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Non-binding Arbitrations Before
Jeffrey C. Fereday, Arbitrator

Initiated Pursuant to Final Settlement Stipulation
Kansas v. Nebraska & Colorado
No. 126, Orig., U.S. Supreme Court
Decree of May 29, 2003, 538 U.S. 720

Nebraska's Alternative Water Short Year Plan
(Arbitration Initiated February 8, 2013)

and

Nebraska's Rock Creek Augmentation Plan
(Arbitration Initiated March 21, 2013)

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**PRE-FILED TESTIMONY OF KANSAS EXPERT
DALE E. BOOK, P.E.**

August 21, 2013

1 **Q: What is your current professional position?**

2 **A:** I am currently employed as a Principal Engineer with the consulting firm of
3 Spronk Water Engineers, Inc., located in Denver, Colorado. I am president of the
4 firm. The firm provides consulting services in the areas of water resources, water
5 rights engineering and water supply planning. I have been with the firm since its
6 inception in 1984. Ex. WSY/RC_K4 is my curriculum vitae.

7 **Q: Please describe your education and professional experience as it relates to**
8 **the matters in this hearing.**

9 **A:** I have a bachelor's and master's degree in civil engineering, with a specialty in
10 water resources. My master's degree was obtained in 1980. I have been a
11 consulting engineer specializing in water resources and water rights for more
12 than 30 years.

13 **Q: Would you summarize your experience as a water resources engineer?**

14 **A:** My experience has been related to water supply development within the prior
15 appropriation system, primarily in the western United States. Areas of
16 specialization include quantification of water supply, water use demands,
17 irrigation engineering, including crop demand, irrigation systems evaluation and
18 management. Our clients include municipalities, irrigation districts, state
19 agencies and private water users. Our work includes collection and processing
20 hydrologic data and river basin modeling. An important element of this work is to
21 assess impacts of water use on streamflow and available water supply.

22 **Q: Would you generally describe water rights engineering?**

23 **A:** Water rights engineering involves determination of available water supply
24 distributed pursuant to water rights and requires knowledge and analysis of

1 hydrology, water demands, water use structures and consumption of water.
2 Analyses typically involve determination of yields over a range of water supply.
3 An important aspect is to assess impacts of changes of water rights on the
4 stream system and other water users. Water rights engineering requires an
5 understanding of administration of water under the prior appropriation system.
6 The administration of interstate compacts is a specialized area of water rights,
7 involving allocation of water supplies over ranges of conditions and water use
8 accounting.

9 **Q: Would you summarize your technical background as it relates to this**
10 **matter?**

11 A: My technical experience is specialized in issues related to water resources
12 engineering, including water supply, river basin analysis, stream-aquifer
13 interaction, reservoir operations, hydrology and irrigation. I am experienced in
14 the development and use of river basin and groundwater models. I also have
15 experience with irrigation management and crop consumptive use, which is the
16 primary form of water use in the Republican River Basin.

17 **Q: In which states have you worked in on such matters?**

18 A: I have worked in other river basins in Colorado, Kansas, New Mexico, Montana,
19 Wyoming, Idaho, and Oregon.

20 **Q: Have you testified previously as an expert?**

21 A: Yes, I have. I have testified in various district water courts in the State of
22 Colorado as an expert witness in water resources and water rights engineering.
23 My experience has been related to water rights applications and changes and

1 plans for augmentation. I have also testified before the U.S. Supreme Court in
2 the cases of *Kansas v. Colorado*, No. 105, Original and *Kansas v. Nebraska &*
3 *Colorado*, No. 126, Original. I am scheduled to testify in the Supreme Court case
4 of *Montana v. Wyoming*, No. 137 Original, set for trial in October of this year.

5 **Q: In what areas have you been accepted as an expert in those proceedings?**

6 A: I have testified as an expert in the areas of water resources engineering, water
7 rights, hydrology, river basin hydrologic modeling, and irrigation engineering.

8 **Q: Would you please describe your experience working on matters in the**
9 **Republican River Basin?**

10 A: Since 1994, I have assisted the State of Kansas as a consultant on matters
11 related to the Republican River Compact. I have conducted various
12 investigations related to compact compliance issues as they evolved over the
13 years, since 1994. I participated in the proceedings and settlement negotiations
14 in *Kansas v. Nebraska & Colorado* which resulted in the Final Settlement
15 Stipulation ("FSS"). I was a member of the technical committee that developed
16 the RRCA Groundwater Model (Model) used for annual compact accounting. I
17 participated in the negotiations that developed the FSS and the RRCA
18 Accounting Procedures contained in Appendix C of the FSS. Since the entry of
19 the Court's Decree approving the FSS I have continued to assist the State of
20 Kansas in evaluations of compliance with the FSS as it related to the uses both
21 in Nebraska and Colorado. I have provided expert witness testimony in *Kansas*
22 *v. Nebraska & Colorado*, No. 126 Original, which went to trial before the Special

1 Master for the Supreme Court in 2012. I also provided expert witness testimony
2 in the two previous arbitration cases conducted pursuant to the FSS.

3 **Q: Are you familiar with stream augmentation plans through your work?**

4 A: Yes, the development and implementation of stream augmentation as a
5 management tool for water rights administration is common in the State of
6 Colorado as a means to facilitate new development of water supply in basins that
7 are normally fully appropriated. Such use is generally facilitated by changes of
8 existing water rights or importation of water from outside of the basin.
9 Augmentation plans provide replacement supplies to the stream to facilitate
10 diversion or groundwater pumping for new uses.

11 **Q: Have you worked with augmentation plans?**

12 A: Yes; a significant aspect of the work by our firm in Colorado is the development
13 and implementation of augmentation plans. This often involves the analysis of
14 stream depletions caused by groundwater pumping and quantification of the
15 replacement supply, based on changes of use and physical availability.

16 **Q: Are there similarities between augmentation plans you have worked on and
17 a Plan to assist with compact compliance pursuant to the FSS?**

18 A: Yes; the principles are similar. A water supply is provided that is not otherwise
19 available to supplement streamflow and offset stream depletions caused by the
20 project proponent. This is, in effect, a replacement supply of water. Such plans
21 require measurement and accounting to ensure that the replacement is sufficient.
22 For a plan to operate successfully, the replacement supply must be managed to
23 offset the impacts being replaced. An important aspect of such plans is

1 documentation and monitoring the operation of deliveries and quantification of
2 credit. The plans anticipated under the FSS would most likely rely on
3 groundwater pumped to the stream. In the case of the FSS, it is necessary to
4 integrate the augmentation supply into the compact accounting for water supply,
5 allocation and use.

6 **Offer As An Expert**

7 The State of Kansas offers Mr. Book as an expert in the areas of water resources
8 engineering, water rights engineering, hydrology, hydrologic modeling and
9 irrigation engineering.

10 **Q: What was your general assignment from Kansas for this project?**

11 A: I was asked to review the proposal from the State of Nebraska to the RRCA for
12 approval of an augmentation plan, referred to as the Rock Creek Augmentation
13 Project. Based on my familiarity with the Republican River Compact, the FSS
14 and the Accounting Procedures, and augmentation plans in general, I was
15 requested to evaluate whether the Rock Creek Project conformed with the
16 provisions of the FSS and to develop opinions concerning the adequacy of the
17 proposal.

18 **Q: Would you describe your review and analysis?**

19 A: I reviewed the documents submitted by Nebraska related to the Project, including
20 records of pumping, data for streamflows on Rock Creek and the Republican
21 River and modeling results. I also reviewed Nebraska's and Colorado's expert
22 reports on the Rock Creek Augmentation Project.

1 **Q: What is an augmentation plan, in the context of the Republican River**
2 **Compact?**

3 A: Under the provision of subsection III.B.1.k of the FSS, augmentation plans are
4 described as wells acquired or constructed by a state for the sole purpose of
5 offsetting stream depletions in order to comply with its compact allocations. Such
6 Plans are to be approved by the RRCA.

7 **Q: Would you provide a brief description of the Rock Creek Augmentation**
8 **Project?**

9 A: This plan will pump from a group of wells located in Dundy County, Nebraska, in
10 the Upper Republican Natural Resources District. There are presently 10 wells
11 which were drilled for this plan, replacing 24 existing irrigation wells. The wells
12 will discharge through a pipeline to Rock Creek at a location approximately 11
13 stream miles upstream of the Republican River.

14 **Q: What elements of the Plan did you review for this analysis?**

15 A: I reviewed the proposal to the RRCA for two specific elements required by the
16 FSS for augmentation plans. The first is the limitation on such plans which rely
17 on groundwater pumping to not cause new net depletions. The second is the
18 provision related to the determination of the credit for compact accounting to be
19 derived from augmentation pumping.

20 **Q: Did you prepare a report for this proceeding?**

21 A: Yes; I prepared a report, submitted on July 1, 2013 (Ex. WSY/RC_K5).

22 **Q: Would you describe generally the content of the report?**

1 A: The report includes an introductory section, a summary of my opinions
2 concerning this plan, and a summary of my experience and qualifications. The
3 report also contains sections describing the project features and hydrologic data,
4 the bases for my opinions concerning limitations on augmentation pumping and
5 determination of the augmentation credit. A discussion of terms and conditions
6 recommended for the plan is also included.

7 **Q: Why are changes to Compact Accounting Procedures necessary for an**
8 **augmentation plan?**

9 A: An augmentation plan is intended to produce supplemental streamflow from a
10 source that would not otherwise contribute to streamflow to offset depletions
11 charged against a State's compact allocation. A plan relying on groundwater
12 produces new streamflow by removing water from aquifer storage and
13 discharging to the stream system. Because the pumping is from the aquifer
14 hydraulically connected to the streams, streamflow depletion also results from
15 the pumping, but normally at a rate less than the pumping rate. Therefore, it is
16 appropriate to include augmentation supply, to the extent it adds to streamflow,
17 as a credit in the compact accounting for the water supply of the basin, so long
18 as the depletive pumping effects are also included as stream depletions charged
19 against the compact allocation.

20 **Q: What are the important aspects of an Augmentation Plan for purposes of**
21 **your evaluation?**

22 A: An Augmentation Plan pursuant to the FSS was expected to consist of wells
23 pumping groundwater to the stream. Either new or existing wells would

1 discharge to a stream to produce streamflow not otherwise available. The
2 amount of pumping allowed for a plan would be attributed to an existing use that
3 would be retired. The credit for discharges would be determined in a manner that
4 would account for losses to the aquifer or by evapotranspiration (ET), such that
5 the credit would reflect actual contributions to streamflow. Since the locations of
6 augmentation pumping projects were not known at the time of the FSS, the
7 details of crediting were assigned to the RRCA.

8 **Q: Why is it inappropriate to provide credit for all of the water discharged from**
9 **the augmentation pipeline?**

10 A: The contribution to streamflow will reflect loss in the stream system, referred to
11 as transit loss. It is necessary to account for this reduction of surface water flow
12 when determining the credit for the compact accounting.

13 **Q: Would you provide an overview of your opinions regarding the**
14 **augmentation Plan, as proposed by the State of Nebraska?**

15 A: 1.) The Plan does not have a limitation on the amount to be pumped. The
16 amount of pumping by the Plan should be limited generally to prevent enlarged
17 stream depletions caused by the pumping, when compared to the depletions for
18 existing irrigation wells to be retired. 2.) The credit received for the
19 augmentation discharge should account for transit losses downstream. This is
20 most appropriately done with the Model in a manner consistent with the
21 quantification of pumping and imported water supply credits. 3.) The Plan
22 should include terms and conditions specifying how the Plan will be incorporated

1 into the accounting and operated pursuant to the FSS. These opinions are
2 stated with more detail on page 2 of my report.

3 **Q: Would you summarize the significant elements of the Rock Creek**
4 **Augmentation Plan?**

5 A: The Plan consists of 10 wells, which were drilled to replace 24 wells used for
6 irrigation. The wells were used for irrigation on 3,262 certified acres. The District
7 has since acquired an additional 1,900 acres of irrigated land to include in the
8 project. The additional wells and acreage were not part of the submittal for
9 RRCA review. The wells will pump into a pipeline which discharges to Rock
10 Creek. The pumping rate has been approximately 28 cfs. The reported capacity
11 of the project to pump is 20,000 acre-feet/yr.

12 **Q: Would you describe the availability of streamflow records in the vicinity of**
13 **the project?**

14 A: There are two USGS streamflow gages that are considered to be in significant
15 locations for consideration of this project. The first is located on Rock Creek near
16 the confluence with the Republican River, approximately 11 stream miles
17 downstream of the pipeline discharge location. Prior to the start of the pumping
18 this gage was flowing approximately 7 cfs. A stream gage on the Republican
19 River is located downstream of Rock Creek at Stratton, just upstream of
20 Swanson Reservoir. The data are summarized in my report in Tables 2, 3 and
21 Figure 4 and 5.

22 **Q: What information about the irrigation wells was provided by Nebraska for**
23 **this plan?**

1 A: Nebraska provided a map and listing of the wells and documented pumping from
2 the wells used to irrigate 3,262 acres. They provided pumping figures dating
3 from 1985. The average pumping for the period 1985 – 2010 was 4,150 acre-
4 feet/yr. (See Table 1 and Figures 2 and 3 of my report.)

5 **Q: Has Nebraska proposed a limitation on the amount of water to be pumped**
6 **for this plan?**

7 A: No. The Plan does not include a limit on the amount that could be pumped for
8 augmentation credit.

9 **Q: Would you describe Nebraska’s proposal to address the provision in the**
10 **FSS prohibiting new net depletions?**

11 A: The Plan includes a provision to allocate a portion of the pumping to replace any
12 increase in pumping depletions computed for the plan, described as maintenance
13 pumping. The Plan includes a provision to compare actual pumping and
14 depletions to a calculation of pumping and associated stream depletions if
15 irrigation were continued. Any increase in stream depletions would be
16 considered offset by a fraction of the amount pumped.

17 **Q: What is the effect of this method of accounting for pumping?**

18 A: This operation could result in increased pumping and stream depletion since the
19 amount discharged would always exceed the rate of stream depletion while
20 pumping is occurring. The Plan would also require continuous pumping at a
21 computed level to replace increased stream depletions when the wells were not
22 being used for compact compliance.

1 **Q: Does this method of operation and accounting result in a limitation on the**
2 **amount of pumping by the Plan?**

3 A: No; the result of this operation would be a level of pumping from the wells that
4 would not be limited, except for the capacity of the project, and that lack of a limit
5 would facilitate enlarged use.

6 **Q: Is this method of operation and accounting consistent with the FSS?**

7 A: No; this method of operation and accounting is not consistent with the limitations
8 expressed in the FSS.

9 **Q: Why not?**

10 A: Augmentation pumping will produce more water than the stream depletion while
11 pumping occurs. Therefore, assignment of a portion of the pumping and
12 continuous maintenance pumping would facilitate enlarged pumping and
13 associated stream depletions. This interpretation would make Subsection
14 III.B.1.k of the FSS ineffective in implementation of the moratorium on new wells.

15 **Q: Are there provisions of the FSS that support your conclusions?**

16 A: Yes; there are two provisions; 1.) New net depletions are prohibited either
17 annually or over the long term. Augmentation pumping will exceed the stream
18 depletion while pumping, but not after pumping ends. 2.) Augmentation wells are
19 acquired or constructed for the sole purpose of compliance with the compact
20 allocations which does not include replacing the project's enlarged depletions.

21 **Q: Does the Nebraska proposal result in any limitation on pumping for this**
22 **Plan?**

1 A: No; the logical conclusion of this method of operation and accounting is that
2 there would be no limit on an augmentation plan's pumping other than the
3 physical capacity of the project.

4 **Q: Does the FSS require that some limit be applied to augmentation pumping?**

5 A: Yes; the limitation to no new net depletions is a limitation on new well
6 development that is dedicated to the purpose of augmentation pumping. The
7 limitation to depletions instead of consumptive use is a reflection of the fact that
8 the augmentation wells could be relocated from the original wells to a degree that
9 would change the amount of depletion associated with the augmentation
10 pumping. However, the limitation of augmentation pumping to the historical
11 pumping level is a simpler means to accomplish the same result.

12 **Q: Has there been any serious disagreement among the States on this matter
13 until this proposal was submitted by Nebraska in 2013?**

14 A: No; the states appeared to be in agreement on the matter throughout the period
15 from 2008 – 2011. Initially, Colorado developed a proposal for an augmentation
16 plan on the North Fork of the Republican River that was submitted to the RRCA
17 for action. The amount of that Colorado plan was based on the net amount of
18 pumping for the wells irrigating land to be retired. The Colorado plan submittal
19 included a "historical use" analysis (Ex. WSY/RC_K18). The State of Nebraska
20 reviewed the analysis and provided comments noting that the quantification was
21 overstated. Colorado subsequently reduced the quantification as a result of the
22 Nebraska expert critique (Ex. WSY/RC_K19). Kansas engineers also reviewed
23 the quantification and accepted the original analysis without comment. At the

1 time of the 2009 arbitration proceedings concerning Nebraska compliance,
2 Nebraska's report noted that Nebraska was undertaking investigations to develop
3 plans to achieve compact compliance, and one of the alternatives being
4 considered was augmentation. A study of augmentation was described in the
5 2009 report with four objectives, which included identifying "existing uses that
6 could be retired to comply with the FSS's terms regarding augmentation." Ex.
7 WSY/RC_K20, pg.15.

8 **Q: How does the Nebraska proposal deviate from this requirement?**

9 A: The requirement for maintenance pumping to be continuous for the Rock Creek
10 Augmentation Plan would provide water to offset any enlarged depletions at the
11 time of pumping. However, a general characteristic of augmentation pumping is
12 that depletions after the cessation of pumping remain and must be addressed as
13 an element of a complete plan. At a minimum, the sustainability of the plan
14 would need to be evaluated and it would be necessary to provide another source
15 of supply to offset the ongoing effects. The Rock Creek Augmentation Plan
16 proposal implies that any ongoing depletions would either be so far into the future
17 as to not warrant addressing in this plan or that the augmentation pumping would
18 be expanded as necessary in the future. However, neither of these options are
19 consistent with the exception to the moratorium for augmentation pumping, which
20 precludes enlarged depletions due to pumping.

21 **Q: What is a practical way to implement the FSS provision in conjunction with**
22 **an augmentation project such as this?**

1 A: Where pumping and depletions are to be limited to prevent expanded use, a
2 historical use quantification provides a reasonable and commonly adopted
3 methodology. Limiting the pumping to historical levels would reasonably satisfy
4 this condition.

5 **Q: Did you provide an opinion regarding the determination of augmentation**
6 **credit?**

7 A: Yes; this is described on pages 6 – 7 of my July 1 report.

8 **Q: What is your opinion concerning Nebraska's proposal for determining the**
9 **augmentation credit for the accounting?**

10 A: The proposal to receive a credit for 100% of the discharge from the pipeline will
11 result in credit for more than the amount of increased streamflow. This excessive
12 credit will result because some of the pipeline discharge will infiltrate to the
13 aquifer or be consumed by ET. It is necessary to consider these losses when
14 providing credit for the augmentation water in the accounting.

15 **Q: How should this be accomplished?**

16 A: The Model should be used to determine the impact of discharging the
17 augmentation water at the current discharge point on Rock Creek. This would
18 consider flows on Rock Creek and on the mainstem of the Republican River
19 down to Swanson Reservoir. The most reasonable way to account for this is to
20 analyze the credit with the Model.

21 **Q: Is there a provision in the FSS related to this issue?**

22 A: Yes; The provision that determination of augmentation credit be determined with
23 the Model is applicable to this issue.

1 **Q: What would be the effect of allowing credit for all of the augmentation**
2 **discharge in the compact accounting?**

3 A: This would result in credit for offset of stream depletions and consumptive use
4 that would include, in part, ET and accrual to aquifer storage. These are
5 processes that do not count as stream depletion when the impacts of pumping
6 are computed with the Model.

7 **Q: Would you summarize your opinion concerning the need for terms and**
8 **conditions in the Plan review process?**

9 A: The action to be taken on the Plan should include terms and conditions sufficient
10 to provide for the implementation of the provisions developed to comply with the
11 requirements of the FSS. These would include provisions for measurement and
12 reporting the pumping, augmentation discharge, how actual pumping would be
13 compared to a historical level of pumping. The terms would also specify the
14 procedure to determine the augmentation credit with the Model as part of the
15 annual compact accounting.

Pursuant to 28 U.S.C. §1746, I declare under penalty of perjury that the foregoing is true and correct.

Executed on August 19, 2013.


