this proposal by the State of Kansas, Nebraska studied this issue more thoroughly and determined that the problem was more widespread than originally thought, and could be fully addressed through the proposed modifications to the accounting procedures that were presented in the recent arbitration regarding this issue. This paper evaluates the proposal from Colorado and compares the sufficiency of this proposed change relative to Nebraska's more comprehensive proposal.

Background

The RRCA groundwater model is utilized in the Compact accounting to produce a series of five model runs, the results of which are used to compute the Computed Beneficial Consumptive Use (CBCU) from groundwater pumping by the three states and Nebraska's Imported Water Supply (IWS) Credit. This process is described in the RRCA accounting procedures and summarized and discussed in the March 1, 2010, Colorado paper. It generally involves the use of a "base" run, three "no state pumping" runs (one for each state), and a "no NE import" run. The three "no state pumping" runs and the "no NE import" runs are each compared to the "base" run to determine the three states' groundwater CBCU and the IWS Credit, respectively.

In 2007, Nebraska discovered that the value determined for Nebraska's CBCU from groundwater pumping was less than current accounting results when the "base" run and the "no state pumping" run were evaluated with the surface water recharge associated with Nebraska's IWS turned off. This appeared to be inconsistent with Subsection IV.F of the Final Settlement Stipulations (FSS), which states: "Beneficial Consumptive Use of IWS shall not count as Computed Beneficial Consumptive Use of Virgin Water Supply." Therefore, Nebraska proposed that the accounting procedures should be modified by the RRCA so that the "base" run and the "no state pumping" run did not include the surface

water recharge associated with Nebraska's IWS when computing the groundwater CBCU for each state.

Kansas responded with an analysis of the results of the current accounting procedures and Nebraska's proposal. In the analysis, Kansas compared the sum of the impacts to the simultaneously evaluated impact of these four components by comparing the "base" run to a run of the groundwater model with no groundwater pumping in any state and no surface water recharge associated with Nebraska's IWS (referred to herein as the "all off" run). When the entire basin was evaluated as a whole, the current accounting procedures produced results for each individual state and the IWS Credit that, when combined, were closer to the result of comparing the "base" run to the "all off" run than the new proposed accounting procedure (the difference between the sum of the individual state impacts and the IWS Credit and the result of comparing the "base" run and the "all off" run is herein referred to as the "residual"). Based on this, Kansas rejected Nebraska's proposal. The current proposal from Colorado is essentially identical to that proposal.

Upon further analysis, Nebraska determined that the Kansas analysis was fundamentally flawed because it did not look at the accounting results for the individual sub-basins and the mainstem independently, but only summed those results and evaluated the basin as a whole. When Nebraska evaluated the "residuals" produced by the current accounting procedures within the sub-basins and the mainstem, most of the sub-basins contained negative "residuals" (a negative residual is defined as the sum of the groundwater impacts and IWS Credit being less than the comparison of the "base" run and the "all off" run) and the mainstem contained a positive "residual" (the Medicine Creek sub-basin also contains a positive residual, but it is small in comparison to the mainstem residual and will be ignored here for the purpose of discussion). While the sum of the "residuals" tended to be fairly close to zero (positive "residuals" balancing negative "residuals"), the "absolute residual" (the sum of the absolute value of the "residuals") was quite substantial. Evaluation of the "residual" produced by the original proposed changes (and the current Colorado proposal) showed that the negative "residuals" in the sub-basins generally remained, while the positive "residual" in the mainstem was essentially eliminated. Therefore, the sum of the "residuals" became greater than that produced by current Compact accounting, while the sum of the "absolute residual" is substantially less.

Nebraska concluded that a methodology that would eliminate all "residuals" (positive and negative) in all sub-basins in all years would be most appropriate for Compact accounting. The essence of the proposal eventually developed by Nebraska is that, because a comparison of two model runs with one state or the IWS on or off will produce different results depending on whether or not the other states and/or the IWS is on in the two runs being compared, the most reasonable estimate of each state's groundwater CBCU and the IWS credit will take into account all of the potential results. With four stresses that can be either on or off in the model, there are 16 possible model runs with eight possible comparisons of two runs where the only difference is that one state or the IWS is on in one run and off in the other. Each of these eight runs should be considered,

and by carefully selecting the weights assigned to each of the eight comparisons, the "residual" will be eliminated.

Analysis

The current proposal from Colorado does not attempt to directly address the issue of "residuals." As discussed above, it would eliminate the positive residuals that occur in the mainstem under the current accounting procedures. The results of the Colorado proposed accounting procedure do not match the results of Nebraska's proposed accounting procedure for the groundwater CBCU and IWS Credit for the mainstem. This difference and resulting implications for Compact accounting are discussed further below.

The positive "residuals" that occur in the mainstem using the current accounting procedures are found primarily in the stream reach between Swanson Reservoir and Harlan County Lake. In this reach, only two of the four stresses accounted for using results from the RRCA groundwater model have any significant impact on stream baseflow, Nebraska pumping, and the IWS. Though Nebraska's proposal uses 16 different groundwater model runs and eight different comparisons to evaluate the effects of the three states' pumping and the IWS, there are really only four combinations of the three states' pumping and the IWS that produce significantly different stream baseflows in the Swanson to Harlan reach:

1) Nebraska pumping on, IWS on;
2) Nebraska pumping off, IWS on;
3) Nebraska pumping on, IWS off; and
4) Nebraska pumping off, IWS off.

Therefore there are really only two different types of comparisons for evaluating Nebraska groundwater CBCU and the IWS Credit. For Nebraska groundwater CBCU, these are:

1) The IWS is *on* in the two runs being compared, and
2) The IWS is *off* in the two runs being compared.

Similarly, for the IWS Credit, these are:

1) Nebraska pumping is *on* in the two runs being compared, and
2) Nebraska pumping is *off* in the two runs being compared.

The Nebraska proposal assumes that neither of the two options for computing Nebraska groundwater CBCU (with IWS on or with IWS off) and the IWS Credit (with Nebraska pumping on and with Nebraska pumping off) is more or less valid than the other, and essentially averages the two different results for each.

Colorado's proposal, on the other hand, is based on the premise that the FSS defines which of the two types of differences are correct. According to this proposal, for

computing the IWS Credit, the Nebraska groundwater pumping should be on. For computing Nebraska's groundwater CBCU (and the other states', though this is not really significant), the IWS credit should be off.

The effect of the two proposals is to essentially eliminate the positive "residuals" that are observed in the mainstem under the current accounting procedures. Nebraska's proposal accomplishes this by essentially splitting the residual and assigning half to Nebraska's groundwater CBCU (reducing the CBCU) and half to the IWS Credit (increasing the Credit). On the other hand, Colorado's proposal accomplishes this by assigning the entire residual to Nebraska's groundwater CBCU (reducing the CBCU), and leaves the IWS Credit unchanged.

While the Colorado proposal does not address the negative "residuals" that would remain in many of the sub-basins, these do not have nearly the same effect on the final outcome of the RRCA annual accounting as the positive "residuals" in the mainstem ***at this time***. In other words, fixing the positive "residual" in the mainstem is currently far more important than fixing the negative "residuals" that occur in the sub-basins with regard to the accuracy of Nebraska's annual balance (Allocation + IWS Credit – Nebraska CBCU).

Conclusions

The issue of the "residuals" that result from the current accounting procedures can be separated into two categories, the negative "residuals" that occur in the sub-basins and the positive "residual" that occurs primarily in the mainstem. The positive "residuals" have a much greater impact on the accuracy of Nebraska's final Compact accounting results, so any proposal that would fix these, even without fixing the negative "residuals" in the sub-basins, should be considered by Nebraska. Colorado's proposal has a different effect on accounting results than Nebraska's, because only the Nebraska groundwater CBCU is changed in the Colorado proposal while both the Nebraska groundwater CBCU and the IWS Credit are affected by Nebraska's proposal. Therefore, the change in Nebraska's final accounting balances resulting from Colorado's proposal is slightly less than that of Nebraska's proposal.

Given all of these considerations, it would be beneficial for Nebraska to adopt the Colorado proposal (again, this is essentially identical to Nebraska's original proposal on the issue) and seek to have the RRCA accounting changed accordingly. The remaining "residuals" should be monitored in the future to determine if/when they would also need to be resolved.

EXHIBIT J

RESOLUTION BY THE REPUBLICAN RIVER COMPACT ADMINISTRATION REGARDING MODIFICATIONS TO THE ACCOUNTING PROCEDURES TO REFLECT FUTURE OPERATIONS OF BONNY DAM

Whereas, storage levels in Bonny Reservoir have trended downward for several years and it appears that this trend will continue in the future;

Whereas, due to changing hydrologic conditions and other factors, Bonny Reservoir is planned to be operated as a "run of the river" dam without active storage;

Whereas, operating Bonny Dam as a run of the river dam will allow all baseflows and non-flood surface flows to be passed through the former reservoir area and such water will continue to flow down the South Fork of the Republican River;

Whereas, Bonny Dam will continue to provide valuable flood control benefits to the State of Kansas while operated as a run of the river dam, and releases of any temporarily stored flood flows will be as the maximum volume that will avoid damage to the dam or downstream property;

Whereas, the area now comprising Bonny Dam and Reservoir was simulated in the RRCA Ground Water Model for the years 1918 to 1950 as stream segment;

Whereas, currently when Bonny Dam is simulated in the RRCA Ground Water Model, the inflow from the upstream portions of the South Fork and Landsman Creek are removed from the Model. The reservoir segment is essentially a specified head in the Model. This flow is not routed through the remainder of the stream network of the Model. Below the reservoir, outflow from the toe drain below the Reservoir is simulated by setting a set flow volume into the stream segment to a constant 10 cfs, regardless of Reservoir stage;

Whereas, when there is no longer active storage the current representation of Bonny Dam and Reservoir in the RRCA Groundwater Model will no longer represent the physical and hydrogeological characteristics of the South Fork of the Republican River to a reasonable degree;

Whereas, for purposes of this Resolution, the term "active storage" shall mean water stored behind Bonny Dam above the level of the outflow works at an elevation above 3638 msl.

Now, therefore, it is hereby resolved that in order for the RRCA Groundwater Model to represent the physical and hydrogeological characteristics of the South Fork of the Republican River to a reasonable degree:

1. While there is still an active storage pool in Bonny Reservoir, no changes will be made to the current representation of Bonny Reservoir in the RRCA Ground Water Model or the RRCA Accounting Procedures; if Bonny again stores water in the active storage pool in the future, the representation of Bonny Reservoir in the RRCA Ground Water Model or the RRCA Accounting Procedures shall return to the procedures used prior to August 12, 2009 while water remains stored in the active pool;

2. The State of Colorado shall report to the RRCA when the active storage pool in Bonny Reservoir is empty and shall further report when the outflow gates in Bonny Dam have been left open so as to pass all inflow reaching the gates;

3. When there is no longer an active storage pool in Bonny Reservoir, the State of Colorado shall report to the RRCA the surface area and elevation of the dead pool, if any, remaining in the Reservoir. Such reporting shall continue as part of the data required by the RRCA Accounting Procedures, Subsection V.C.1.b;

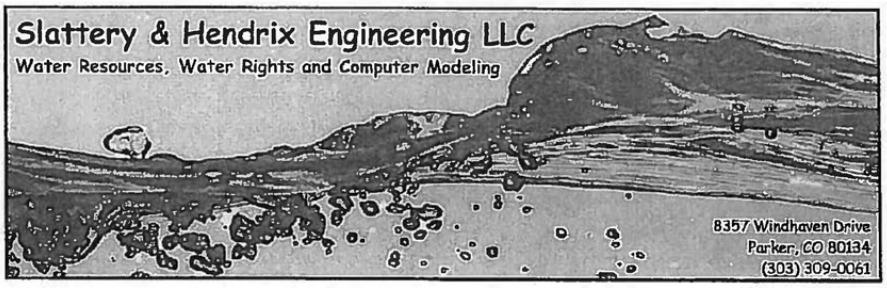
4. When there is no longer an active storage pool in Bonny Reservoir, calculation of evaporation from the dead pool, if any, or temporary storage of flood flows, if any, shall be made in the same manner as for storage in the other Federal Reservoirs, and;

5. When there is no longer an active storage pool in Bonny Reservoir, in order to represent the physical and hydrogeological characteristics of the South Fork of the Republican River to a reasonable degree in the absence of active storage in Bonny Reservoir, the RRCA Groundwater Model shall be returned to the stream network package of the pre-1950 condition. This shall be accomplished by setting the stream conductance and elevation to the pre-1950 values and the Manning's roughness coefficient to 0.030 as in the pre-1950 simulation so that stage is calculated as a function of discharge for stream segment 150. In addition the stream routing will be modified so that the inflow from the upstream segments is routed through segment 150, and the outflow from segment 150 is routed to the downstream segment and the 10 cfs inflow from the toe drain shall be removed.

Approved by the RRCA this 12th day of August, 2009.

_____	_____
Brian Dunnigan, P.E. Nebraska Member Chairman, RRCA	date
_____	_____
David Barfield, P.E. Kansas Member	date
_____	_____
Dick Wolfe, P.E. Colorado Member	date

EXHIBIT K



To: Dennis M. Montgomery – Hill & Robbins, P.C.

From: James E. Slattery and Randy L. Hendrix

Date: February 11, 2010

Subject: Haigler Canal – Available Water Supply

This memorandum provides an estimate of the additional water that will be available for irrigation use from the Haigler Canal by landowners within the Pioneer Irrigation District of Dundy County, Nebraska ("Pioneer Irrigation District-Nebraska"), as the result of the purchase of surface water rights in Colorado and the lease of those water rights by the Republican River Water Conservation District, acting by and through its Water Activity Enterprise (RRWCD WAE).

The Pioneer Ditch diverts from the south bank of the North Fork of the Republican River approximately 5 miles upstream of the Colorado-Nebraska State Line as shown in Figure 1. Once the Pioneer Ditch crosses the State Line, it is referred to as the Haigler Canal. Approximately 1,600 acres in Nebraska are irrigated from the Haigler Canal as shown in Figure 2.

In June 2008, the RRWCD WAE entered into a lease for the remainder of 2008 of 61/96th of the Laird Ditch water right, 100% of portion of the water right decreed to the Pioneer Ditch owned by the Colorado Board of the Pioneer Irrigation District of Colorado ("Pioneer Irrigation District-Colorado"), and various other water rights decreed for diversion from the North Fork or its tributaries as presented in Table 2. The RRWCD WAE at that time already had under lease the remaining interests in the Laird Ditch water right. At the same time, Yuma County Water Authority ("YCWA") entered into a revised letter of intent with the Pioneer Irrigation District-Colorado and the owners of various other North Fork water rights that led to purchase by the YCWA Public Improvement District ("PID") in December 2008 of 81/96th of the Laird Ditch water right, 100% of the water right decreed to the Pioneer Ditch owned by the Pioneer Irrigation District-Colorado, and various other surface water rights. On December 29, 2008, the RRWCD WAE leased these water rights from the YCWA PID for a 20-year term. The RRWCD WAE leased these water rights to assist the State of Colorado to comply with the Republican River Compact and has left the water available to these water rights in the river. As can be seen in Figure 1, several of the leased water rights are located so that the water left in the river is available for diversion at the Pioneer Ditch headgate by the Pioneer Irrigation District-Nebraska.

We analyzed the historical hydrology for the 10-year period prior to the lease of the water rights (1998-2007) to estimate the additional water that will be available for irrigation use from

the Haigler Canal by landowners within the Pioneer Irrigation District-Nebraska. As shown in Table 1, the water rights leased by the RRWCD WAE diverted an average of 4,797 ac-ft/yr during the period 1998 through 2007. The diversions shown in Table 1 represent approximately 98% of all agricultural diversions from the North Fork in Colorado during the 1998-2007 time frame.

The gaged flows for the North Fork of the Republican River at the Colorado-Nebraska State Line (USGS gaging station number 06823000) and the measured flows at the Haigler Canal State Line Flume for the years 1998 through 2007 are presented in columns (2) and (3) of Table 2. The 2008 and 2009 values are presented for comparison.

It should be noted that prior to 2005 the State Line Flume operated under submerged conditions. In 2005, work was done on the Flume so that it now operates under proper flow conditions. Thus, the flows recorded for 2005 through 2009 are more accurate than the flows recorded in the previous years.

The purpose of this analysis was to estimate the amount of water historically diverted by the leased water rights that is now available for irrigation use by landowners within the Pioneer Irrigation District-Nebraska at the Haigler Canal State Line Flume. In addition, this analysis provides an estimate of the additional water that was available for diversion at the Pioneer Ditch headgate that was not diverted by the Pioneer Ditch. The basis for the analysis is outlined in the sections below.

Colorado Pioneer Ditch

The additional water that is now available at the Haigler Canal State Line Flume as the result of the RRWCD WAE's lease of the water right formerly owned by the Pioneer Irrigation District-Colorado was estimated using the following steps:

1. The analysis was done using daily diversions for the 1998-2007 study period.
2. The Pioneer Ditch diversions for the Pioneer Irrigation District-Colorado were estimated as the total Pioneer Ditch diversions at the river headgate minus the flow at the Haigler Canal State Line Flume.
3. Ditch losses between the Pioneer Ditch headgate and the Haigler Canal State Line Flume were estimated as 10% of the additional diversions at the river headgate.
4. Because the Haigler Canal water right is limited to 29 cfs at the Haigler Canal State Line Flume, additional water that is now available at the Haigler Canal State Line Flume as the result of the RRWCD WAE's lease of the Colorado Pioneer's water right in excess of an amount that would provide 29 cfs at the Haigler Canal State Line Flume was not included in the estimate of additional water available to the Haigler Canal.
5. Diversions of additional water were limited to the April 1 – October 31 period.

6. This analysis resulted in an estimate of an average of 1,907 ac-ft/yr of additional water being available at the Haigler Canal State Line Flume as the result of the RRWCD WAE's lease of the Colorado Pioneer's water right as shown in column (4) of Table 2.
7. An analysis without regard to the 29 cfs limit at the Haigler Canal State Line Flume would indicate that 2,042 ac-ft/yr would now be available at the Haigler Canal State Line Flume after accounting for a 10% ditch loss (2,042 = 0.9 x 2,269). The estimate (1,907 ac-ft/yr) developed in the 5 step process described above is 135 ac-ft/yr lower because the analysis limited the deliveries at the Haigler Canal State Line Flume to 29 cfs.

Laird Ditch and Other Smaller Upstream Ditches

As shown in Table 1, most of the historical diversions associated with the other water rights were by the Laird Ditch. A small portion of the lands historically irrigated from the Laird Ditch were upstream of the Pioneer Ditch headgate and most of the return flows from those lands would have accrued to the North Fork upstream of the Pioneer Ditch headgate. The remainder of the lands historically irrigated from the Laird Ditch were downstream of the Pioneer Ditch headgate and diversions to irrigate those lands would have been effectively 100% depletive of the stream flow relative to the Pioneer Ditch headgate as shown in Figure 1.

The O'Donnell Ditch irrigates land on the eastern edge of the town of Wray, Colorado, as shown in Figure 1. As also shown in Figure 1, four of the ditches leased by the RRWCD WAE are located downstream of the Pioneer Ditch headgate and the water diverted by these water rights would not have been physically available at the Pioneer Ditch headgate. The Holy Joe Canal and the Holy Joe Reservoir water rights are located upstream of the Pioneer Ditch headgate, but only very limited diversions were recorded during the 1998-2007 study period, so these water right were not considered in the analysis.

For the purpose of this study, rather than estimating the monthly consumptive use and return flows from the O'Donnell Ditch, it was assumed that the effects of the lease of the O'Donnell Ditch water right could be approximated by using the historical Laird Ditch diversions without any adjustment for return flows from the small portion of lands under the Laird Ditch that historically returned above the Pioneer Ditch headgate. In other words, while a small amount of the Laird Ditch diversions came back as return flows upstream of the Pioneer Ditch headgate, these return flows are approximately offset by the consumptive use associated with the diversions by the O'Donnell Ditch.

The additional water that is now available at the Haigler Canal State Line Flume as the result of the RRWCD WAE's lease of the Laird Ditch and the O'Donnell Ditch water rights was estimated using the following steps:

1. The analysis was done using daily diversions for the 1998-2007 study period.
2. Ditch losses between the Pioneer Ditch headgate and the Haigler Canal State Line Flume were estimated as 10% of the additional diversions at the river headgate.

3. River flows available for diversion at the Pioneer Ditch headgate include historical flows diverted at the Pioneer Ditch headgate plus the additional water that is now available as the result of the RRWCD WAE's lease of the Laird Ditch and the O'Donnell Ditch water rights. However, because the Haigler Canal water right is limited to 29 cfs at the Haigler Canal State Line Flume, river flows available for diversion at the Pioneer Ditch headgate in excess of an amount necessary to provide 29 cfs at the Haigler Canal State Line Flume were not included in the estimate of additional water available to the Haigler Canal from the lease of the Laird Ditch and the O'Donnell Ditch water rights. This limitation included the additional water that was estimated to be available as the result of the RRWCD WAE's lease of the Pioneer Irrigation District-Colorado water right as discussed in the previous section.
4. Diversions of additional water were limited to the April 1 – October 31 period.
5. The above analysis resulted in an estimate of an average of 1,757 ac-ft/yr of additional water being available at the Haigler Canal State Line Flume as the result of the RRWCD WAE's lease of the Laird Ditch and the O'Donnell Ditch water rights as shown in column (5) of Table 2.
6. An analysis just using the average annual historical diversions would indicate that 1,942 ac-ft/yr would now be available at the Haigler Canal State Line Flume after accounting for a 10% ditch loss (1,942 = 0.9 x 2,158). The estimate (1,757 ac-ft/yr) developed in the 5 step process described above is 185 ac-ft/yr lower because the analysis limited the deliveries at the Haigler Canal State Line Flume to 29 cfs.

Additional Water Available for Diversion from the North Fork

Historically, the water in the North Fork that was available for diversion but was not diverted by the Pioneer Ditch was estimated using the following steps:

1. The analysis was done using daily diversions and streamflow records for the 1998-2007 study period.
2. Ditch losses between the Pioneer Ditch headgate and the Haigler Canal State Line Flume were estimated as 10% of the additional diversions at the river headgate.
3. River flows available for diversion at the Pioneer Ditch headgate for delivery at the Haigler Canal State Line Flume were estimated as the historical flow for the North Fork of the Republican River at the Colorado-Nebraska State Line gage minus 7 cfs. The 7 cfs is an approximation of the flow at the State Line that was the result of stream gain that occurred downstream of the Pioneer Ditch headgate and was estimated from an examination of historical streamflow records at the State Line.
4. River flows available for diversion at the Pioneer Ditch headgate include historical flows diverted at the Pioneer Ditch headgate plus the additional water that is now available as the result of the RRWCD WAE's lease of the water rights described in the previous

sections. The historical river flows also include river flows available for diversion at the Pioneer Ditch but not historically diverted. Because the Haigler Canal water right is limited to 29 cfs at the Haigler Canal State Line Flume, river flows available for diversion at the Pioneer Ditch headgate in excess of the amount necessary to provide 29 cfs at the Haigler Canal State Line Flume were not included in the estimate of additional water available at the Haigler Canal State Line Flume. This limitation included the additional flows that were estimated to be available as the result of the RRWCD WAE's lease of the water rights described in previous sections.

5. Diversions of additional river flows were limited to the April 1 – October 31 period.
6. This analysis resulted in an estimate of an average of 2,293 ac-ft/yr of additional water (as measured at the Haigler Canal State Line Flume) that was available for diversion but was not diverted by the Pioneer Ditch as shown in Table 2.
7. An analysis of just the annual average streamflow would indicate that an average of 3,866 ac-ft/yr of additional water was available for diversion at the Pioneer Ditch headgate and that 3,479 ac-ft/yr was potentially available at the Haigler State Line Flume after accounting for a 10% ditch loss (3,479 = 0.9 x 3,866). The estimate developed in the 6 step process described above (2,293 ac-ft/yr) is 1,186 ac-ft/yr lower because the analysis limited deliveries at the Haigler Canal State Line Flume to 29 cfs.

Summary

A summary of the estimated additional water that is now available for irrigation use by landowners within the Pioneer Irrigation District-Nebraska resulting from the RRWCD WAE's lease of the North Fork water rights and water available in the North Fork that was not historically diverted by the Pioneer Ditch is shown in Table 2. As shown in column (3) of Table 2, the historical flows at the Haigler Canal State Line Flume averaged 5,140 ac-ft/yr for the 1998-2007 period.

The additional water that has been made available for irrigation use by landowners within the Pioneer Irrigation District-Nebraska as the result of the RRWCD's lease of the Colorado Pioneer's water right averages 1,907 ac-ft/yr. The additional water that has been made available for irrigation use by landowners within the Pioneer Irrigation District-Nebraska as the result of the RRWCD's lease of the Laird and O'Donnell water rights averaged 1,757 ac-ft/yr. The total amount of water made available from the leased water rights is 3,664 'ac-ft/yr. This additional water is summarized in columns (4) and (5) of Table 2 and is shown graphically in Figure 3

As shown in column (6) of Table 2, there was approximately 2,293 ac-ft/y of additional water (measured at the Haigler Canal State Line Flume) available for diversion from the North Fork of the Republican River that was not historically diverted by the Pioneer Ditch. This additional water is shown graphically in Figure 4. In total, it is estimated there is now approximately 11,097 ac-ft/yr of water available for irrigation use by landowners within the

Pioneer Irrigation District-Nebraska at the Haigler Canal State Line Flume as shown graphically in Figure 5 and in column (7) of Table 2, which is equal to 6.9 ac-ft/acre (6.9 ac-ft/acre = 11,097 ac-ft/yr/1,612 acres).

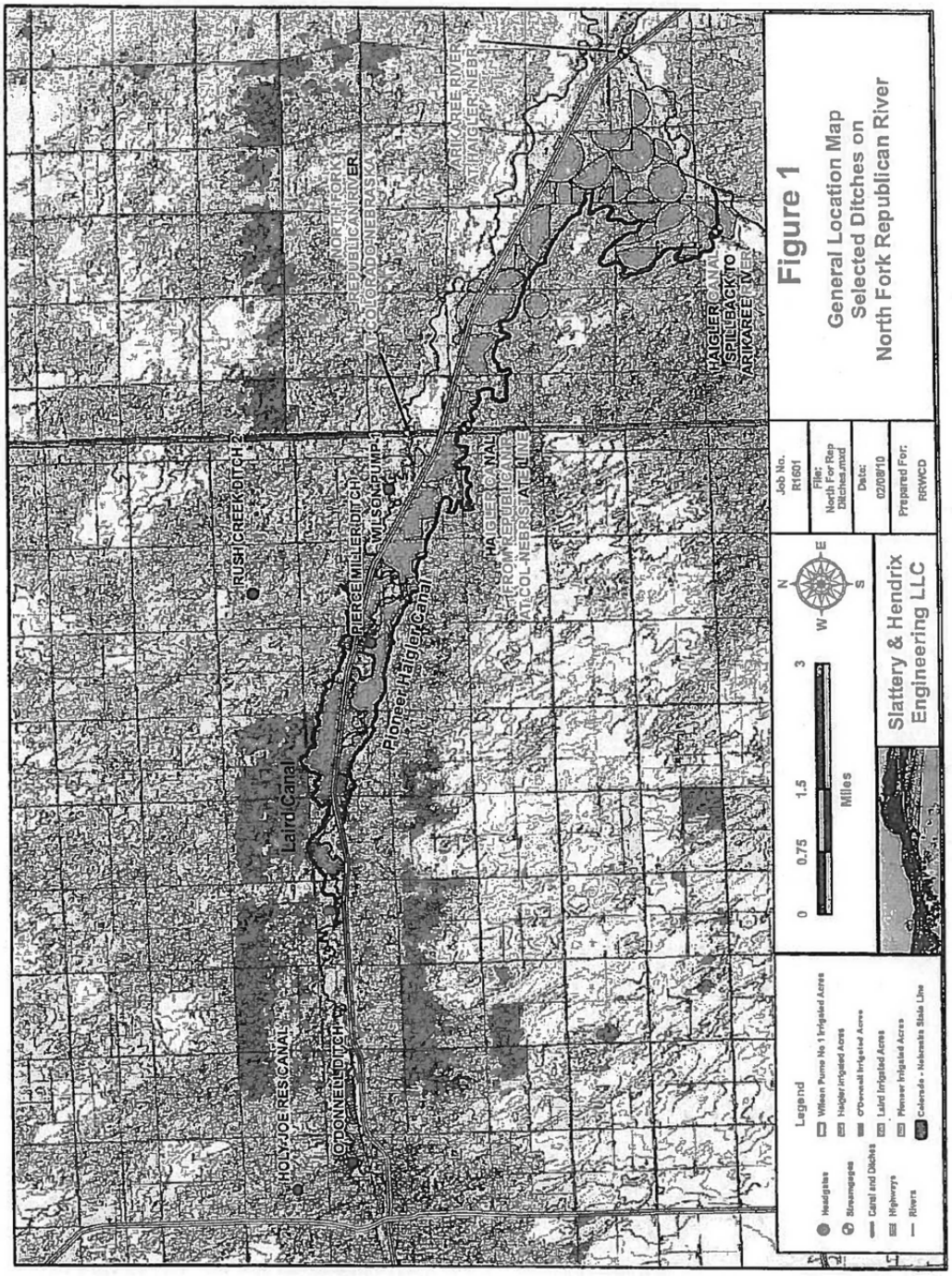


Figure 1
General Location Map
Selected Ditches on
North Fork Republican River
Slattery & Hendrix
Engineering LLC
Job No.
R1601
File:
North For Rep
Ditches.mxd
Date:
02/08/10
Prepared For:
RRWCD
Legend
Headgates
Streamgages
Canal and Ditches
Highways
Rivers
Wilson Pump No 1 Irrigated Acres
Haigler Irrigated Acres
O'Donnell Irrigated Acres
Laird Irrigated Acres
Pioner Irrigated Acres
Colorado - Nebraska State Line
0
0.75
1.5
3
Miles
N
W
E
S
HOLY JOE RES CANAL
O'DONNELL DITCH
Laird Canal
RUSH CREEK DITCH
PIERCE MILLER DITCH
WILSON PUMP
Pioneer Haigler Canal
HAIGLER CANAL
FROM REPUBLICAN
COLORADO-NEBRASKA STATE LINE
NORTH FORK
REPUBLICAN RIVER
ARIKAREE RIVER
HAIGLER CANAL
SPILLBACK TO
ARIKAREE RIVER

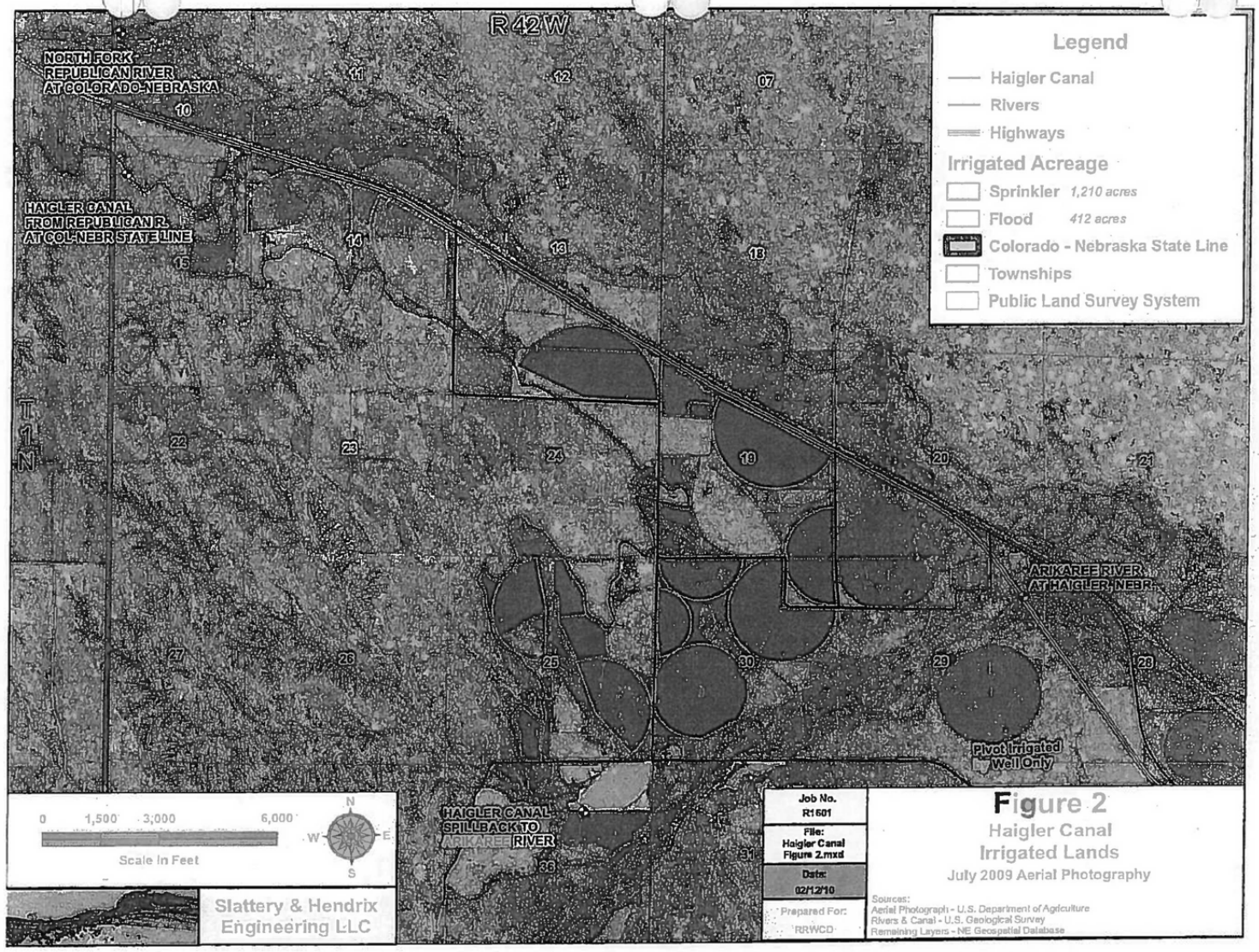

R 42 W
T 1 N
NORTH FORK REPUBLICAN RIVER AT COLORADO-NEBRASKA
HAIGLER CANAL FROM REPUBLICAN R. AT COL-NEBR STATE LINE
HAIGLER CANAL SPILLBACK TO ARIKAREE RIVER
ARIKAREE RIVER AT HAIGLER, NEBR.
Pivot Irrigated Well Only
Legend
Haigler Canal
Rivers
Highways
Irrigated Acreage
Sprinkler 1,210 acres
Flood 412 acres
Colorado - Nebraska State Line
Townships
Public Land Survey System
0 1,500 3,000 6,000
Scale in Feet
N
W
E
S
Slattery & Hendrix Engineering LLC
Job No. R1601
File: Haigler Canal Figure 2.mxd
Date: 02/12/10
Prepared For: RRWCD
Figure 2
Haigler Canal
Irrigated Lands
July 2009 Aerial Photography
Sources:
Aerial Photograph - U.S. Department of Agriculture
Rivers & Canal - U.S. Geological Survey
Remaining Layers - NE Geospatial Database

Table 1

Summary of Historical Diversions Associated with Water Rights Leased by the RRWCD WAE

(units of ac-ft)

Jan-Dec Calendar Year	HOLY JOE RES CANAL	LAIRD DITCH	O'DONNELL DITCH	PIONEER DITCH (Colorado Portion)	Sub-Total for Ditches Upstream of the Pioneer Ditch Headgate	PIERCE MILLER DITCH	RUSH CREEK DITCH 1	RUSH CREEK DITCH 2	Wilson Pump No. 1	Sub-Total for Ditches Downstream of the Pioneer Ditch Headgate	Total for all Ditches
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1998	0	2,179	131	1,527	**3,836**	0	15	0	0	**15**	3,851
1999	0	2,358	83	1,709	**4,151**	0	107	0	0	**107**	4,258
2000	0	2,061	244	2,013	**4,319**	0	182	0	0	**182**	4,501
2001	0	2,182	381	1,719	**4,282**	0	127	0	16	**143**	4,425
2002	0	2,948	345	3,650	**6,943**	0	79	0	26	**105**	7,048
2003	0	1,841	206	2,409	**4,457**	0	83	0	0	**83**	4,540
2004	0	2,303	282	2,071	**4,656**	0	0	89	0	**89**	4,745
2005	0	2,221	169	2,423	**4,813**	0	0	250	27	**277**	5,090
2006	0	1,797	120	2,654	**4,571**	0	0	192	60	**252**	4,823
2007	3	1,693	311	2,512	**4,519**	0	90	7	73	**169**	4,688
Avg	0	2,158	227	2,269	**4,655**	0	68	54	20	**142**	4,797

Source:
1) Colorado DWR HydroBase records.

Table 2

Summary of Water Available to the Haigler Canal at the Stateline Flume

(units of ac-ft)

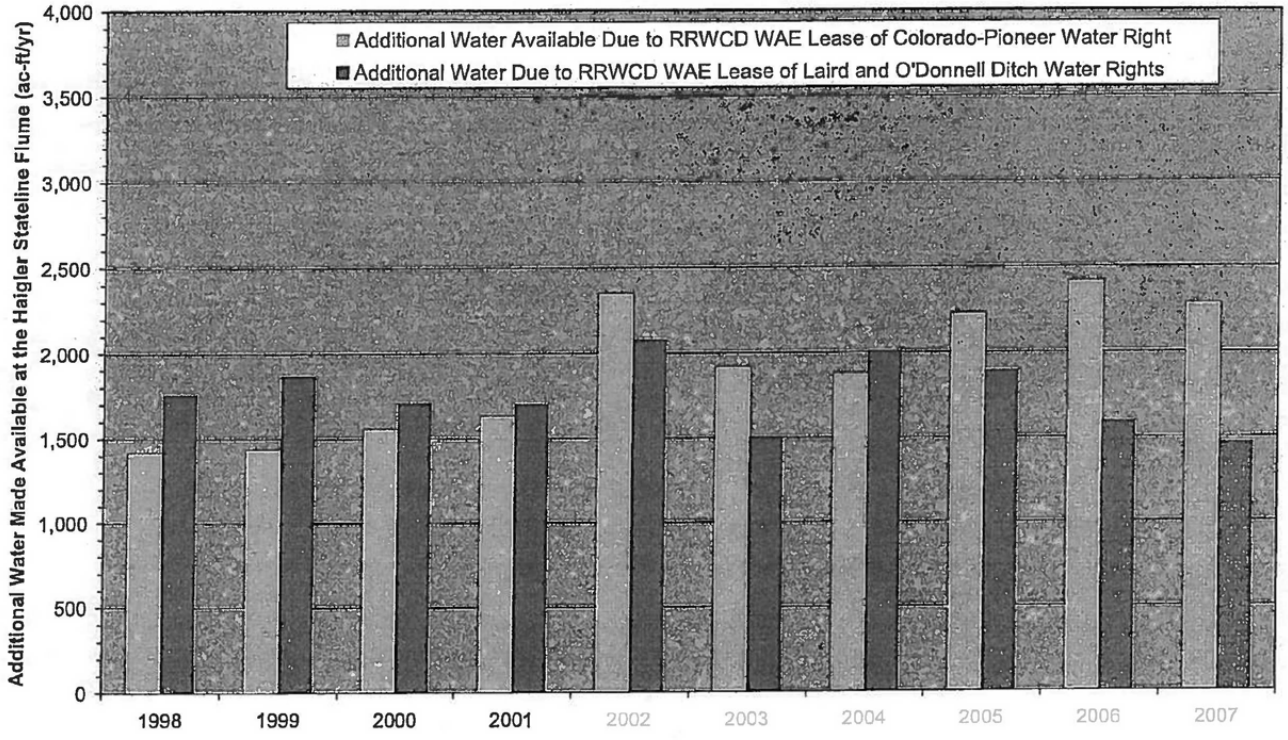
Year	North Fork of the Republican River at Colorado-Nebraska State Line	Haigler Canal Stateline Flume	Additional Water Available Due to RRWCD WAE Lease of Colorado-Pioneer Water Right	Additional Water Due to RRWCD WAE Lease of Laird and O'Donnell Ditch Water Rights	Additional Water Available in North Fork during April - October Irrigation Season	Total Additional Water Available	Total Potential Haigler Canal Diversions
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1998	20,747	6,075	1,414	1,760	2,473	5,647	11,722
1999	21,575	6,469	1,433	1,868	1,748	5,049	11,518
2000	19,430	5,922	1,551	1,706	2,107	5,364	11,287
2001	19,748	4,929	1,626	1,698	3,139	6,463	11,392
2002	15,903	5,910	2,347	2,082	945	5,374	11,284
2003	17,703	4,722	1,911	1,505	2,173	5,589	10,310
2004	19,476	3,737	1,870	2,007	2,791	6,668	10,404
2005	21,068	4,724	2,225	1,890	2,270	6,385	11,108
2006	17,280	4,418	2,413	1,592	2,017	6,022	10,440
2007	20,333	4,494	2,277	1,464	3,268	7,009	11,503
Avg 1998-2007	19,326	5,140	1,907	1,757	2,293	5,957	11,097
2008	21,618	4,744					
2009	24,361	4,229					

Explanation of Columns

(1) Jan-Dec Calendar Year
(2) USGS recorded streamflow records. 2009 data is provisional.
(3) Historical Haigler Canal flows as recorded by the Colorado DWR.
(4) See memorandum text for steps to estimate these value.
(5) See memorandum text for steps to estimate these value.
(6) See memorandum text for steps to estimate these value.
(7) Calculated as the sum of Col(4) + Col(5) + Col(6)
(8) Calculated as the sum of Col(3) + Col(7)

Analysis of Available Pioneer Divs.xls, Table 2, 2/11/2010

Figure 3
Additional Water Available to the Haigler Canal Due to the RRWCD WAE Lease of Water Rights



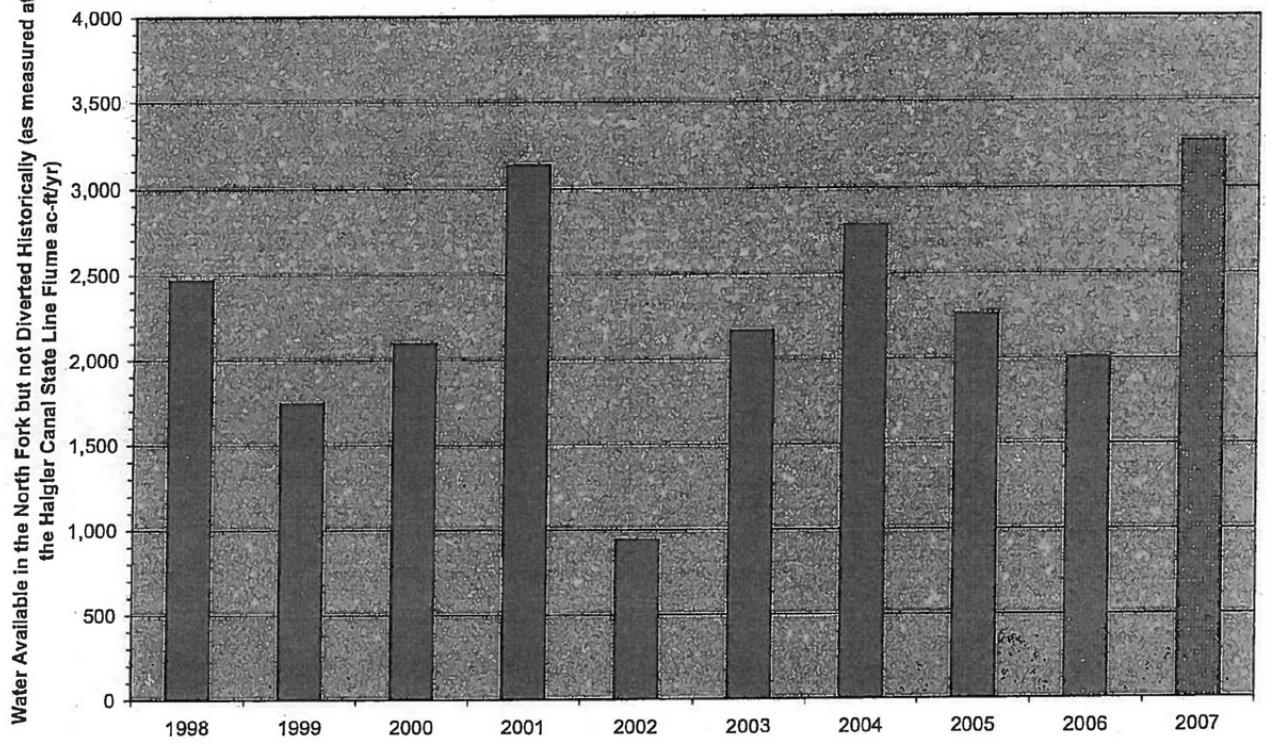
Note: See Table 2 for explanation on how values were estimated.

Analysis of Available Pioneer Divs.xls, Fig 3, 2/11/2010

Figure 4

North Fork of the Republican River

Additional Water Available (as measured at the Haigler Canal State Line Flume)

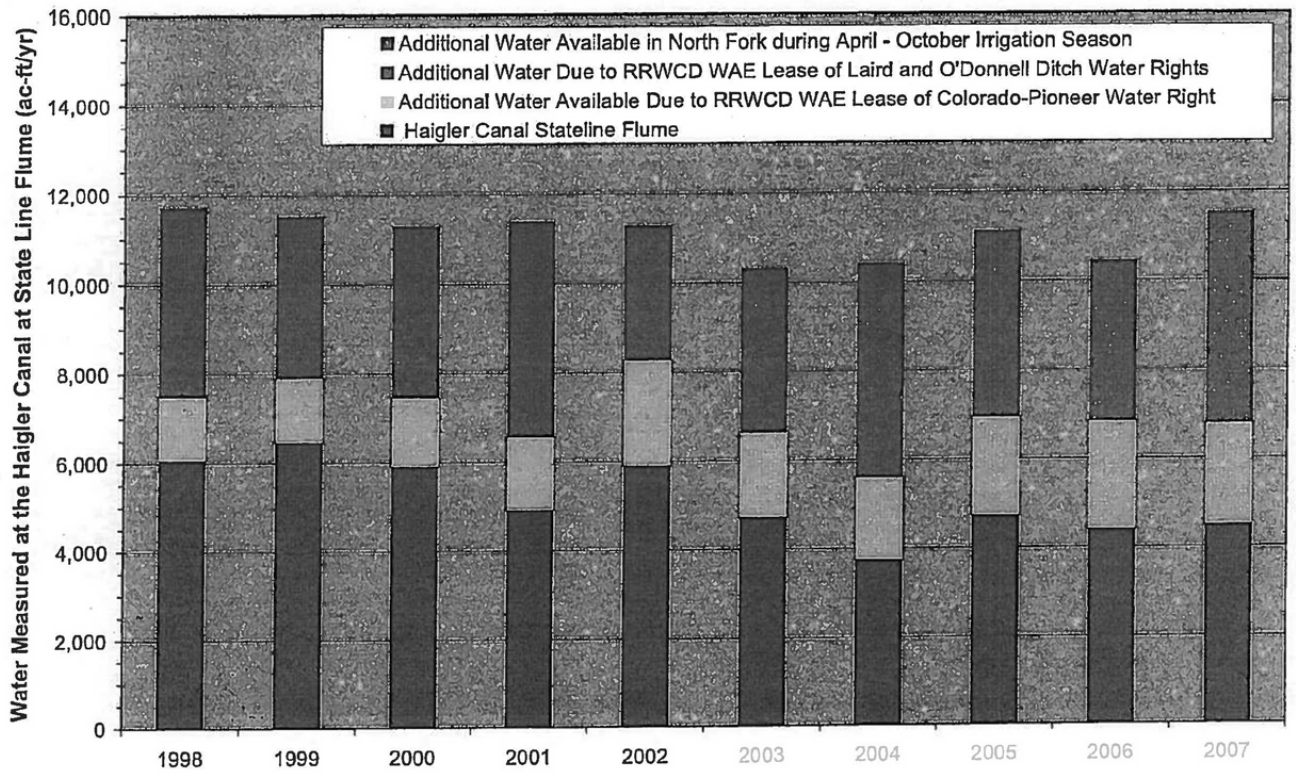


Note: See Table 2 for explanation on how values were estimated.

Analysis of Available Pioneer Divs.xls, Fig 4, 2/11/2010

Figure 5

Water Available for Delivery to the Haigler Canal State Line Flume



Note: See Table 2 for explanation on how values were estimated.

Analysis of Available Pioneer Divs.xls, Fig 5, 2/11/2010

EXHIBIT L

Date: 4/6/2010

To: James E. Slattery and Randy L. Hendrix

Cc: Jim Schneider, Tom Wilmoth

From: David R. Kracman (The Flatwater Group)

RE: Pioneer Irrigation District Supply Availability

The Flatwater Group reviewed the February 11, 2010, memorandum by James Slattery and Randy Hendrix on Haigler Canal's available water supply, and also developed a separate analysis of water supplies in the North Fork. The purpose of this memo is to summarize the review of the Feb. 11, 2010, memorandum, and to outline the findings of the new analysis by TFG on supply availability for the Pioneer Irrigation District in Nebraska.

Review of Slattery and Hendrix, Feb. 11, 2010, Memorandum

The Flatwater Group (TFG) conducted a review of the February 11, 2010, memorandum by Slattery and Hendrix on the available water supply for Haigler Canal. TFG initially attempted to replicate the procedure used in the analysis, and, with a few exceptions, was successful in replicating the results. Later, TFG was provided with the spreadsheets used by Slattery and Hendrix to develop their analysis, which was helpful in identifying the actual procedures and data sources.

Data Sources

There were a few issues related to the data that became apparent in examining the Slattery and Hendrix report:

1. For several time periods, the Slattery and Hendrix used a slightly different procedure for filling in data gaps for provisional records (North Fork Republican River at Colorado-Nebraska Gage 06823000), which led to minor differences in results. Their method involved using a single value for all blank entries in a data gap, whereas TFG used linear interpolation.
2. It appears the "61400 Haigler Canal at State Line (DCP)" gage data from Nebraska DNR used in the Slattery and Hendrix study was offset by a day for all entries from Sept. 30, 2007, to Sept. 30, 2008, probably due to a data gap for the first day in that period. This discrepancy led to small differences in results. Also, Footnote 3 in Table 2 incorrectly indicates that the Haigler Stateline Flume data is from Colorado DWR records (should indicate Nebraska DNR as source, at least through Sept. 30, 2008). For data after Sept. 30, 2008, it appears Slattery and Hendrix used provisional gage data from Colorado DWR for gage PIOSTLCO. However, PIOSTLCO data appears to be missing for the Oct. 1, 2008 to Oct. 28, 2008, period in the Slattery and Hendrix data.

3. Although the data were not used in the Slattery and Hendrix memo, entries for diversions at the Pioneer Ditch headgate appear to be missing for Oct. 1, 2008 to Oct. 16, 2008 in the Slattery and Hendrix spreadsheet.

Otherwise, the data appear to at least approximately match the values obtained by TFG from Colorado DWR online databases.

Approach

With respect to approach, while the Slattery and Hendrix memorandum appears to follow a logical progression, there are concerns that its findings may not capture certain trends and issues related to overall supply availability on the North Fork Republican River. This is due to three primary factors:

1. **Geographical location for supply availability analysis.** For the Slattery and Hendrix memorandum, the focus was on the Haigler Canal gage at the state line. While this point is unquestionably important in determining Compact issues and the protection of Nebraska's Pioneer Irrigation District water right, TFG believes that it is also important to consider the flows in the North Fork River just above the Pioneer Ditch headgate. As will be discussed in the section describing the TFG study, trends in water availability on the North Fork may be masked unless the total river flow is considered.
2. **Time frame for analysis.** While the Slattery and Hendrix memorandum considers the 1998 to 2007 time frame, focusing only on this time period may result in a distorted picture of actual supply availability, and may mask longer-term trends. The TFG analysis considered conditions from 1966 to 2007, which captures a larger period of record.
3. **Time within each year (months) chosen for analysis.** In addition to considering the overall time period (which years to include), it's also important to look at shorter time periods within a year to see if water supply availability may be insufficient during certain critical periods of the growing season (namely July and August). The Slattery and Hendrix report looked at conditions over the entire growing season (April through October), which may prevent the identification of short-term shortages critical to crop development.

Several other differences in approach were identified which, at least on initial inspection, appear to be reasonably minor. The Slattery and Hendrix study made an assumption with respect to Laird Ditch return flows and O'Donnell Ditch operations, in which the return flows for portion of the Laird Ditch service area that drains to the North Fork above the Pioneer Ditch headgate is assumed to be equal to the difference between O'Donnell Ditch diversions and return flows. The TFG approach used O'Donnell Ditch diversion records and estimates of O'Donnell Ditch return flows while assuming all return flows from the Laird Ditch occurred below the Pioneer Ditch. The differences between these two approaches is expected to be minor, and TFG results would be expected to show slightly greater available supplies than the Slattery and Hendrix results based on this element. On a separate issue, the Slattery and Hendrix memorandum estimated 1,612 acres within Nebraska's portion of the Pioneer Irrigation District, while the permitted area in the

district is 1,899 acres. According to Jim Slattery[1], the 1,612 acres figure was based on 2009 aerial photography (included in their memorandum as Figure 2), along with site visits and reference to 2005 aerial photography. The acre number was only used in the last sentence of the memorandum text (Page 6), and appears to have had no impact on the remainder of the report.

TFG Independent Analysis of North Fork Supply Availability

TFG developed its own analysis of the water supply conditions on the North Fork with respect to the Pioneer Ditch. This section describes the procedures and results involved with this analysis.

Data Sources

Whenever possible, the TFG analysis used the same data sources as those used in the Slattery and Hendrix memorandum. The majority of the data was obtained from either the Colorado Decision Support Systems (CDSS) or Colorado's Surface Water Conditions web pages, both managed by the Colorado Division of Water Resources. North Fork state line gage data were obtained from USGS, as was done in the Slattery and Hendrix memorandum.

Approach

The basis of the TFG approach was centered around a generalized water balance, following the representation shown in Figure 1 below. As shown, O'Donnell Ditch and Laird Ditch have diversion points upstream of both the Pioneer Ditch headgates and the primary analysis point. TFG assumed that all Laird Canal return flows would accrue to the river downstream of the Pioneer Ditch headgates. TFG followed the Slattery and Hendrix estimate of 7cfs gain in the reach between the Pioneer Ditch headgate and the state line river gage. Preliminary results indicate that using this 7cfs estimate yields slightly higher estimates of available supply than would be obtained by estimating individual diversions and return flows in this reach.

TFG used the Slattery and Hendrix value of estimated canal losses between the Pioneer Ditch headgates and the state line gage (a 10% canal loss), which is relatively close to (although perhaps less than) a 2 cfs loss estimate[2] provided by Lynn Hohmann at the Pioneer Irrigation District. For O'Donnell Ditch, return flows were estimated as 40% of diversions, which is the percentage set for non-federal canals in the RRCA Accounting Procedures[3]. Return flows from Laird Ditch and Colorado's portion of the Pioneer Ditch were assumed to be part of the 7cfs gain estimate.

[1] March 25, 2010, phone call with Jim Slattery.
[2] Lynn Hohmann (Pioneer Irrigation District), phone conversation, Feb. 4, 2010.
[3] RRCA Accounting Procedures, Page 20.

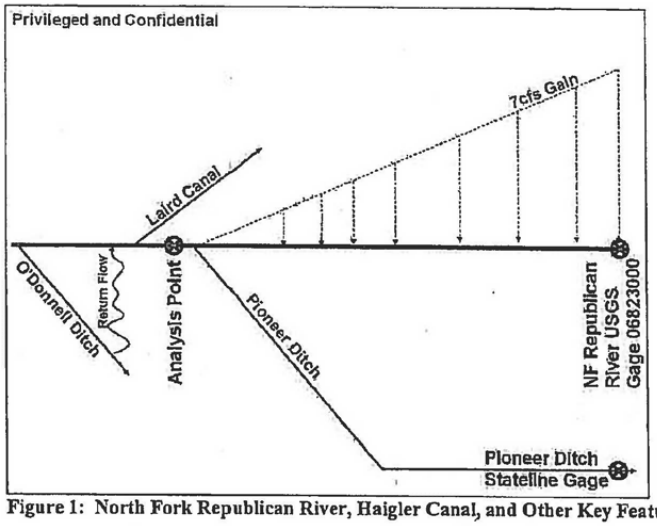


Figure 1: North Fork Republican River, Haigler Canal, and Other Key Features

The first step in determining flows at the analysis point involved estimating historical flows. The equation representing historical conditions is shown below.

> Historic Flow at Analysis Point = NF Republican River Gage 0682300 + Pioneer Ditch Diversions – 7cfs Gains

To estimate flows at the analysis points under conditions where the O'Donnell Ditch and Laird Canal were not operating (lease conditions), the formula was changed as follows:

> "Lease Conditions" Flow at Analysis Point = Historic Flow at Analysis Point + O'Donnell Ditch Diversions – O'Donnell Ditch Return Flows + Laird Canal Diversions

In addition, a constraint was applied on the equations so that the calculated historic flow at the analysis point could never be less than the amount of water diverted at the Pioneer Ditch headgates, or less than zero.

Once the flows at the analysis point were determined, the flow available for diversion was estimated by capping the maximum possible diversion at the 29 cfs level, adjusted for the 10% canal loss from the headgates to the state line – resulting in a maximum possible diversion at the headgates of about 32 cfs. These maximum "divertible" flows at the headgates were calculated for both historic and "lease" conditions.

Results

The results of this analysis are shown in Figures 2 through 4 below.

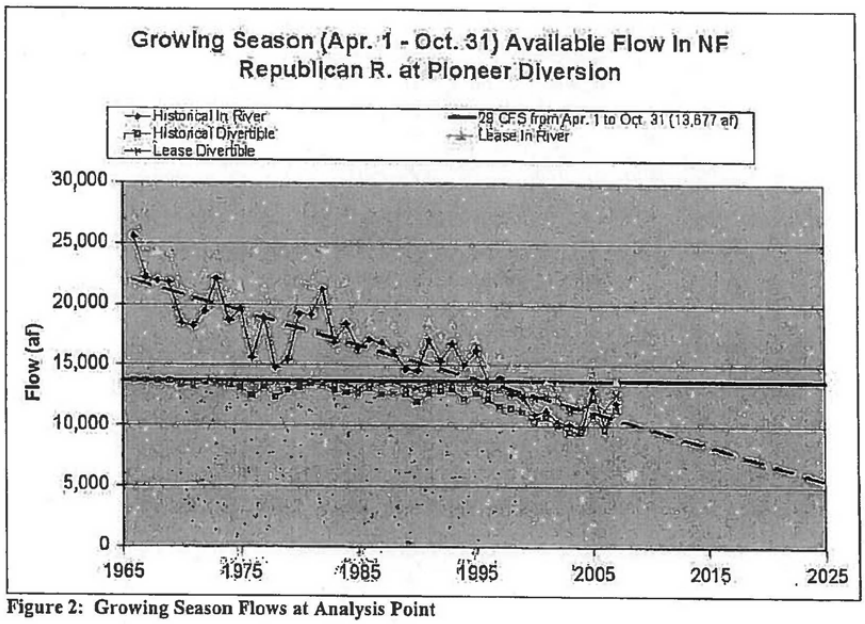


Figure 2: Growing Season Flows at Analysis Point

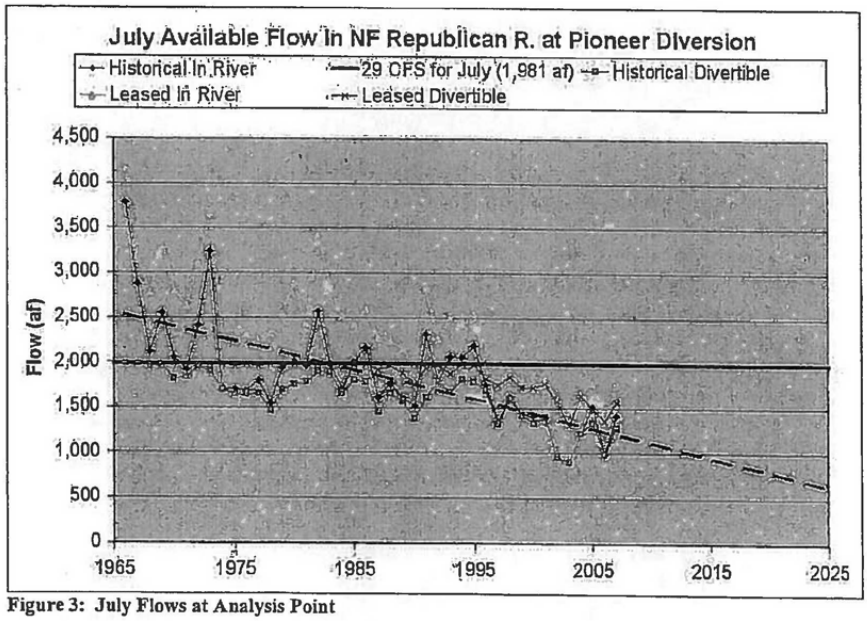


Figure 3: July Flows at Analysis Point

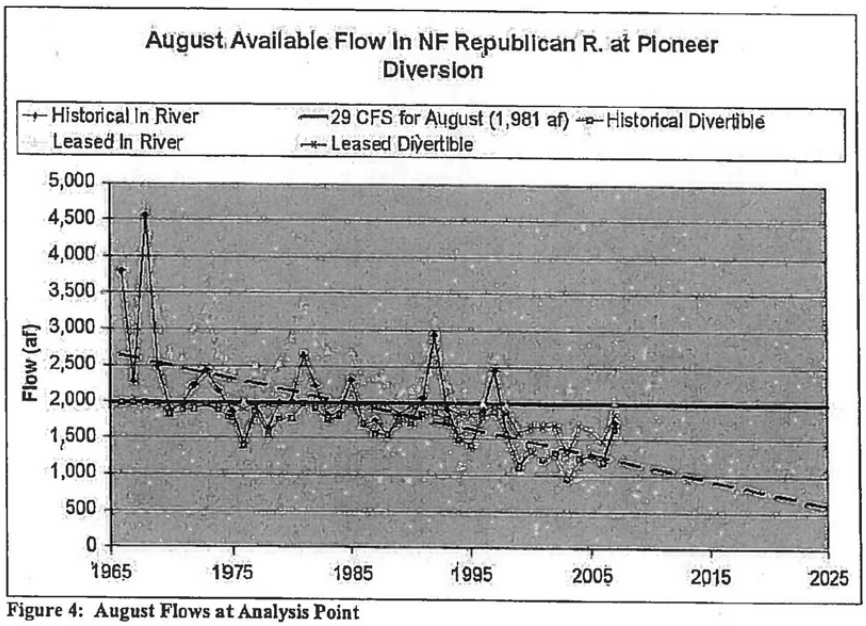


Figure 4: August Flows at Analysis Point

Figures 2 through 4 show the estimated flows at the analysis point (just upstream of the Pioneer Ditch headgates) under both historic and "lease" conditions for the growing season, July, and August, respectively. The trend lines (dashed straight lines) for all three figures are based on the historical flow in the river (blue line). The straight horizontal red lines in the figures indicate the cumulative flow in acre-feet that would need to be diverted to meet the 29 cfs requirement at the canal's state line gage (equivalent to 32.22 cfs at the headgates, as explained above). Several key findings are apparent from the results:

1. Available flows for all three time periods (growing season, July, August) are at or below the levels required to meet Nebraska's 29 cfs water right for the most recent year (2007), and the trend in all cases is decreasing. This applies to both estimated historic conditions and estimated conditions if the additional supplies gained through Colorado's lease arrangements were available for diversion.

2. Available flows for the critical months of July and August are more scarce than during the overall growing season.

3. The trend in available flows during the 1998 to 2007 period (the period analyzed in the Slattery and Hendrix memorandum) is not as easy to identify as is the trend for the longer-term period shown in the graphs above. By focusing on the shorter, more recent time period, the long-term decrease in supply availability may have been more difficult to detect in the Slattery and Hendrix memorandum.

4. Actual divertible flows, which used to generally remain near the 29 cfs level, have begun to decrease since the mid to late 1990s. This is an important point, in that while available flows in the river previously were great enough to usually meet the 29 cfs requirement, they have recently begun to drop below the 29 cfs threshold, making it impossible to fully divert at the water right level.

5. The trend in available flows is consistently decreasing, despite a modest increase for the most recent analyzed year (2007). This would suggest a likelihood of worsening flow conditions and increased water scarcity for Pioneer Irrigation District in the future – even with the additional supplies obtained by Colorado through the lease arrangements.

EXHIBIT 2

EXHIBIT 2

Exhibit 2: Changes to the Accounting Procedures

III A 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." This will be the same "no NE import" run used to determine groundwater Computed Beneficial Consumptive Uses for each State.

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.

III 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~~no NE import" 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", with the exception that surface water recharge associated with Nebraska's Imported Water Supply shall be turned "off.".

The "no State pumping" run shall be the run with the same model inputs as the ~~base~~"no NE import" 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~~no NE import" 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.

*Taken from the August 12, 2010 Accounting Procedures