No. 105, Original

In The

Supreme Court of the United States

STATE OF KANSAS,

Plaintiff,

v.

STATE OF COLORADO,

Defendant,

UNITED STATES OF AMERICA,

Defendant-Intervenor.

On Exceptions To The Report Of The Special Master

COLORADO'S EXCEPTIONS TO THE THIRD REPORT OF THE SPECIAL MASTER AND BRIEF IN SUPPORT THEREOF

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COLORADO'S EXCEPTIONS TO THE THIRD REPORT OF THE SPECIAL MASTER

The State of Colorado respectfully files the following exceptions to the Third Report of Special Master Arthur L. Littleworth dated August 2000:

1. Colorado excepts to the Special Master's recommendation that a monetary remedy for violations of the Arkansas River Compact should include losses suffered by individual water users in Kansas.

2. Colorado excepts to the Special Master's recommendation that the unliquidated nature of Kansas' claim

for damages should not limit an award of prejudgment interest.

3. Colorado excepts to the Special Master's recommendation that Kansas' damages should include prejudgment interest at the rates proposed by Kansas and that prejudgment interest should be awarded from 1969 to the date of the judgment.

4. Colorado excepts to the Special Master's recommendation that damages for crop production losses on surface water only lands in Kansas should be based on the crop yield-evapotranspiration relationships used by the Kansas experts.

Respectfully submitted,

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QUESTIONS PRESENTED

The State of Colorado will address the following issues:

1. Whether the Special Master erred in recommending that money damages awarded to the State of Kansas for violations of the Arkansas River Compact should include losses suffered by individual water users in Kansas.

2. Whether the Special Master erred in failing to consider extenuating factors in determining the amount of damages that should be awarded for violation of the Arkansas River Compact.

3. Whether the Special Master erred in recommending that prejudgment interest should be awarded on unliquidated damages; or, if prejudgment interest is awarded, whether the Master properly considered factors that should limit an award of prejudgment interest.

4. Whether the Special Master erred in recommending that prejudgment interest should be awarded on damages suffered by individuals in Kansas at the interest rates paid by those individuals, rather than the interest rates received by the State of Kansas.

5. Whether the Special Master erred in accepting the crop production losses estimated by the Kansas experts to determine damages.

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BRIEF IN SUPPORT OF COLORADO'S EXCEPTIONS TO THE THIRD REPORT OF THE SPECIAL MASTER

The State of Colorado submits this brief in support of its exceptions to the Third Report of Arthur L. Littleworth, Special Master.

JURISDICTION

The Court has original jurisdiction of this case under Article III, Section 2, of the United States Constitution and 28 U.S.C. § 1251(a).

STATEMENT OF THE CASE

This original action is before the Court on exceptions to the Third Report of Special Master Arthur L. Littleworth, which contains his recommendations on a remedy for depletions to usable Stateline flows in violation of the Arkansas River Compact.

1. Summary Of The Prior Proceedings

The State of Kansas brought this original action against the State of Colorado to resolve disputes under the Arkansas River Compact, Act of May 31, 1949, ch. 155, 63 Stat. 145 (1949) ("Compact"). This Court granted Kansas leave to file its complaint, *Kansas v. Colorado*, 475 U.S. 1079 (1986), and later appointed Arthur L. Littleworth as the Special Master. 484 U.S. 910 (1987). The Master conducted a trial limited to questions of liability

and submitted a report recommending that the Court find that post-Compact well pumping in Colorado had violated Article IV-D of the Compact. This Court overruled the exceptions of both Kansas and Colorado to the Master's first report and remanded the case to the Master for determination of unresolved issues in a manner not inconsistent with the opinion. 514 U.S. 673 (1995).

The Master submitted a second report in September 1997, in which he quantified depletions to usable Stateline flows through 1994, reviewed Colorado's actions to comply with the Compact, and made recommendations concerning a remedy for past depletions. Colorado filed exceptions to two of the Master's recommendations. This Court overruled the exceptions without prejudice to Colorado's right to renew those exceptions at the conclusion of the remedial proceedings. 522 U.S. 1073 (1998).

2. Proceedings Leading Up To The Trial Of The Remedy Phase

After Kansas filed its complaint in 1986, the Court held for the first time that money damages could be awarded as a remedy for breach of an interstate water compact. *Texas v. New Mexico*, 482 U.S. 124 (1987).[1] Kansas

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[1] That case was remanded to its Special Master for such further proceedings as he deemed necessary and for his recommendation as to whether New Mexico should be allowed to elect a monetary remedy and, if so, to suggest the size of the payment and other terms that New Mexico must satisfy. *Texas v. New Mexico*, 482 U.S. at 132. In 1990, Texas and New Mexico stipulated to a payment of $14 million as a settlement of all claims for breaches of the Pecos River Compact for the years

then filed a motion to amend its complaint to include a prayer for general and special damages, which was granted. First Report at 18-19. At Kansas' request, the case was bifurcated into a liability and a remedy phase. *Id.* at 24-25.

Following the Court's decision in 1995, the Master required Kansas to file a statement of its position regarding a remedy for violations of the Compact, indicating whether Kansas sought a remedy in money, water, or a combination of both. Second Report at 3. Kansas stated that it sought a remedy for past violations of the Compact "in the form of money only." *Id.* Kansas also stated that money damages should be the greater of Colorado's gains or Kansas' losses, that money damages should include losses suffered by individual water users in Kansas, and that prejudgment interest should be awarded on all losses. *Id.* at 75, 88, 105 (App. to Third Report at 1, 21, 38).[2]

Colorado asked the Master to rule on certain legal issues related to Kansas' claim for money damages. *See* App. to Third Report at 6-7. In addition, Colorado suggested that repayment of past depletions to usable Stateline flows in water rather than money might be a more equitable remedy. Second Report at 73. In his Second

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1952 through 1985, plus all claims for attorneys' fees and other costs prior to August 10, 1989. *Texas v. New Mexico*, 494 U.S. 111 (1990).

[2] The Master has reprinted several portions of his Second Report in the Appendix to his Third Report. This brief will cite to the Appendix for those portions of the Second Report.

Report, the Master addressed several legal issues regarding a remedy, including the applicability of the 11th Amendment and prejudgment interest if money damages were recommended as a remedy. *See* Appendix to Third Report at 1-10, 18-44.

3. Trial Of The Remedy Phase

After Colorado's exceptions to the Second Report were overruled, the Master ordered counsel for the States and appropriate experts to confer on hydrologic and engineering facts that would underlie the expert testimony on Kansas' claim for money damages, and the States thereafter entered into a Stipulation to allocate depletions to usable Stateline flows within Kansas for the period 1950-1994. Third Report at 8. The Stipulation was approved by the Master and provided a common factual basis to estimate damages based on the Master's recommendations in his Second Report. *Id.* In addition to the Stipulation, Kansas used, and Colorado accepted, a ground water model to determine water level declines in the regional area, beyond the ditch service areas, resulting from depletions to usable Stateline flows. *Id.* at 9.

Based on the Stipulation and the ground water model results, experts for Kansas estimated four categories of costs or losses resulting from depletions to usable Stateline flows: (1) the additional costs incurred by farmers in the ditch service areas to pump additional ground water to replace depletions of farm headgate deliveries; (2) the increased costs to pump ground water in the larger regional area, in both the past and the future, due to water level declines attributable to depletions of usable

Stateline flows; (3) crop production losses on lands in the ditch service areas that did not have wells to replace depletions to farm headgate deliveries and were irrigated by surface water only; and (4) secondary or indirect economic losses to the Kansas economy resulting from the increased costs of pumping and crop production losses. Third Report at 3.

In each category of costs or losses, the Kansas experts estimated two types of damages: (1) lost state income tax revenues that resulted from higher pumping costs and crop production losses; and (2) after-tax losses suffered by well owners and farmers in Kansas as the result of depletions to usable Stateline flow. In addition to damages, Kansas claimed prejudgment interest on all past losses based on one set of interest rates to compound the losses of Kansas well owners and farmers and another, lower set of interest rates to compound the tax losses of the State of Kansas.

Initially, the Kansas experts' calculation of money damages was $77.67 million in 1998 dollars, which was equivalent to awarding prejudgment interest on the past damages to 1998. Third Report at 16, 87-88. In response to a report prepared by Colorado's expert, the Kansas experts revised their estimates of damages. *Id.* at 16. Additional revisions were made during trial, and the Kansas experts' final calculation of damages, with prejudgment interest to 1998, was $62,369,173. *Id.* at 1, 87. The Kansas claim for damages in nominal dollars (*i.e.*, in the dollars in the year they occurred), including the present value of higher pumping costs in the future, was only $9,218,305. *Id.* at 87. The bulk of Kansas' claim

consisted of $53,150,867 in prejudgment interest from 1950 to 1998. *Id.* at 87-88.

In his Third Report, the Master recommends that a remedy for past depletions to usable Stateline flows should be in money damages rather than repayment in water. Third Report at 11, 119. He recommends that money damages should include all losses that have occurred as a result of Compact violations, including losses suffered by individual water users in Kansas, and that prejudgment interest should be awarded at the rates proposed by Kansas on such losses from 1969 to the date of judgment. *Id.* at 12-13, 64, 107, 119-20. He also makes a number of recommendations on factual issues related to the calculation of damages. *Id.* at 14-86. Based on the Master's recommendations, the States have agreed that the total damages, including prejudgment interest from 1969 to 1998, would be approximately $38,000,000.

SUMMARY OF ARGUMENT

The State of Kansas brought this action to enforce its rights under the Arkansas River Compact, which apportions the waters of the Arkansas River between Colorado and Kansas. This Court resolved the issues of liability in an earlier decision, *Kansas v. Colorado*, 514 U.S. 673 (1995), which accepted the Master's recommendation that post-Compact well pumping in Colorado had violated Article IV-D of the Compact. In his Third Report the Master has recommended money damages as a remedy for the Compact violation.

At the outset, it should be noted that this is not a case where Colorado withheld money owed to Kansas and had the benefit of the use of the money. *Cf. Virginia v. West Virginia*, 206 U.S. 290 (1907) (suit by Virginia against West Virginia for equitable proportion of public debt that West Virginia had agreed to assume). Rather, this is a case where private individuals in Colorado drilled wells and pumped additional ground water after the Compact became effective in 1949. The Compact did not prohibit future development by private individuals in Colorado or Kansas, provided that the usable waters of the Arkansas River were not materially depleted by such development.

Colorado's liability for the violation of the Compact in this case is not because it failed to deliver a specific quantity of water set out in the Compact, but because it failed to limit future beneficial development by private individuals where, for many years, neither State was aware that usable Stateline flows were being depleted by such development. Thus, the facts in this case are different than *Texas v. New Mexico*, where it became clear soon after the Pecos River Compact went into effect that Stateline flows were significantly below the amount that would have been predicted and the Pecos River Commission undertook a study and made findings regarding shortfalls as early as 1961. *Texas v. New Mexico*, 462 U.S. 554, 560-61 (1983).

The Master recommends that Kansas be awarded money damages for all losses that have occurred as a result of Compact violations, including the losses to individual Kansas water users, distinguishing the Court's previous 11th Amendment cases on the grounds that Kansas does not intend to turn over the damages to its

water users. Colorado believes that the Master's recommendation is based on a misunderstanding of the nature of quasi-sovereignty and the limitation imposed by the 11th Amendment.

Further, the Master recommends that prejudgment interest be awarded on damages from 1969, based on his finding that Colorado knew, or should have known, by 1968 that well pumping was depleting usable Stateline flows. This finding is inconsistent with this Court's previous decision that the evidence of the impact of increased well pumping on usable Stateline flows was vague and conflicting.

The Master also recommends that prejudgment interest be awarded at the rates proposed by Kansas, which include rates paid by farmers, notwithstanding the fact that the damages will be paid to the State of Kansas, not the farmers. This recommendation is inconsistent with the basis on which Kansas was allowed to bring this action and is unfair and punitive to Colorado.

Finally, the Master recommends that Kansas be awarded damages for losses to farmers based on estimates of crop production losses by the Kansas experts. The very high losses estimated by the Kansas experts are simply not reasonable.

Colorado believes that this Court, exercising the extraordinary power conferred by the Constitution to resolve controversies between states, should reject the position that a state, suing for breach of an interstate water compact, is necessarily entitled to recover money damages for losses to individuals that have occurred as a

result of such violations. First, the Court's 11th Amendment decisions counsel against such a recovery. Second, other equitable considerations here also counsel against such an award.

In his Third Report, the Master found that neither State knew or had reason to know that post-Compact well pumping in Colorado was depleting usable Stateline flows before 1968, and this Court in its previous opinion pointed out the difficulty of assessing the impact of increases in post-Compact well pumping on usable Stateline flows because of changing conditions during the 1970s and early 1980s. An award of money damages that includes all losses that have occurred as a result of Compact violations, including losses suffered by individual water users in Kansas, is not a fair and equitable remedy in this case. Furthermore, under these circumstances, a departure from common-law principles to award prejudgment interest for the first time in interstate water compact litigation is neither warranted nor fair. However, if the Court rules that an award of prejudgment interest is appropriate, prejudgment interest should only be awarded from 1985, the date Kansas formally complained about post-Compact well pumping, and the interest rates used to award prejudgment interest should be the interest rates received by the State of Kansas, not the farmers who cannot sue Colorado because of the 11th Amendment.

I. A STATE ACTING IN ITS *PARENS PATRIAE* CAPACITY IS NOT ENTITLED TO RECOVER MONEY DAMAGES FOR LOSSES TO INDIVIDUAL WATER USERS THAT HAVE OCCURRED AS A RESULT OF A VIOLATION OF AN INTERSTATE COMPACT

A. Introduction

The case presents several issues of first impression: How should the amount of money damages for violation of an interstate water compact be determined? Should prejudgment interest be allowed on such damages, and, if so, what interest rates should be used to award prejudgment interest? Should extenuating factors be considered in awarding damages or prejudgment interest? *See* Third Report at 10, 11-13. As the Master notes, one commentator[3] has said there is a "special drama" when one state sues another invoking the original jurisdiction of this Court; and, as the Master states, "that drama is surely heightened by the money damage issues in this case." Third Report at 10.

This case may be the first to present these issues, but it will not be the last. While water was and is important in the eastern United States for domestic use, navigation, fisheries, and power generation, *e.g., New Jersey v. New York*, 283 U.S. 336 (1931), irrigation was an absolute necessity to raise crops in the arid and semi-arid regions of the

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[3] Vincent L. McKusick, 45 Maine L. Rev. 185 (1993). Justice McKusick is the former Chief Justice of the Maine Supreme Judicial Court. He served as a Special Master in *Connecticut v. New Hampshire*, No. 119, Original, and is currently serving as Special Master in *Kansas v. Nebraska*, No. 126, Original.

West. *California v. United States*, 438 U.S. 645, 648-49 (1978). Intrastate conflicts over water in the West led to the development of new legal doctrines and institutions. *Id.* at 653-56. Interstate conflicts over water led this Court to announce the doctrine of equitable apportionment in 1907, *Kansas v. Colorado*, 206 U.S. 46 (1907), and, thereafter, to encourage states to settle their differences by compact rather than litigation in this Court. *E.g., Colorado v. Kansas*, 320 U.S. 383, 392 (1943). Since 1922, when commissioners appointed by the seven states of the Colorado River Basin reached an agreement, now known as the Colorado River Compact, *see Arizona v. California*, 373 U.S. 546, 557 (1963), there have been 24 other compacts apportioning the waters of interstate rivers and 12 flood control and water resources compacts. Council of State Governments, *Interstate Compacts and Agencies 1998*, 118-33 (1999).

As population growth has continued in the West, and as new technology has allowed new developments, particularly the use of ground water, pressure on existing apportionments has increased, as this and other recent cases demonstrate. *E.g., Texas v. New Mexico*, 462 U.S. 554 (1983); *Nebraska v. Wyoming*, 515 U.S. 1 (1995) (No. 108, Original); *Kansas v. Nebraska*, No. 126, Original. The new century will likely require this Court, in the exercise of the extraordinary judicial power conferred by the Constitution over controversies between states, to clarify the remedies for breach of interstate water compacts and equitable apportionment decrees entered by the Court. How the Court defines these remedies, and the factors considered in determining such remedies, may well

determine how frequently this Court is called upon to resolve such claims.

B. Colorado's Exception To The Master's Recommendation Is Now Appropriate For Consideration

Based on the fact that Kansas is the signatory to the Compact, and, in the Master's view, the only party that can sue to protect the Stateline flows guaranteed for use by Kansas water users, the Master recommended in his Second Report that if a money remedy were awarded for Compact violations in this case, "the damages should include all losses that have occurred as a result of such violations, including those suffered by individual water users, subject only to the overriding consideration that the remedy must finally be a 'fair and equitable solution'." App. to Third Report at 36, *quoting Texas v. New Mexico*, 482 U.S. 124, 134 (1987). Colorado filed an exception to the Master's recommendation on the grounds that the 11th Amendment to the U.S. Constitution barred an award of damages for the losses suffered by individual water users.

The United States pointed out in its brief in opposition to Colorado's exceptions that it was unclear whether the Master had simply ruled that use of individual loss evidence could be considered in determining Kansas' damages or had ruled that the money damages awarded for past Compact violations necessarily should include such individual losses. Brief for the United States in Opposition to the Exceptions of Colorado 16, 20 n.5

(December 1997). The United States accordingly recommended that Colorado's exceptions be overruled without prejudice because the Master's recommendation concerning the use of evidence of individual losses had uncertain significance at that stage of the proceedings. *Id.* at 10. Ultimately, the Master has recommended a monetary remedy that raises 11th Amendment concerns. Thus, it is now appropriate for the Court to consider Colorado's exception to the Master's recommendation.

C. The 11th Amendment Does Not Allow A State To Present And Enforce The Claims Of Its Citizens

The 11th Amendment to the U.S. Constitution states:

> The Judicial power of the United States shall not be construed to extend to any suit in law or equity, commenced or prosecuted against one of the United States by Citizens of another State, or by Citizens or Subjects of any Foreign State.

This Court has understood the 11th Amendment "to stand not so much for what it says, but for the presupposition which it confirms;" namely, that "federal jurisdiction over suits against unconsenting States 'was not contemplated by the Constitution when establishing the judicial power of the United States.' " *Seminole Tribe of Florida v. Florida*, 517 U.S. 44, 54 (1996), *quoting Blatchford v. Native Village of Noatak*, 501 U.S. 775, 779 (1991), and *Hans v. Louisiana*, 134 U.S. 1, 15 (1890).

As the Master recognizes, this Court's decisions make it clear that if Kansas were suing to recover damages that would be directly turned over to its citizens, the

claim would be barred by the 11th Amendment. *E.g.*, *North Dakota v. Minnesota*, 263 U.S. 365 (1923); *New Hampshire v. Louisiana*, 108 U.S. 76 (1883); App. to Third Report at 23-24, 28. The Master distinguishes such cases on the basis that the recovery in this instance will not go to the individuals, but instead will be paid to Kansas, although he acknowledges that Kansas will be free to spend the money as it decides, including, presumably, turning the money over to its water users. *Id.* at 21-22, 34. In Colorado's view, the Master's conclusion is based on a misunderstanding of the nature of quasi-sovereignty and the limitation imposed by the 11th Amendment.

It is well-settled that a state may obtain injunctive relief to vindicate its quasi-sovereign interests. *See e.g.*, *Kansas v. Colorado*, 206 U.S. 46, 99 (1907); *Georgia v. Tennessee Copper Co.*, 206 U.S. 230, 237 (1907). However, a state's right to represent its quasi-sovereign interests in a controversy between states does not allow a state to present and enforce claims of its citizens. This has been clear since *New Hampshire v. Louisiana*, 108 U.S. 76 (1883), where citizens of New Hampshire assigned their claims on bonds issued by the State of Louisiana to the State of New Hampshire for collection. The Court recognized in that case that the 11th Amendment prevented the citizens who owned bonds from bringing suit on their own behalf against the State of Louisiana. 108 U.S. at 88. Therefore, the Court said, "the real question" was "whether a state can allow the use of its name in such a suit for the benefit of one of its citizens." *Id.* First, the Court rejected the argument that a state could prosecute such suits as sovereign trustee of its citizens. *Id.* at 89-90. Second, the Court rejected the argument that the Constitution granted states

the right to prosecute the claims of their citizens in the federal courts:

> The evident purpose of the [11th] Amendment, so promptly proposed and finally adopted, was to prohibit all suits against a State by or for citizens of other States, or aliens, without the consent of the State to be sued, and, in our opinion, one State cannot create a controversy with another State, within the meaning of that term as used in the judicial clauses of the Constitution, by assuming the prosecution of debts owing by the other State to its citizens. *Such being the case, we are satisfied that we are prohibited, both by the letter and the spirit of the Constitution, from entertaining these suits, and the bill in each of them is, consequently, dismissed.*

108 U.S. at 91 (emphasis in original).

These principles were further developed in *North Dakota v. Minnesota*, 263 U.S. 365 (1923), where an impermissible claim for damages for losses to individuals was coupled with a permissible claim by a state for injury to its quasi-sovereign interests. There, North Dakota sought both an injunction and damages for flooding allegedly caused by drainage ditches in Minnesota. The Court found that North Dakota could seek an injunction against operation of the Minnesota ditches:

> [W]here one state, by a change in its method of draining water from lands within its border, increases the flow into an interstate stream, so that its natural capacity is greatly exceeded and the water is thrown upon the farms of another state, the latter state *has such an interest as quasi sovereign in the comfort, health, and prosperity of her farm owners* that resort may be had to this

> court for relief. It is the creation of a public nuisance of simple type *for which a state may properly ask an injunction.*

Id. at 374 (emphasis added). However, the Court held that North Dakota could not recover damages for losses to its inhabitants whose farms were flooded and whose crops were lost:

> North Dakota, in addition to an injunction, seeks a decree against Minnesota for damages of $5,000 for itself, and of a million dollars for its inhabitants whose farms were injured and whose crops were lost. It is difficult to see how we can grant a decree in favor of North Dakota for the benefit of individuals against the state of Minnesota, in view of the 11th Amendment to the Constitution, which forbids the extension of the judicial power of the United States to any suit in law or equity prosecuted against any one of the United States by citizens of another state, or by citizens and subjects of a foreign state.
>
> . . . *The right of a state as parens patriae to bring suit to protect the general comfort, health, or property rights of its inhabitants, threatened by the proposed or continued action of another state, by prayer for injunction, is to be differentiated from its lost power as a sovereign to present and enforce individual claims of its citizens as their trustee against a sister state.* For this reason the prayer for a money decree for the damage done by the floods of 1915 and 1916 to the farms of individuals in the Bois de Sioux valley is denied for lack of jurisdiction.

Id. at 374-76 (emphasis added).

The Court has repeatedly reaffirmed the distinction between proper *parens patriae* actions by states to protect quasi-sovereign interests and improper attempts by states to present and enforce claims for injuries of individual citizens. *E.g., Alfred L. Snapp & Son, Inc. v. Puerto Rico*, 458 U.S. 592, 607 (1982); *Maryland v. Louisiana*, 451 U.S. 725, 745 n.21 (1981) ("[A]n original action between two States only violates the Eleventh Amendment if the plaintiff State is actually suing to recover for injuries to specific individuals."); *Pennsylvania v. New Jersey*, 426 U.S. 660, 665 (1976) ("[A] State has standing to sue only when its sovereign or quasi-sovereign interests are implicated and it is not merely litigating as a volunteer the personal claims of its citizens."); *Hawaii v. Standard Oil Co.*, 405 U.S. 251, 258 n.12 (1972) ("An action brought by one State against another violates the Eleventh Amendment if the plaintiff State is actually suing to recover for injuries to designated individuals.").[4]

The Master reviews these cases but concludes that in the later half of the Twentieth Century there has been "some development" of the Court's attitude toward coupling of private claims with those of a state suing as quasi-sovereign, citing *Maryland v. Louisiana*, 451 U.S. 725 (1981). App. to Third Report at 30. He says that in that case Maryland and several other states challenged the constitutionality of Louisiana's "first-use" tax on natural

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[4] There has been no suggestion that Colorado waived its sovereign immunity to claims by individual water users for violation of the Compact. *Cf. Petty v. Tennessee-Missouri Bridge Comm'n*, 359 U.S. 275 (1959). Indeed, the premise of the Special Master's recommendation is that individual water users have no remedy.

gas, and also sought recovery of the taxes already paid. *Id.* He notes that the complaint estimated the direct injuries to the plaintiff states at $1.5 million and to their citizen consumers of gas at $120 million. *Id.* at 30-31, *citing* 451 U.S. at 736 n.12.

In that case, however, the plaintiff states were not suing for damages, but to have Louisiana's "first-use" tax declared unconstitutional and to have the taxes collected by Louisiana pursuant to the "first-use" tax refunded, which is the relief ultimately granted. *Maryland v. Louisiana*, 452 U.S. 456, 457 (1981). Moreover, the Court ordered that the revenues be refunded to the taxpayers, not to the plaintiff states. *Id.*

In *Maryland v. Louisiana*, the injuries to the citizen consumers were cited to demonstrate that the injury alleged affected the general population of the state so that the plaintiff states were acting as *parens patriae* as the representatives of their citizens. 451 U.S. at 739-744. Louisiana had argued that the case should be dismissed for want of standing because the "first-use" tax was imposed on pipeline companies and not directly on the ultimate consumers. *Id.* at 736. The Court noted that the states were substantial consumers of natural gas and that while the tax was imposed on the pipeline companies, it was clearly intended to be passed on to the ultimate consumer. *Id.* The Court then said that "[i]t is clear that the plaintiff states, as major purchasers of natural gas whose cost has increased as a direct result of Louisiana's imposition of the First-Use Tax, are directly affected in a 'substantial and real' way so as to justify their exercise of this Court's original jurisdiction." *Id.* at 737. The Court then went on to say that jurisdiction was also supported "by

the States' interest as *parens patriae*." *Id.* The Court noted that a state is not permitted to enter a controversy as a nominal party in order to forward the claims of individual citizens, but may act as the representative of its citizens where the injury alleged affects the general population of a state in a substantial way. *Id. Maryland v. Louisiana* did not hold that private claims may be "coupled" with those of a state suing as quasi-sovereign. Rather, the case held that a state may act as *parens patriae* where the injury alleged affects the general population of the state in a substantial way.

D. The Special Master's Recommendation Is Based On The Mistaken Assumption That The 11th Amendment Is Not A Factor In This Case

Notwithstanding the fact that a state as *parens patriae* may not present and enforce the claims of its citizens, the Master concludes that the 11th Amendment is not a barrier to recovery of damages by Kansas for injuries suffered by individual water users in Kansas based on the "fundamental rule" that, once the Court accepts a case between states as involving sovereignty or quasi-sovereignty, "the 11th Amendment is not a factor." App. to Third Report at 36. This "fundamental rule" fails to recognize that, in one action, a state's complaint may raise both proper proprietary or quasi-sovereign claims, over which the Court has jurisdiction, and improper claims for the benefit of individuals. *E.g., North Dakota v. Minnesota*, 263 U.S. at 374-76. The fact that the 11th Amendment is not a factor in a proper original action does not mean that a state can also recover damages for the benefit of individuals in the same action. *Id.*

The Master, however, gives four reasons for allowing Kansas to recover losses suffered by individual water users in this case: (1) the nature of quasi-sovereignty; (2) the Court's statements in *Texas v. New Mexico*, 482 U.S. 124 (1987); (3) the Laramie River decisions, which used individual water rights as the basis for an interstate apportionment; and (4) the lack of any other remedy for Kansas water users. App. to Third Report at 33-36.

First, the Master states that "[q]uasi-sovereignty . . . throws the mantle of the state itself over the area and people involved in order *to permit a general recovery for them*, albeit the recovery is payable to the state itself." App. to Third Report at 34 (emphasis added). This misapprehends the nature of quasi-sovereignty. This Court has made it clear that the concept "does not involve the State stepping in to represent the interests of particular citizens who, for whatever reason, cannot represent themselves." *Snapp*, 458 U.S. at 600[5]; *North Dakota v. Minnesota*, 263 U.S. at 376. Rather, to have *parens patriae* standing, the state must assert injury to its quasi-sovereign interests, *Snapp*, 458 U.S. at 601, which have consistently been described as "*apart from* the interests of particular private parties," *id.* at 607 (emphasis added), "*apart from* that of the individuals affected," *Pennsylvania v. West Virginia*, 262 U.S. 553, 592 (1923) (emphasis added), and "*independent of* and

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[5] *Snapp* involved the question of a state (or commonwealth's) standing to bring a *parens patriae* action in federal district court. The Court recognized that "a more circumspect inquiry may be required" into such an issue in original jurisdiction cases between states, to ensure that the 11th Amendment was not "too easily circumvented." 458 U.S. at 611 (Brennan, J., concurring); *see also id.* at 603 n.12.

behind the titles of [a state's] citizens." *Snapp*, 458 U.S. at 604 (emphasis added), quoting *Georgia v. Tennessee Copper Co.*, 206 U.S. 230, 237 (1907). A state's right to protect its quasi-sovereign interest is distinct from its foregone sovereign right to present and enforce its citizens' individual claims as assignee or trustee. *Oklahoma ex rel. Johnson v. Cook*, 304 U.S. 387, 392-93 (1938); *North Dakota v. Minnesota*, 263 U.S. at 374-76; *New Hampshire v. Louisiana*, 108 U.S. at 91. To say that quasi-sovereignty permits a general recovery for individual water users in Kansas undermines the purpose of the 11th Amendment, which was to protect states from the impact of unconsented suits by citizens. *Seminole Tribe*, 517 U.S. at 54.

The Master also concludes that a state should be able to obtain a money remedy for Compact violations that includes losses suffered by individual water users because a state is allowed to sue for repayment in water, which would directly benefit the individual water users in the state. App. to Third Report at 22-23. This conclusion fails to recognize the difference between injunctive relief and damages. The fact that this Court has approved injunctions to vindicate states' quasi-sovereign interests that also may have benefitted private individuals does not suggest that quasi-sovereignty allows recovery of damages to private individuals. *Hawaii v. Standard Oil Co.*, 405 U.S. at 261; *North Dakota v. Minnesota*, 263 U.S. at 375-76.

The Arkansas River Compact does not change the nature of Kansas' quasi-sovereign interest in this case. The Compact settles disputes "between the States of Colorado and Kansas, and between citizens of one and citizens of the other State, . . . " Arkansas River Compact,

Article I-A. It does *not* purport to resolve disputes between the citizens of Kansas and the State of Colorado, and the 11th Amendment embodies "the background principle of state sovereign immunity" which precludes such claims. *Seminole Tribe*, 517 U.S. at 72. Any waiver of such immunity must be clearly expressed. *See Port Authority Trans-Hudson Corp. v. Feeney*, 495 U.S. 299, 305 (1990).

Second, the Master states that "the key case on this subject, *Texas v. New Mexico*, 482 U.S. 124 (1987), speaks broadly of providing a remedy for past breaches [of an interstate compact]." App. to Third Report at 34. The Master also relies heavily on the Court's statement in *Texas v. New Mexico* that, "[i]n *proper* original actions, the Eleventh Amendment is no barrier, for by its terms, it applies only to suits by citizens against a State." *Id.* at 35, *quoting Texas v. New Mexico*, 482 U.S. at 130 (emphasis added). However, as *North Dakota v. Minnesota* established, an original action may include a proper claim by a state and improper claims on behalf of individuals. *Texas v. New Mexico* simply determined for the first time that money damages could be awarded as a remedy for past breaches of an interstate compact. The Court did not address how the size of a monetary payment should be determined; that issue was remanded to the Special Master in that case for his recommendation, 482 U.S. at 132, and ultimately the states stipulated to a monetary payment. *Texas v. New Mexico*, 494 U.S. 111 (1990).

The Master also relies on the Court's statement (in response to the argument that money damages would not benefit the actual injured parties) that "the State should recover any damages that may be awarded, . . . " App. to

Third Report at 22, quoting *Texas v. New Mexico*, 482 U.S. at 132 n.7. By referring to "*any* damages that *may* be awarded," the Court did not determine that Texas could recover damages for losses suffered by individual farmers. Rather, it simply recognized that any damages that Texas recovered for its representation of the "general public interest," *id.*, could be spent by Texas as it saw fit. It would be a strange interpretation of the 11th Amendment to allow a state to recover money damages for losses suffered by individuals only if it decides to keep the money in the state coffers rather than aiding the injured individuals. Such an interpretation would also be inconsistent with the statement in *Texas v. New Mexico* that the state "would be free to spend [the money] in the way it determines is in the public interest." 482 U.S. at 132 n.7. Therefore, the applicability of the 11th Amendment must depend not on how the state ultimately spends any damages it may recover, but on the nature and origin of the claims on which damages are based.

Third, the Master reads the Court's Laramie River decisions[6] as doing "exactly what Colorado now says it cannot do" because the equitable apportionment of the Laramie River was based on the prior appropriations of individual water users. App. to Third Report at 27. The Laramie River cases, however, are consistent with the concept of quasi-sovereignty described above. Although the states' apportionments were based on use by their

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[6] *Wyoming v. Colorado*, 259 U.S. 419 (1922); *Wyoming v. Colorado*, 286 U.S. 494 (1932); *Wyoming v. Colorado*, 298 U.S. 573 (1936); *Wyoming v. Colorado*, 309 U.S. 572 (1940).

respective water users, they were not the *same* as those individual claims. The final decision made this clear by holding that the apportionment determined only the relative rights of the two States, *Wyoming v. Colorado*, 309 U.S. 572, 575-76 (1940), and that each state could determine in-state uses according to its own laws. *Id.* at 579, 580-81; *see also Connecticut v. Massachusetts*, 282 U.S. 660, 670 (1931). Thus, the states' apportionments were "independent of and behind," *see Snapp*, 458 U.S. at 604, those of their water users.

Fourth, the Master states that Kansas is the signatory to the Compact and the only party that can sue to protect the Stateline flows guaranteed for use by Kansas water users under the Compact. App. to Third Report at 36. He concludes that Kansas "would be a feeble representative" if it could not recover damages for losses suffered by individual farmers. *Id.* It is not clear why the Master believed that Kansas is the only party that could sue for a breach of the Compact. *See* Arkansas River Compact, Art. VII-A. In any case, Kansas is hardly a "feeble representative," even if it cannot recover losses suffered by individual water users. Kansas as *parens patriae* can sue to enforce compliance with the Compact, and the Court has the power to fashion a suitable remedy, which may include money damages. The Master's reasoning, however, ignores the principle of state sovereign immunity embodied in the 11th Amendment, which prevents individual water users from suing Colorado for damages. *See Seminole Tribe*, 517 U.S. at 72. The fact that those claims are barred does not allow Kansas to step in to recover those losses. *New Hampshire v. Louisiana*, 108 U.S. at 91.

In Section III, Colorado argues that even if losses suffered by individuals can be considered in determining the size of a monetary remedy for violations of the Compact, the Master failed to consider extenuating circumstances in this case; but, first, we address the Master's recommendation concerning prejudgment interest.

II. PREJUDGMENT INTEREST SHOULD NOT BE AWARDED ON KANSAS' UNLIQUIDATED CLAIM AGAINST COLORADO

In addition to its position that money damages should be awarded as a remedy in this case, Kansas argued that an award of prejudgment interest is necessary to provide complete compensation for injuries resulting from Colorado's violation of the Compact. App. to Third Report at 38. Colorado opposed such an award on the grounds that Kansas did not complain about a compact violation until 1984 at the earliest, thereafter there was a good-faith dispute over compact compliance, and the amount of any depletion was far from readily ascertainable. *See id.* at 38-39. Colorado noted that the common law rule is that prejudgment interest is not awarded on unliquidated damages and that prejudgment interest had not been awarded on judgments in cases between states, absent a clear obligation to pay interest. *E.g., Virginia v. West Virginia*, 238 U.S. 202, 234-35 (1915).

In his Second Report, the Master concluded that if the remedy were to include money damages, the unliquidated nature of Kansas' claim does not, in and of itself, bar an award of prejudgment interest. App. to Third Report at 43. In reaching this conclusion, the Master

relied heavily on the Court's decision in *City of Milwaukee v. Cement Div., National Gypsum Co.*, 515 U.S. 189 (1995). Colorado took an exception to this recommendation, which was overruled without prejudice. Since the Master has now recommended that prejudgment interest be awarded on Kansas' damages, it is now appropriate for the Court to consider Colorado's exception.

As the Master acknowledges, *City of Milwaukee* was an admiralty case, where the general rule has been to allow prejudgment interest. App. to Third Report at 41. The Master relies on the Court's observation that the distinction between liquidated and unliquidated claims "has faced trenchant criticism for a number of years." *Id.* at 39, citing *City of Milwaukee*, 515 U.S. at 197. However, the cases cited by the Court as examples of such criticism involved awards of prejudgment interest granted pursuant to statutory provisions. For example, *Funkhouser v. J.B. Preston Co.*, 290 U.S. 163 (1933), simply determined that a New York statute providing for prejudgment interest was not an unconstitutional impairment of contracts.

While there has been a trend in recent years to allow prejudgment interest on unliquidated claims, that trend has been primarily the result of legislative action. *Cf. Monessen Southwestern Ry. Co. v. Morgan*, 486 U.S. 330, 339 (1988) (denying prejudgment interest in FELA claims because of congressional inaction to change longstanding common law rule). The Court has found prejudgment interest to be appropriate to effectuate the purpose of federal remedial schemes, which typically include detailed enforcement provisions, including time limits for bringing claims. *See, e.g., Loeffler v. Frank*, 486 U.S. 549

(1988) (approving prejudgment interest in sex discrimination case against U.S. Postal Service); 42 U.S.C. § 2000-16(c) (imposing time limit for bringing such claims). Statutory provisions providing for prejudgment interest have also been accompanied by legislative changes placing other limits on liability. *See General Motors Corp. v. Devex Corp.*, 461 U.S. 648, 654-55 (1983) (noting that 1946 change in patent law providing for prejudgment interest contained corresponding change eliminating recovery for infringer's profits).[7]

As the Master recognizes, "Kansas' claim for damages in this case certainly represents an unliquidated claim." App. to Third Report at 43. Colorado's violation of the Compact was not willful or deliberate, *Id.* at 3-4, 6, and determining depletions of usable Stateline flows due to wells is a "complex matter." *Id.* at 3.

This Court found that the "vague and conflicting evidence" concerning the impact of increased well pumping on usable Stateline flows excused Kansas' failure to raise its claim until 1985. *Kansas v. Colorado*, 514 U.S. at 689. Further, the Court noted that it had not decided whether the equitable doctrine of laches should be applied in original actions to enforce an interstate compact, *id.* at 687, and there is no applicable statute of

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[7] *General Motors Corp.* also recited the common law standard (which the Court would presumably have followed in the absence of a statutory change), under which "prejudgment interest could not be awarded where damages were unliquidated, absent bad faith or other exceptional circumstances." 461 U.S. at 653.

limitations. Given the fact that depletions to usable Stateline flows are only now apparent with "hindsight and the benefit of sophisticated computer modeling," Third Report at 106, that determining depletions to usable Stateline flows has been extremely difficult (*see* Section III, *infra*), and that there is no time limitation on actions for violation of an interstate compact, this is not a case in which the Court should depart from the traditional rule against awarding prejudgment interest on unliquidated claims, absent bad faith or other exceptional circumstances, which are not present in this case.

III. THE MASTER'S RECOMMENDATIONS THAT AN AWARD OF DAMAGES SHOULD INCLUDE LOSSES SUFFERED BY INDIVIDUAL WATER USERS AND PREJUDGMENT INTEREST ON SUCH LOSSES IS FUNDAMENTALLY UNFAIR TO COLORADO AND IS INCONSISTENT WITH THIS COURT'S PRIOR DECISION EXCUSING KANSAS FROM MAKING A COMPLAINT ABOUT POST-COMPACT WELL PUMPING IN COLORADO UNTIL 1985

If the Court determines that the 11th Amendment does not bar recovery of losses suffered by individual water users and that prejudgment interest may be awarded on such losses, the size of an award should be reviewed carefully for fairness and equity, and factors in extenuation should be considered both in determining the size of an award of monetary damages for violation of the Compact and whether to award prejudgment interest on any or all such damages, just as this Court took into account factors in extenuation in determining whether Colorado should be held in contempt for violation of a

decree of this Court equitably apportioning the Laramie River. *Wyoming v. Colorado*, 309 U.S. 572, 582 (1940).

The Master concludes that the general lack of knowledge in the early years about pumping in Colorado and its impacts along the Arkansas River served to protect Kansas against a claim of laches and that the same degree of fairness should relieve Colorado of an obligation to pay prejudgment interest at the full interest rates on damages from depletions from 1950 through 1968, which, he states, "only with hindsight and the benefit of sophisticated computer modeling can be found to have occurred." Third Report at 106. However, the Master finds that "by 1968 Colorado knew, or should have known, that postcompact wells were causing material depletions of *usable* Stateline flows." *Id.* at 103 (emphasis added). The Master concedes it is "essentially correct" that Kansas did not register a formal complaint until 1985, but states "that is not to say that Colorado was unaware of the impact of its postcompact pumping until that time." *Id.* Relying on a 1968 study of surface diversions and groundwater pumping along the Arkansas River, known as the 1968 Wheeler Report (Jt. Exh. 92), the Master states that "Colorado had to know that the impacts on the other side of the Stateline in Kansas were no different." *Id.* at 104. Thus, he recommends that prejudgment interest, at the rates proposed by Kansas, be awarded on damages from 1969 to the date of the judgment. *Id.* at 107.

The Master's finding is inconsistent with the Court's ruling in 1995 that Kansas was not guilty of inexcusable delay in making its well pumping claim because of the "vague and conflicting evidence available to Kansas." 514 U.S. at 689. In effect, the Master has said that Kansas was

excused from making a complaint about post-Compact well pumping in Colorado until 1985 because of the difficulty of determining the impact of increases of post-Compact well pumping in Colorado on usable Stateline flows, but Colorado should be liable for all losses resulting from such increases, and should pay prejudgment interest on such losses beginning in 1969, even though it had no reason to know of any such impacts until at least 1968 and it was extremely difficult to determine such impacts after 1968. This recommendation is simply not fair.

A. The Difficulty of Determining The Impacts Of Ground Water Withdrawals Should Be Considered In Determining Whether To Award Damages And Prejudgment Interest On Damages

The difficulty of determining the impacts of ground water withdrawals is not limited to this case. The common law rule, still adhered to by some states, is that landowners had an unlimited right to withdraw ground water beneath their property because the movement of ground water beneath the earth was so mysterious that courts could not resolve disputes between parties regarding the impacts of withdrawals. *Roath v. Driscoll*, 20 Conn. 533, 541 (1850); *Acton v. Blundell*, 12 Mees and W. 324, 152 Eng. Rep. 1223 (1843). As the science of ground water hydrology developed, many states rejected the "absolute ownership" doctrine in favor of rules allowing "reasonable use" or correlative rights. Meyers, Tarlock, Corbridge, and Getches, WATER RESOURCES MANAGEMENT 596 (3d ed. 1988). These rules effectively placed limits on ground water withdrawals without generally requiring courts to determine facts concerning the rate or direction

of ground water movement in order to adjudicate disputes between competing claimants. As ground water usage became more prevalent, a distinction was often made between wells withdrawing ground water in defined underground channels, which was subject to the rules governing surface use, and "percolating ground water," which was governed by rules applicable to ground water. *Id.* at 592. These distinctions, which had little scientific basis, reflected the difficulties of proof in determining the rate and direction of ground water movement. *See In Re the General Adjudication of All Rights to Use Water in the Gila River System and Source*, 9 P.3d 1069 (Ariz. 2000) (recognizing that distinction between "subflow" and "percolating ground water" is not hydrologically based, but instead a legal definition adhered to for almost 70 years).

The development of the computer, which allowed hydrologists to solve efficiently the equations of ground water flow, led to the development of mathematical models that could simultaneously calculate the effects of pumping from wells on water levels and streamflow, and track such effects over time. *See* R. Allan Freeze and John A. Cherry, GROUNDWATER 352 (1979).[8] As is often the case, scientific advancements led to litigation over the impacts of earlier developments.

The Master recommends that Colorado be relieved of the obligation to pay full interest rates on damages

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[8] Dr. R. Allan Freeze was one of the pioneers in the application of computer models to ground water problems and testified as a witness for Colorado about the history of ground water modeling. *See* First Report at 232 and n.76.

because of the difficulties of proof. Third Report at 106. By recommending that prejudgment interest be awarded beginning in 1969, *id.* at 107, however, he fails to recognize that determination of the impacts from pumping on usable Stateline flows was extremely difficult after that date.

B. Colorado's Effort To Regulate Ground Water Withdrawals For The Benefit Of Senior Surface Water Rights In The 1970s Demonstrates The Difficulty of Determining The Impacts Of Ground Water Withdrawals At That Time

Part of the rationale for the Master's recommendation appears to be the fact that Colorado had limited state regulation of ground water. The Master states that prior to 1965 Colorado had no system for the regulation of ground water and that wells could be drilled without state permission and even without the state's knowledge. Third Report at 103. Nor, he says, were any reports required of the amounts pumped. *Id.* This is not entirely correct, but Colorado was hardly unique in having limited state regulation of ground water at that time.[9] The same was true in Kansas until 1978. *See* App. to Third Report at 2. However, the Master failed to take note of Colorado's continuing efforts to study and regulate ground water. In 1963 Colorado entered into a cooperative investigation with the U.S. Geological Survey to (1)

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[9] In 1957, Colorado passed a law requiring permits to use ground water. Colo. Sess. Laws, ch. 289, § 5 (1957). First Report at 109.

inventory wells in the Arkansas River Valley, (2) document and evaluate the effects of development, (3) construct and verify an electrical analog model to aid in the evaluation of the hydrology, and (4) develop models and water-management plans. Jt. Exh. 66 (Colo. App. Item 1). *See* First Report at 158.

As part of the cooperative study, the U.S. Geological Survey developed an electric analog model[10] of the alluvial aquifer along the Arkansas River and a digital (*i.e.*, computer) model to evaluate water management plans (the Taylor-Luckey model). These efforts led to a series of papers and reports that were published in the 1960s, including the 1968 Wheeler Report, which were the basis of Colorado's argument that Kansas knew or should have known, at the latest by 1968, that the number of post-Compact wells and the amount of post-Compact pumping had increased, *see* First Report at 158, 159-60; yet the Master rejected Colorado's argument because the reports did not address the "impact on usable flow at the Stateline." *Id.* at 161. The Court affirmed the Master's conclusion, holding that the same reports constituted only "vague and conflicting" evidence which did not put Kansas on notice of an obligation to make its claim before 1985. *Kansas v. Colorado*, 514 U.S. at 688-689. If this evidence, including the 1968 Wheeler Report, was insufficient to alert Kansas to the need to make its claim, it was

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[10] Electric analog models are based on the physical and mathematical analogy between electrical flow and ground water flow. Freeze and Cherry, GROUNDWATER 360. They were used as an alternative approach when digital computer models, which required large computers and relatively sophisticated programming expertise, were not readily available. *Id.*

also insufficient to establish that Colorado knew, or should have known, about the impact of post-Compact well pumping on usable Stateline flows, thereby obligating Colorado to pay damages for all losses that occurred as a result of post-Compact well development and prejudgment interest on such losses. Moreover, the Master failed to consider the fact that Colorado's efforts to regulate well pumping after 1969 were unsuccessful because of the difficulties of proof.

In 1974 the Colorado State Engineer proposed an amendment to rules and regulations to limit all pumping in 1976 and thereafter unless depletions caused by well pumping were replaced. First Report at 126. However, after a trial, the proposed amendment was not approved by the Colorado Water Judge, who made extensive findings that challenged some of the basic assumptions in the Wheeler Report and the Taylor-Luckey model. Among other things, the Water Judge found:

> Notwithstanding theoretical hydrological analyses that support the State's contention that wells have depleted surface flows in the Arkansas River, the Court finds no competent evidence in the record that stream flows have suffered in fact during the post-well period or that reductions, if any, can be traced to well diversions rather than to increased irrigation efficiencies, increased groundwater storage, phreatophyte and evaporation losses, stock ponds, municipal sewage lagoons and pot holes or changes in side channel inflows. . . .

Jt. Exh. 157, ¶ 17 (Colo. App., Item 2). The Colorado Supreme Court affirmed the Water Judge's decision.

Kuiper v. Atchison, Topeka & Santa Fe Ry. Co., 195 Colo. 557, 581 P.2d 293 (1978).

Eighteen years later, with the benefit of extensive new studies by both States regarding increases in phreatophyte growth, stock ponds, and changes in side channel inflow, as well as new computer modeling studies, the Master came to a different conclusion. First Report at 116, 228-90. Hindsight and the benefit of those new studies should not obscure the fact that in the mid-1970s the Colorado State Engineer was unable to prove, based on the evidence developed with the tools available at that time, that surface stream flows had suffered during the post-well period or that reductions, if any, were attributable to well pumping. Indeed, the Water Judge's decision provided direction to both states on other factors that needed to be considered before any conclusions could be drawn about the effects of ground water pumping on surface flows.

C. Kansas' Difficulty In Proving Its Case Further Demonstrates The Difficulty Of Determining The Impact Of Ground Water Pumping On Usable Stateline Flows

Even in 1990, Kansas had enormous difficulty proving its case. As the Master stated in his First Report, the H-I Model, which was developed by Timothy J. Durbin for Kansas to quantify the effects of individual causes of depletion, "represents an enormously difficult task, the complexities of which may not have been fully appreciated when Durbin began to develop the basic structure of the model." First Report at 230 (footnote omitted). The

Master also found that the Taylor-Luckey Model developed by the USGS in 1974 "was neither required nor intended to provide the level of accuracy and detail demanded in an adversarial trial." *Id.* at 231.

These findings, and the Master's findings about difficulties experienced by the Kansas experts after some five years of data collection and model development, First Report at 236-37, underscore the unfairness of holding Colorado liable for all losses that resulted from post-Compact well pumping since 1950, and prejudgment interest beginning in 1969. As the Master himself found in the Second Report in rejecting Kansas' argument that the measure of damages should be the greater of Colorado's gains or Kansas' losses:

> Although by the 1970s the extent of pumping in Colorado was a matter of common knowledge, that is not to say, as I concluded in my earlier report, "that the impact of such pumping on usable Stateline flows was generally known or understood." Report of Special Master at 169. Wells *per se* do not violate the compact. Only if they cause a material depletion in usable Stateline flows are they wrongful. Determining what flows are usable, and the depletions of usable flow in contrast to depletions of total flow, is a complex matter. And as the Supreme Court noted in its earlier Opinion, isolating the impacts of wells on usable Stateline flow was rendered all the more difficult because of other changing conditions during the 1970s and 1980s. The 1970s were generally dry years, and some reduction in flow would have occurred apart from pumping. Pueblo Dam came on line in 1976 and began to reregulate native flows.

> Transmountain imports were also increased during this period, which to some extent provided an offset to pumping. The Winter Water Storage Program was instituted. Finally, there was no quantitative or specific entitlement against which depletions to usable flow could be judged.

App. to Third Report at 3, citing *Kansas v. Colorado*, 514 U.S. 675 (1995).

If the Court accepts the Master's recommendation that Kansas' damages should include losses suffered by individual water users in Kansas, Colorado recommends that the Court reduce the amount of the damages by some fair percentage to reflect the fact that neither State knew, or had reason to know, that post-Compact well pumping was depleting usable Stateline flows until at least 1968 and that determining the impact of such pumping on usable Stateline flows after 1968 was extremely difficult. *Cf. Talbot v. Seeman*, 5 U.S. (1 Cranch) 1, 44 (1801). If prejudgment interest is awarded on such losses, Colorado recommends that prejudgment interest be awarded only beginning in 1985, the date when Kansas first made a formal complaint to the Arkansas River Compact Administration. By waiting to make a formal complaint until 1985, Kansas not only had the benefit of the USGS studies and Colorado's effort to curtail ground water withdrawals, but also significant advances in hydrologic computer modeling. Had Kansas brought its complaint in 1974, for example, proving the very existence, much less quantifying, depletions to usable Stateline flows would have been problematic; witness Colorado's lack of success during this period.

IV. THE MASTER'S RECOMMENDATION THAT PREJUDGMENT INTEREST SHOULD BE AWARDED ON DAMAGES SUFFERED BY INDIVIDUALS IN KANSAS AT THE INTEREST RATES PAID BY THE INDIVIDUALS, RATHER THAN AT THE INTEREST RATES RECEIVED BY THE STATE OF KANSAS, IS INCONSISTENT WITH THE BASIS ON WHICH KANSAS WAS ALLOWED TO BRING THIS SUIT AND IS UNFAIR TO COLORADO

Without significant discussion, the Master recommends that prejudgment interest be awarded on Kansas' damages at the rates proposed by Kansas. Third Report at 107. He notes that the Kansas experts used interest rates which reflected the opportunity costs *to farmers* to compound the losses attributable to farmers, *id.* at 94, which are by far the largest losses, but did not expressly address Colorado's argument that if prejudgment interest were to be awarded, the interest rates applicable to the State of Kansas, which are lower and were used to calculate prejudgment interest on tax losses to the State of Kansas, should be used instead. *Id.* The Master's recommendation that prejudgment interest be awarded at rates higher than those received on state revenues underscores the problems with his interpretation of Kansas' quasi-sovereign interests.

The Master acknowledges that the damages in this case will be paid, at least initially, to the State of Kansas, not to individual water users. App. to Third Report at 21-22. Indeed, he quotes from *Texas v. New Mexico*, where the Court, in response to counsel's argument that any

such damages might go into the state's general fund, "rather than benefit those who were hurt," responded:

> But the basis on which Texas was permitted to bring this original action is that enforcement of the Compact was of such general public interest that the sovereign State was a proper plaintiff. *See Maryland v. Louisiana*, 451 U.S. 725, 735-739 (1981). It is wholly consistent with that view that the State should recover any damages that may be awarded, money she would be free to spend in the way it determines is in the public interest.

Texas v. New Mexico, 482 U.S. at 132 n. 7, *quoted in* App. to Third Report at 21-22. The Master says: "It is the same situation here. Any damages will go to the State of Kansas, to be spent as it decides, and not to individual water users." App. to Third Report at 22.

Colorado agrees that it is the same situation here. But the Master fails to perceive the inconsistency of awarding damages to the State of Kansas, while using interest rates of the farmers as the basis to award prejudgment interest on damages that will be awarded to the State of Kansas. The Master's recommendation is fundamentally inconsistent with the basis on which Kansas was allowed to bring this action and is punitive and unfair to Colorado.

The State of Kansas was permitted to bring a suit for violation of the Compact because the State of Kansas as *parens patriae* has an interest apart from that of the individuals affected and which stands behind the rights of its citizens. *Maryland v. Louisiana*, 451 U.S. at 731-39; *Pennsylvania v. West Virginia*, 262 U.S. 553, 592 (1923). It is inconsistent with the Master's theory of quasi-sovereignty to

use the interest rates experienced by the water users as the basis for awarding prejudgment interest on damages awarded to the State of Kansas. Payment of damages to Kansas rather than to individual water users was the Master's sole reason for distinguishing *North Dakota v. Minnesota*, which would otherwise bar recovery of those individuals' losses. Using the water users' interest rates in fact contradicts the Master's reasoning that Kansas was not simply advancing individuals' claims.

The traditional reason that courts did not award prejudgment interest on unliquidated damages was the perceived unfairness to the defendant, who could not tender payment of a specific sum to the plaintiff to stop the accumulation of interest. App. to Third Report at 39. The Master has acknowledged that until 1968, neither State knew nor had reason to know that post-Compact well pumping in Colorado was causing depletions to usable Stateline flows in violation of the Compact. Third Report at 106. Therefore, until at least that time, Colorado had no reason to set aside a sum of money to pay damages or to tender a sum to Kansas to stop the accumulation of interest. Even as of 1969, Colorado had no way of knowing the amount of such depletions.

But, even assuming that, in spite of all of the uncertainties, Colorado had set aside money beginning in 1969 for the payment of damages to Kansas or tendered to Kansas an amount for payment of damages, the interest rates received on such monies would have been at the rates received on state government revenues, not the interest rates paid by farmers in Kansas. In this case, given both the difficulty of determining the amount of depletions to usable Stateline flows and the constitutional

limit on the recovery of individual losses by states, it is fundamentally unfair to award prejudgment on Kansas' damages at the interest rates paid by farmers. Colorado did not earn interest at those rates on money that will be used to pay damages and Kansas would not have received interest at those rates if the damages had been received at an earlier date. To use the interest rates of farmers to award prejudgment interest, which are higher than rates received on state revenues, is punitive rather than compensatory, and the facts of this case simply do not justify a punitive award of prejudgment interest.

V. THE CROP PRODUCTION LOSSES ESTIMATED BY THE KANSAS EXPERTS ARE NOT REASONABLE AND THE MASTER'S RECOMMENDATION TO AWARD THESE LOSSES TO KANSAS SHOULD NOT BE ACCEPTED BY THE COURT

The Master notes that the largest component of the Kansas damage claim is based upon crop production losses due to surface water depletions. Third Report at 45. The losses relate to the lands within the ditch service areas in Kansas irrigated by surface water only. *Id.* In 1950, the acreage irrigated by surface water only was approximately 29,000 acres of some 50,000 acres irrigated in the ditch service areas. *Id.* This acreage declined steadily over time as more wells were developed in the ditch service areas. *Id.* By 1994, the total acreage irrigated by surface water in the ditch service areas had declined to 44,000 acres, and the acreage irrigated by surface water only had declined to 8,709 acres. *Id.* at 7, 45. The number of wells in the ditch service areas had correspondingly increased from 282 in 1950 to 618 in 1988. *Id.* at 45.

The amount of the depletions to farm headgate deliveries of lands irrigated with surface water only was agreed to in the Stipulation between the States. Third Report at 8-9. The total amount of those depletions was 72,036 acre-feet, *id.* at 9, which was almost exactly one-half of the depletions to farm headgate deliveries that were replaced by additional pumping by wells in the ditch service areas (154,526 acre-feet). *Id.* Looked at from another perspective, only 17 percent of the total depletions to usable Stateline flows during the period 1950-1994 (72,036 acre-feet of 420,070 acre-feet) were reductions to farm headgate deliveries that would have resulted in crop production losses on surface water only lands.

It was therefore troubling that 72% of the Kansas claim for damages, with prejudgment interest, was based on crop production losses on the surface water only lands ($45.1 million of $62.4 million). Third Report at 1, 45. Not only did this seem surprising because of the small amount of the depletions to farm headgate deliveries of lands irrigated by surface water only; but, until 1977, any farmer in the Kansas ditch service areas could have drilled a well to obtain additional water, and many did. Third Report at 60; First Report at 225. This Court pointed out the availability of inexpensive ground water underlying the ditch service areas in 1943 in *Colorado v. Kansas*:

> As has been pointed out, despite Colorado's alleged increased depletions, the acreage under irrigation in western Kansas through existing ditches has steadily increased, over the period 1895-1939, from approximately 15,000 acres to approximately 56,000 acres. Moreover, the arid

> lands in western Kansas are underlaid at shallow depths with great quantities of ground water available for irrigation by pumping at low initial and maintenance cost. There is persuasive testimony that farmers who could be served from existing ditches have elected not to take water therefrom but to instal [sic] pumping systems because of lower cost.

320 U.S. at 399.

The trend in increasing use of ground water in southeast Kansas continued after the Compact was adopted.[11] Thus, the magnitude of the crop production loss damages on the surface water only lands raises a fundamental question about the Kansas damages claim: If crop values were as high as the Kansas experts estimated, why didn't every farmer in the ditch service areas drill a well to pump additional ground water?

As the Master states, the Kansas approach to estimating crop losses and lost income was "unexpectedly simple." Third Report at 47. Rather than collecting records of crop yields for representative farms irrigated by surface water only, the Kansas experts relied on linear crop yield – evapotranspiration (ET) relationships developed from research studies on experimental farms. *Id.*[12]

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[11] Pumping in the entire regional area in Kansas, including the ditch service areas, increased from about 77,000 acre-feet in 1951 to about 718,000 acre-feet in 1988. App. to Third Report at 72. The acreage irrigated in the entire area increased from approximately 66,000 acres in 1949 to 351,000 acres by 1979. First Report at 221.

[12] The Master says that research studies have shown a linear relationship between crop yield and ET. However, as

The Master discusses Colorado's criticisms of the crop yield-ET coefficients used by the Kansas experts but says these are highly technical issues and were refuted by Professor Stone. Colorado will not trouble the Court to review the testimony on the technical issues because Colorado has a more basic objection to the Master's recommendation. The Kansas analysis implies very high values of water for irrigating alfalfa, grain sorghum, and winter wheat, values that are unreasonable when compared to the low cost of installing and operating a well to provide supplemental water for either these crops or the higher value crop of corn. These comparisons suggest that Kansas' "unexpectedly simple" approach to estimating crop losses was in fact deceptively simple, failing to account for other variables that affect crop production, and thus are inappropriate for the purpose of estimating losses to farmers who did not have well water.

One of Colorado's experts was Professor Richard M. Adams, who is a professor of agricultural and resource economics at Oregon State University and, as the Master notes, has served as a consultant to the U.S. Environmental Protection Agency. Third Report at 62 n. 16. Of particular note is the fact that the issue on which Professor Adams has served as a consultant to EPA is the assessment of crop losses due to air pollution, and specifically losses due to ozone, which is a highly contested issue. RT Vol. 200 at 34-35, 43-44 (Colo. App., Item 4).

Professor Adams focused on the values of water implied in the analysis by the Kansas experts. First, he

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Colorado's experts pointed out, weather, disease, and pests can dramatically reduce the marketable yield of crops, regardless of the amount of evapotranspiration. Third Report at 52.

calculated the acre-foot value of water in the Kansas analysis and then compared those values of water to other economic studies reporting values of water for production of irrigated crops. Third Report at 62. Although estimates of water values can be affected by a variety of factors, he stated that one expects central tendencies in the estimates, and comparison of results with those from similar studies is a standard procedure in scientific research and the peer review process for publication in scientific journals. Colo. Exh. 1203 at 1 (Colo. App., Item 3). Based on his review of the per acre-foot values for water from a number of studies at various locations across the western United States, Professor Adams concluded that, using the most conservative method for calculating the Kansas values of water, the Kansas values were three to four times higher than the values found in the literature for these crops. Colo. Exh. 1203 at 7 (Colo. App., Item 3); Third Report at 63.

Second, Professor Adams compared the value of the water to the cost to pump ground water in the ditch service areas. Third Report at 60. For example, in the Kansas analysis the value of an additional acre-foot of water delivered to surface water only lands in 1950 was $42. RT Vol. 208 at 50 (Colo. App., Item 9); Colo. Exh. 1203, Table 2 (Colo. App., Item 3). The cost to pump an acre-foot of ground water in 1950 from a deep (*i.e.*, Ogallala aquifer) well powered by natural gas in the Amazon Ditch service area in the original Kansas Report was only $3.77, or less than 10 percent of the value of the water. *Id.* Based on that comparison Professor Adams said it struck him as "extremely odd that the farmers would not have drilled wells given that differential between potential profit and the cost of pumping water." RT Vol.

208 at 49-51 (Colo. App., Item 9)[13]. Throughout the period when wells could be drilled in Kansas (1950-77), the value of water in the Kansas analysis was nine to twenty times higher than the cost to pump ground water. *Id.* at 67. As Professor Adams testified, farmers are astute and would not have foregone the opportunity to increase their incomes by drilling wells if the value of water was as high as the Kansas analysis implies. *Id.* at 67-69.

The fact that more than 8,700 acres in the ditch service areas continued to be irrigated only with surface water reinforced Professor Adams' conclusion that the crop production losses estimated by the Kansas' experts on those lands were too high. Colo. Exh. 1203 at 8 (Colo. App., Item 3).

The Master rejected Professor Adams' comparison of the values of water in the Kansas analysis and values of water in the literature on the basis that Professor Adams acknowledged that the Kansas analysis involved a "short-short run" or "intra-seasonal" situation, which would generally be higher than the values of water reported in other situations. Third Report at 63. He cited to a recent two-year transfer of water between the Palo Verde Irrigation District and the Metropolitan Water District in California at $143 per acre-foot and stated that James Lochhead, the former Director of the Colorado Natural Resources, testified that the cost of acquiring water in the

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[13] A deep well powered by natural gas in the Amazon Ditch service area was used for comparison because this example was presented in the Kansas Report, Kan. Exh. 892, Table A14, and because wells in the Amazon Ditch service area had the greatest historical pumping lifts, at least in the 1950s. *See* RT Vol. 204 at 122-23 (Colo. App., Item 7).

Arkansas River Basin might be higher than the $143 per acre-foot figure used in the California transfer. *Id.* at 63-64.

The Master has cited this evidence out of context. Professor Adams did acknowledge that the literature values he had cited were not "intra-seasonal" values, but noted that there were very few studies of "intra-seasonal" values, and said that whether the "intra-seasonal" values would be higher was an empirical question. RT Vol. 200 at 121-22 (Colo. App., Item 5).[14] He testified that most of the values he had obtained from the literature were based on well water, which would be higher than the value of unregulated surface water in Kansas, and were therefore appropriate for comparison. *Id.*; RT Vol. 208 at 69-70 (Colo. App., Item 9); *id.* at 97-99 (Colo. App., Item 10).

The transfer by the Palo Verde Irrigation District to Metropolitan Water District (which supplies water to Los Angeles and San Diego) was for *municipal* use and does not reflect the price that *farmers* would be willing or able to pay for water for low-value crops such as alfalfa, grain sorghum, or winter wheat. *See* RT Vol. 208 at 59-63 (Colo. App., Item 9). In the Arkansas River Valley in Colorado, water is sold for agricultural use for $8.00 to $10.00 an

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[14] Professor Whittlesey described the value of water in the Kansas analysis as a "short-short run situation" or "intra-seasonal" because the farmers had already planted crops and generally cropped all their acreage. Therefore, except for the cost to apply additional water and harvest the additional yield, they had made all their investments. But the higher the "intra-seasonal" value of water, the more incentive a farmer has to drill a water well to realize that value. The surface water only lands were not just occasionally short of water, they were water short every year. Third Report at 46.

acre-foot. Second Report at 50. Mr. Lochhead did not testify that the cost of acquiring water in the Arkansas River Basin might be higher than the $143 per acre-foot figure used in the California transfer. The statement was taken from a memorandum prepared by Mr. Lochhead and related to the fact that in a very dry year, if Colorado had to purchase water at rates comparable to municipal users, the price to purchase water for repayment might be higher than $143 an acre-foot. Mr. Lochhead never testified that this was the average price Colorado would have to pay for water or that $143 was a price that farmers could afford to pay for water. Indeed, the Master noted in his Second Report that the current price of replacement water in Colorado was $8.00 to $10.00 per acre-foot. Second Report at 50.

On the comparison of Kansas' implied value of water and the low cost to pump ground water, the Master states: "Given the hindsight of present day economists, it might have been profitable for everyone to drill supplemental wells in those early years. However, there are many reasons why this may not have been done, and the failure to drill wells does not by itself indicate that Kansas' estimates of crop losses is too high." Third Report at 60. He then lists various reasons why farmers may not have drilled wells, such as "[t]he favorable economics of drilling wells may not have been understood at the time." *Id.* at 60-61. It should be noted that Kansas did not call a single farmer who irrigated with surface water only to explain why they had not drilled wells. Rather, those were reasons offered by Kansas' economists.

With all due respect, Colorado believes that the substantial difference between the value of water in the Kansas analysis and the cost to pump ground water is

highly relevant and does indicate that the Kansas estimates of crop losses on surface water only lands are unreasonable. In 1943, this Court noted that the lands in western Kansas "are underlaid at shallow depths with great quantities of ground water available for irrigation by pumping at low initial and maintenance cost." *Colorado v. Kansas*, 320 U.S. at 399. The Court noted that there was "persuasive testimony that farmers who could be served from existing ditches have elected not to take water therefrom but to install pumping systems because of lower cost." *Id.*

Colorado does not believe that it is reasonable to suggest that in the 1950s and 1960s the "favorable economics of drilling wells may not have been understood at the time" or that "[q]uality information regarding costs and returns was not readily available." Third Report at 60. The favorable economics of drilling wells was pointed out by this Court in 1943. There may have been reasons why an individual did not drill a well, but, as Professor Adams said, it simply does not make sense that over a period of 28 years (1950-1977), farmers would not have drilled wells to irrigate some 8,700 acres in the ditch service areas if the values of water in the Kansas analysis were correct. RT Vol. 208 at 67-68 (Colo. App., Item 9).

The crop production losses estimated in the Kansas analysis should be rejected by the Court as the basis to award damages to Kansas. They are an unreasonable and inequitable basis for awarding damages to the State of Kansas for losses to individual water users – individuals who are not before the Court – particularly if such losses are compounded by prejudgment interest.

CONCLUSION

Colorado recommends that its exceptions to the Special Master's Third Report be granted and that the case be remanded to the Master for completion of the remedy phase consistent with the Court's opinion.

Respectfully submitted,

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APPENDIX
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Appendix Item 1

Excerpts from Joint Exhibit 66
(pages 1-2, 4-5)

COLORADO WATER
CONSERVATION BOARD
BASIC-DATA RELEASE NO. 21 (1970)
[Pages 1-2, 4-5]

HYDROGEOLOGIC DATA FOR THE LOWER ARKANSAS RIVER VALLEY, COLORADO

BY THOMAS J. MAJOR, R. THEODORE HURR, AND JOHN E. MOORE U.S. GEOLOGICAL SURVEY

PREPARED BY THE UNITED STATES GEOLOGICAL SURVEY IN COOPERATION WITH THE COLORADO WATER CONSERVATION BOARD AND SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT DENVER, COLORADO
1970

ABSTRACT

Ground-water use as a supplemental irrigation supply in the Arkansas River valley increased substantially between 1950 and 1965. During this 15-year period about 1,000 wells were drilled. Withdrawal of ground water by wells increased from 31,000 to 185,000 acre-feet annually in this period. The annual average withdrawal was 65,400 acre-feet for the first 5 years and 144,000 acre-feet for the last 5 years. This report presents the basic data collected during the inventory of the water resources of the reach of the valley from Pueblo to the Kansas State line. It includes maps showing the location of large-capacity irrigation, public supply, and industrial wells, records of well construction and yield, chemical analyses of ground water, water-level measurements, and well logs. Records of 1,348 irrigation wells and 119 public supply and industrial wells are included.

INTRODUCTION

An investigation of the water resources in the Arkansas River valley was begun in 1963 in cooperation with the Colorado Water Conservation Board and Southeastern Colorado Water Conservancy District. The purpose of the study is to make a comprehensive evaluation of the hydrology of the valley and to provide basic information to water users and state and local agencies for the planning, management, and administration of the water resources. The approach is to (1) inventory the water resources, (2) document and evaluate the effects of development, (3) construct and verify an electrical analog model to aid in the evaluation of the hydrology, and (4) develop models and test water-management plans.

PURPOSE AND SCOPE

This release presents the basic data collected during the inventory of the water resources of the Arkansas River valley. The release includes maps (plates 1 through 4) showing the location of large-capacity (yield greater than 100 gallons per minute) irrigation, public supply, and industrial wells that withdraw water from the valley-fill aquifer. In addition, the maps show the location of test holes, observation wells, stock wells, and domestic wells used to determine the physical character, saturated thickness of the valley-fill deposits, and seasonal fluctuations of the water table. Records of large-capacity wells, observation wells, and water levels are presented in tables 3, 4, and 5. Chemical analyses of water from selected wells and logs of test holes drilled in the valley fill are given in tables 6 and 7.

The information contained in this report has been used to construct and calibrate an electrical analog model of the Arkansas River valley and forms the basis for interpretive reports which will follow. The analog model of the Arkansas River valley was constructed at the U.S Geological Survey's Analog Model Unit in Phoenix, Ariz. It has been used to evaluate the relation between the stream and valley-fill aquifer (Moore and Wood, 1967). The model is being used at present (1970) to test alternate plans for improved utilization of both the ground- and surface-water supplies.

This report should be useful to land owners and drillers who are contemplating drilling a new well. Records of wells near a proposed well site can be studied to predict conditions likely to be encountered when drilling a new well.

DESCRIPTION OF AREA

The report area is a 150-mile reach of the Arkansas River valley extending from Pueblo to the Kansas State line. The report contains hydrogeologic data for the valley-fill aquifer which is adjacent to, underlies, and is in hydraulic connection with the Arkansas River. The aquifer consists of unconsolidated deposits of gravel, sand, silt, and clay. It ranges from 1 to 14 miles in width and covers an area of about 500 square miles in parts of Pueblo, Otero, Crowley, Bent, and Prowers Counties.

The aquifer fills a U-shaped trough cut into the bedrock, which consists of shale, limestone, and sandstone of Cretaceous age (table 1). The relation of the valley-fill aquifer to the bedrock is shown on the diagrammatic

section (back cover). Recharge, movement, and discharge of ground water from the valley-fill aquifer is also shown on the section. About 2 million acre-feet of water is stored in the valley-fill deposits.

METHODS OF STUDY

Information in this release is based on data collected from 1963 to 1968 and on previous studies. Records of 1,348 irrigation wells and 119 public supply and industrial wells were obtained during the investigation; all known large-capacity irrigation wells are included. As of December 1968, 137 of the irrigation wells were not equipped with a pump. Information on well location, depth to water, depth of well, lithology, discharge rate, days pumped, and acreage irrigated was collected for most of the irrigation wells.

* * *

A network of 965 observation wells was established to provide data for construction of hydrologic maps and to monitor changes in storage in the valley-fill aquifer. Water levels in these wells are measured twice yearly (spring and fall). The spring measurement is made in March or April before irrigation-well withdrawal begins and the fall measurement is made in October or November after withdrawal has stopped. The network consists of 608 irrigation wells, 197 stock and domestic wells, and 160 Geological Survey observation wells. The observation wells were installed where there were no existing wells and where additional control was needed.

Ground-water withdrawal by large-capacity wells was estimated from electrical and natural-gas power data. Information on power use by large-capacity wells

was obtained from gas and electric companies serving the Arkansas Valley, from city officials, and from individual well owners. Since 1964, most of the electric and gas meters on irrigation wells have been read during the spring and fall measurements; these readings provide the major source of data to compute ground-water withdrawal.

Information on the geology and hydrology of the valley-fill aquifer was obtained by drilling test holes and from drillers' logs. The test holes were drilled both by contractors and by the Geological Survey. The drilling and logging of the holes was supervised by personnel of the Geological Survey. Representative lithologic logs obtained from 577 test holes are shown in table 7. Drillers' logs are on file for most of the irrigation wells (see Remarks column, table 3).

A water-quality sampling network was established in 1967. Samples of water are collected and analyzed from these wells each year and published in Water Resources Data for Colorado. Part 2, Water Quality Records (U.S. Geol. Survey, 1967). Records of the wells that are sampled yearly are in table 3. The results of analyses of samples from 154 wells collected and analyzed in September 1964 are shown in table 6.

DEVELOPMENT OF GROUND-WATER SUPPLIES

Ground-water supplies in the Arkansas River valley are obtained from wells tapping the valley-fill deposits or the Dakota Sandstone. A summary of the geologic units and their hydrologic character is given in table 1. The Dakota Sandstone yields water to domestic and public

supply wells in parts of the valley. Wells tappling this aquifer yield as much as 100 gpm (gallons per minute), but the average yield is only 20 gpm. The hydrology of the Dakota Sandstone is not discussed in this report; however, information on this aquifer can be found in reports by Voegeli and Hershey (1965) and Weist (1963, 1965).

The valley-fill deposits are the principal source of water for irrigation and public supply wells. Wells tappling these deposits yield as much as 3,150 gpm; average yield is about 650 gpm. Ground water from the valley-fill aquifer has been developed to supplement surface-water supplies which often are inadequate at the beginning and near the end of the irrigation season. The surface-water supply was developed between 1860 and 1900. The ground-water supply was developed mainly from 1950 to 1965 (figs. 1, 2). During this 15-year period about 1,000 large-capacity irrigation wells were drilled in the Arkansas Valley. Since 1965, there has been a substantial reduction in the rate of well installation. Only 22 new wells have been drilled because of recent restrictions placed by the State of Colorado. There were 1,348 large-capacity irrigation wells in the valley in December 1968.

An increase in ground-water withdrawal has occurred concurrently with the increase in the number of wells. Withdrawal of ground water increased from 31,000 to 185,000 acre-feet annually in the period 1950 to 1965 (fig. 3; table 2). The average annual withdrawal was 65, 400 acre-feet for the first 5 years and 144,000 acre-feet for the last 5 years. A detailed tabulation of ground-water withdrawal in each county from 1964 to 1968 is given in table 2.

Hydrographs of these observation wells (fig. 4) show that the magnitude of the water-level changes varies with the density of irrigation well development. The upper and lower hydrographs are from areas where the density is 2 wells per square mile, whereas the middle hydrograph represents an area where the density is 6 wells per square mile. In general, water levels in the Arkansas Valley are highest in the spring and lowest in the fall. Although water-level declines in observation wells between spring and fall have been as much as 15 feet, the average seasonal change for the entire valley is normally less than 3 feet. The water levels for the past 7 years show no major rise or decline.

* * *

Appendix Item 2

Excerpts from Joint Exhibit 157
(pages 1, 5-21, 31, 32)

IN THE DISTRICT COURT IN AND FOR

WATER DIVISION NO. 2

STATE OF COLORADO

CASES NOS. W-4079, W-4080, W-4083,
W-4084 and W-4085

IN THE MATTER OF AMENDMENT OF THE RULES AND REGULATIONS GOVERNING THE USE, CONTROL AND PROTECTION OF SURFACE AND GROUND WATER RIGHTS LOCATED IN THE ARKANSAS RIVER AND ITS TRIBUTARIES	
PROTESTANT: ATCHISON, TOPEKA AND SANTA FE RAILWAY COMPANY W-4079	FINDINGS OF FACT, CONCLUSIONS OF LAW AND JUDGMENT AND DECREE
PROTESTANT: STRATMOOR HILLS WATER DISTRICT W-4080	
PROTESTANT: SECURITY WATER DISTRICT W-4083	
PROTESTANT: COLORADO WATER PROTECTIVE AND DEVELOPMENT ASSOCIATION W-4084	
PROTESTANT: AMERICAN CRYSTAL SUGAR COMPANY W-4085	

The above matters came on for consolidated trial to the Court on March 12, 13, 14, 17, 18, 19, May 19, 20, 21, 28, 29, 30, October 21, 22 and 23, 1975, pursuant to C.R.S. 1973 37-92-501 (2) (h) on various Protests to a proposed Amendment (herein called "the "Amendment") to Rule 3 of the Rules and Regulations of the State Engineer Governing the Use, Control and Protection of Surface and Groundwater Rights on the Arkansas River and its tributaries (herein called the "1973 Rules").

C. J. Kuiper, State Engineer, Proponent of the Amendment, was represented by James D. Geissinger and Donald H. Hamburg, Special Assistants Attorney General, acting for the Attorney General of Colorado.

* * *

The Court, being fully advised in the premises, having heard and reviewed the evidence and having heard the arguments of counsel on October 28 and 29, 1976, makes the following Findings of Fact, Conclusions of Law and enters the following Judgment and Decree.

FINDINGS OF FACT

1. These proceedings were brought by all Protestants pursuant to Section 37-92-501(2) (h), and in the manner provided by Section 37-92-304, 1973 C.R.S., to protest the validity of a proposed Amendment to Rule 3 of the Rules and Regulations adopted by C. J. Kuiper, State Engineer of Colorado, dated November 16, 1972 and effective February 19, 1973, applying to the use of waters of the Arkansas River and its tributaries.

2. The 1973 Rules, governing the use of ground water in the Arkansas River Basin, were promulgated by the State Engineer on November 16, 1972 and became effective on February 19, 1973 (State Ex. R). They permitted all well owners who were subject to the rules and had filed applications for adjudication of their appropriation rights in the Water Court prior to June 30, 1972, to pump of right for not less than three days each week and for additional periods in high water years as the State Engineer might from year to year allow. According to the testimony of the State engineer, these rules were promulgated on the basis of studies by Harlan Erker and Jeris Danielson, Deputy State Engineers, and were believed to be consistent with directions of the legislature and the best interests of the State, viz. that existing uses of groundwater be recognized to the fullest extent possible. They involved a regulative pattern similar to the four-day-on, three-day-off regimen on the South Platte River that was approved by the Colorado Supreme Court in *Kuiper v. Well Owners Conservation Association*, 176 Colo. 119, 147 (1971). No protest was filed to the 1973 Rules. They remain in effect according to their terms until amended as prescribed by law (State Ex. R).

3. The Amendment was proposed on January 4, 1974, with an effective date of March 27, 1974 unless stayed pending hearings under C.R.S. 1973, 501(2) (State Ex. W). It directed that all pumping be limited to two days a week in 1974, to one day a week in 1975 and to zero days a week in 1976 and thereafter (State Ex. S). It made no exception for wells that could pump from time to time in priority, for diversions by wells that have an uninterrupted regimen of pumping for more than 18

years, for diversions by wells causing no material injury to any vested senior right in Colorado, for diversions by wells at times when no appropriator with a vested senior right has need for water or calls for delivery of water to his diversion facility, or for diversions by wells in excess of quantities that must be curtailed to fill the needs of all vested senior rights that make a call. The Amendment was stayed by Order of May 30, 1975, until final determination of the present proceeding.

4. The Arkansas River arises in the mountains of central Colorado and flows southeasterly to the State line, being joined between Canon City and the State line by a number of tributaries, including the Fountain, Adobe, Horse, and Big Sandy Creeks and the St. Charles, Huerfano, Apishapa, and Purgatoire Rivers (State Exs. J and E-2, pp. 5-8). The flows in the Arkansas River and its tributaries fluctuate erratically both seasonally and from year to year. Water for the satisfaction of the priorities of the River system comes from a variety of sources, including flow of the river from snowpack and rains in the mountains, precipitation, side stream inflow, accumulated ground water, surface return flow from irrigation by both surface and ground water sources, seepage and percolation of ground water. Normal yearly surface flows are relatively low during the spring months, rise as the snowpack in the mountains melts in May and June, then fall dramatically in mid or late July when the runoff from melting mountain snow ends. Flows in August and September are generally quite low, being limited to return flows from irrigation and side-channel inflows from local shower activity (State Ex. E-2, p.5).

5. Between Pueblo and the State line the Arkansas River meanders across an alluvial fill which ranges from a mile to 10-12 miles in width and from zero to 250 feet in thickness. The water table within the alluvial fill ranges from close proximity to the surface to as much as 100 feet below the surface. The material is charged by percolation from the surface and from the river and drains downslope toward and along the river in the direction of its flow. An estimated two million acre feet of water is generally held in transient storage within the alluvial material. Estimates of the amount of this water which is economically recoverable for irrigation range from 450,000 acre feet to 700,00 acre feet.

4. Principal ditches in the Arkansas Valley are located along the peripheral edges of the alluvial basin throughout a substantial part of its configuration (Protestants Ex. 8-1 to 8-4). Between these ditches and the river, lands historically irrigated through such ditches overlie significant portions of the alluvial material and have direct access to the water in transient storage therein (State Ex. D-1 to D-4; Protestants Exs. 13-1 to 13-4). There is no evidence that the quantity of irrigated acreage overlying the alluvium has materially changed in recent years. Several major ditches, e.g., Fort Lyon, Bessemer, Catlin, Rocky Ford Highline and Otero Extend beyond the limits of the alluvium (Protestants Exs. 8-A to 8-D; State Ex. E-2, Table 1). Lands served by these ditches beyond the limits of the alluvial fill have no direct access to alluvium groundwater.

7. In early years irrigation was accomplished primarily by use of surface waters delivered through the ditches, in accordance with their respective priorities, and

released down laterals to the lands they served. From the early part of the twentieth century, however, wells were dug to reach and use water in the alluvium, where available, to supplement the ditch decrees. In this way water would be provided to overlying lands after the spring runoff had ended and the river supplies were gone. The number of such wells rapidly increased subsequent to the early 1950's as a consequence of drought conditions and concurrent availability of inexpensive electrical power in the rural area. By 1956 prior to the first well registration statutes (C.R.S. 1953, 147-19-2), the number of high capacity irrigation wells, (that is, those with a capacity of 100 gallons per minute or more) reached 672; through 1968 (the year preceding the Water Right Determination and Administration Act of 1969), the number reached 1,447; and through 1972 the number reached 1,477 (State Ex. I, Table 6). Based on estimates from electric meter readings during the period 1966-1972, before any implementation of the 1973 Rules or other well regulation, total well diversions averaged 154,700 acre feet per year (State Ex. I, p. 21).

8. Some irrigators with early decreed well rights, such as Protestants' witness John A. Werme, Jr., do not have ditch rights. Their lands have been irrigated historically from groundwater sources from times long prior to well registration, administration or regulation. A substantial part of the groundwater appropriators, however, hold lands under major ditches and own stock and water rights in such ditches (State Ex. E-2, Table 10, and data collected by the Association for use in the augmentation plan prepared for its members, Protestant Exs. 7, 9). John A. Werme, Jr., the Secretary-Treasurer of the Colorado

Water Protective and Development Association, estimated that no more than 20% of the wells of Association members along the Arkansas River are used independently of surface diversions and a substantial number of these are used for domestic, municipal, industrial and other non-irrigation purposes. Membership records of the Association tended to corroborate that estimate.

9. The Arkansas River as a whole is overappropriated and shortages frequently occur on surface decrees, including those of early priority dates, before the runoff commences in the spring and during the late summer months after the runoff has ended. The evidence is uncontroverted that irrigation wells are now used where available to overlying owners to supplement surface decrees when surface supplies are short. Thus, wells are pumped in the spring before the runoff begins in order to start crops. Without supplemental groundwater in the spring, seed loss may be experienced from lack of soil moisture necessary for germination. Wells are also pumped in the late summer and fall when surface water supplies are not adequate to "finish" crops and lack of well water at this time reduces crop yields. Such a regimen of conjunctive use of well and river water has developed uniformly throughout the Arkansas Basin over a substantial time period, and now appears to have the acquiescence if not the support of a substantial part of the irrigation economy in the basin.

10. Conjunctive use has increased the quantity of water available to irrigated lands as a whole. The USGS (Taylor-Luckey) computer analysis of the Arkansas Basin (State Ex. Q) concludes that conjunctive use has increased total water beneficially used for irrigation by some

113,000 acre feet per year and that if wells stabilize irrigation supplies since they intercept return flows and make them available as needed in the late summer period without waiting for them to be returned to the river. The use of wells in the Arkansas Valley has made water available in the early spring and late summer and fall periods when water is needed for irrigation but would not otherwise be available from surface diversions. The State Engineer acknowledged that such use constitutes a sound management practice. The Amendment will significantly curtail such conjunctive use and, as a consequence, will materially reduce the beneficial use of the waters of the Arkansas Basin.

11. The water in the alluvium is hydraulically connected to the river. Well diversions create cones of depression in the alluvium, alter the elevation and slope of the water table and, if not counteracted by other hydrological events, change the size and rate of river gains from, and losses to, the alluvium. While the quantitative effect of well pumping on river flows is controverted in the evidence, there appears to be no dispute that well pumping depletes the river system (i.e., the surface stream and associated aquifer) over time in an amount which is equal to the consumptive use of well water and that the changes in the water table that accompany such depletions reduce system losses from evaporation and evapotranspiration of phreatophytes. The depletive effects of groundwater withdrawals on the stream itself cannot exceed the consumptive use of well-water less such consequential reductions in phreatophyte and evaporation losses, but the timing and size of such

effects and offsetting countereffects appear to depend upon a number of complex hydrological variables.

12. The time at which depletion to the surface stream occurs, if at all, varies with the character of the aquifer material, the location of wells in relation to the stream, the seasonal periods during which the wells are used (State Ex. H) and the timing of various counteracting forces. In general, wells averaging one mile from the river will have no impact on the river until approximately 30 days following commencement of pumping and will not have a peak impact for about 170 to 175 days (State Ex. H). Wells closer to the river can produce a response in shorter time periods and those more distant from the river in longer periods. Wells above John Martin Reservoir have an average distance from the river of three-quarters of a mile. Those in excess of the average distance, if pumped during August and September, will have no appreciable effect upon the river during the same irrigation season. The State considered only irrigation season effects and assumed no zeroing out by winter irrigation practices or other intervening events (State Ex. I). It presented no evidence of (i) non-irrigation season needs by senior appropriators or (ii) non-irrigation season shortages as a consequence of well diversions. There is no evidence that a non-irrigation season impact of late summer pumping will cause material injury to any vested right. But the State contends that if wells are pumped at regular intervals each year, the effect over time levels out, in the absence of intervening events that "zero out" the depletive effects, so as to cause substantially equal depletions to the river in each month throughout the year (State Ex. H) that this plateau point should already be

reached with respect to most wells in the Arkansas Valley, and that the late summer pumping would have some effect upon available surface supplies in later years. It presented no competent evidence, however, to show that the effects are not in fact zeroed out by winter irrigation or that the river flows in subsequent years have in fact been reduced.

13. The size of depletive effects of well diversions on surface stream flows depends upon the percentage of the diverted water consumed (i.e., the consumptive use ratio), changes in evaporation and phreatophyte losses that result from water table changes, changes in groundwater storage and the extent of alluvium recharge that occurs during wet cycles or as a consequence of widespread winter irrigation practices. Although the latter factors do not negate the collected depletions to the river system, they may "zero out" the effects, so that senior appropriators do not lose their historical level of river diversions, are able to supplement such diversions by well water and have no need or right to "call" for the curtailment of wells.

14. The State assumed but introduced no competent evidence to prove a well consumptive use ratio of 75%. This figure was derived from a study of W. W. Wheeler and Associates and Woodward-Clyde & Associates in 1968 (State Ex. E herein called the "Wheeler Report") and from the computer fit employed by James O. Taylor of the United States Geological Survey in his hydrological study of the Arkansas River described in State Exhibit Q and Protestants' Exhibit 2 (herein called the "Taylor Study"). The Wheeler report had no documentation for the assumed consumptive use figure, but described it as a

figure derived from prior USGS studies, (State Ex. E-2 p.ii). The Exhibit was admitted, over objection, for general background data, not for the conclusions stated therein, unless the authors were brought to court for cross-examination and they were not. Taylor explained that his consumptive use figure was the consumptive use percentage of total applied water (including precipitation, ditch and well water) within and outside of the alluvial basin which best fit observed increases in groundwater storage (Protestant Ex. 2); and that he had assumed that 50% of the ditch water was applied outside of the basin and should be charged with a 100% consumptive use (Protestant Ex. 2). This assumption naturally enlarged the "computer fit" number beyond that which might be determined by field testing. Although witnesses for the State agreed that the consumptive use ratio could be determined empirically by field testing they acknowledged that no such testing had in fact been done. On the other hand, Dr. Morton Bittinger, hydrological witness for Protestants, through use of regression analyses developed for variables that could be measured, showed theoretical depletions to the stream during the irrigation season, absent other hydrological influences, to range from 18% to 27 % of total diverted well water (Protestants Exs. 21 and 22). Such analyses were confirmed by Taylor's computer projections of stream depletions in the same level of magnitude, (State Ex. Q). As such analyses and conclusions have not been negated by empirical testing or other competent evidence, the Court finds that, in absence of counteracting hydrological influences, wells in the Arkansas alluvium depleted the Arkansas River during the irrigation season no more than

18% to 27% of total diversions prior to curtailment under the 1973 Rules and, based on the State's evidence of average well diversions of 154,700 acre feet per year, the aggregate of all such depletions during the irrigation season did not exceed 27,500 to 41,300 acre feet per year. Whether actual depletions to the surface stream reached these calculated maximums, however, was never confirmed by the evidence.

15. Although witnesses for the State denied on the basis of personal opinion that the Arkansas was aggrading (i.e., raising its bed and consequent water table by sedimentation) during periods between scouring floods, empirical evidence in the exhibits of both parties shows the amount of water in transient storage in the Arkansas alluvium to have increased in recent years (State Exs. C, EE, Q; Protestant Exs. 10, 12). Such increases represent a loss of water to the surface stream and a loss of water to the stream system as a whole to the extent that the higher water table results in greater evaporation and transpiration losses. To the extent that well withdrawals avoid this loss, through lowering the water table, the quantitative effect of well diversions on surface flows is reduced. Dr. Bittinger attributed the increase in groundwater storage to irrigation of overlying lands and aggradation of the riverbed between periods of scouring flood (Protestant Ex. 12). The Taylor Study (State Ex. Q) predicted a long-range increase in groundwater storage, under the then existing regimen of well pumping, of 11,000 acre feet per year. Taylor also concluded that more groundwater could be withdrawn by wells in the basin without lowering the water table. The rising water table was corroborated by the testimony of Dr. Bittinger that phreatophyte growth is

encouraged by a rise in the water table and by studies published by him in 1963 showing that phreatophyte growth between La Junta and Las Animas had increased from 2,565 acres in 1963 to 3,557 acres in 1957 (Protestant Ex. 11) and by actual well measurements of the USGS and Colorado State University (State Exs. C, D; Protestant Exs. 12, 12A).

16. The depletive effect of well pumping upon observed and measured river flows is also offset by recharges of the aquifer from cyclical wet periods and from widespread winter irrigation practices. Winter irrigation (i.e., from November 1 through March 31) is practiced for the purpose of increasing germination moisture and conditioning the soil. There is little or no applied water consumptively used for plant growth during the non-irrigation season. Although a portion may be held in the root zone area, a substantial amount of the water applied recharges the groundwater aquifer and increases irrigation season return flows. Protestant's witness E. G. Kidder testified that winter irrigation results in a noticeable, rather rapid increase in the water table as observed in drainage ditches. During the 1926-1966 study period of the Wheeler report (State Ex. E-2, p. iv) average canal diversions during the non-irrigation season were 194,000 acre feet.

17. Notwithstanding theoretical hydrological analyses that support the State's contention that wells have depleted surface flows in the Arkansas River, the Court finds no competent evidence in the record that stream flows have suffered in fact during the post-well period or that reductions, if any, can be traced to well diversions rather than to increased irrigation efficiencies, increased

groundwater storage, phreatophyte and evaporation losses, stock ponds, municipal sewage lagoons and pot holes or changes in side channel inflows. None of the evidence of the State, presented through the two Deputy State Engineers, sought in any empirical way to demonstrate actual stream depletions. The mass diagrams of Canon City, Pueblo, Nepesta, La Junta, Las Animas and State line flows between 1940 and 1972 (State Exs. K-2 to K-7) have little, if any, probative weight. Scales used in the presentation of the data were altered from station to station to dramatize asserted downstream effects. The base slopes for comparison purposes were selected for differing base periods and point fits. The comparison periods were of short duration, a condition that Dr. Danielson later claimed to be statistically unreliable. Changes in slopes (purporting to show changes in stream flows) had no particular correlation with the rate of growth in well diversions during the late 1950's and 1960's. In fact the principal slope departure, claimed to show a reduction in stream flows, occurred in the early 1950's in the Pueblo and Nepesta areas before and above the occurrence of principal well activity (State Ex. K-3 and K-4), and did not increase quantitatively at downstream gauges or in after years. Mass diagram techniques used by the State demonstrate changes, not causes, and cannot quantify either. When the Nepesta gauge mass diagram was extended backwards to 1918 by Dr. Bittinger and changes in slopes therein were compared with changes in precipitation and changes in the volume of well diversions (Protestants Exs. 14, 25, 26), it became evident that the slopes on which the State witnesses relied were tied more closely to precipitation cycles than to increases in

the level of well diversions. The mass diagram analysis of the State only showed that the 1940's were above normal in precipitation and runoff, the 1950's were dry and the 1960's were relatively wet (State Ex. P-4 regarding available supply at Canon City). Dr. Danielson's mathematical equations were no more conclusive. They only calculated a theoretical river loss based upon selective imputs [sic]. They ignored numerous factors which Dr. Danielson could not quantify but which he assumed could have effects on river gain or loss that are comparable to wells, i.e., stock ponds, municipal sewage lagoons, irrigation efficiencies, evaporation and phreatophyte losses and pot holes. Dr. Danielson's failure to account in his analysis for substantial side channel inflows from the Purgatiore River and other ungauged tributaries was never satisfactorily explained (Protestants Ex. 4, 5), nor was any credible explanation given for the fact that the slopes of the State's mass diagrams (State Exs. K-2 through K-7) noticeably steepened (showing increases in river flows) during the late 1950's and 1960's when the rate of well diversions was rapidly increasing. On the other hand Protestants' mass diagram of river flows at Nepesta from 1918 through 1972 (Protestant Ex. 14) patently showed cyclical fluctuations through wet and dry periods but no demonstrable change in the overall slope of the mass diagram line (and no visible reduction in river flows) during the entire observation period.

18. The Court finds no competent evidence in the record that senior water rights have been materially injured in fact as a consequence of well diversions permitted by the 1973 Rules. The absence of such evidence would follow from and tend to confirm Finding 17 that

depletions in river flows have not been demonstrated. The tables prepared for State Ex. I stopped with 1972 and excluded from the mass diagram analyses all 1973 and 1974 river flow and diversion data that would show the effect of the 1973 Rules. Dr. Danielson admitted that no such investigations had in fact been made. The only evidence presented by the State in any way relating to its claim of material well-induced injuries to surface rights was (i) Exhibit P-2, as corrected for statistical errors by P-4, regarding available supply and surface diversions from 1940 to 1972 between Canon City and the State Line and (ii) mass diagrams of historic calendar year diversions of certain selected ditches (Excelsior, Rocky Ford Highline, Otero and Amity, State Exs. L-1 to L-8). When the fluctuations in available supply at Canon City and total diversions, as plotted on State Exhibit P-4, are compared, it is apparent that the reduction in diversions in the mid-1950's corresponded with a decrease in available supply at Canon City (i.e., a reduced runoff) and that the increased level of diversions in the late 1950's and early 1960's corresponded with an increase in such available supply. When Dr. Bittinger extended the mass diagram of diversions backward to 1927 (Protestant Ex. 15), it became further apparent that the diversion curve follows the same cyclical slope on the mass diagram as the slope of flows at the Nepesta gauge (Protestant Ex. 14) and the available supply at Canon City (State Ex. P-4). Dr. Danielson's selection and interpretation of data on individual ditches also had little probative value. By extending the mass diagrams back through 1927 (Protestant Exs. 16 to 19), Dr. Bittinger demonstrated that the fluctuations observed by Dr. Danielson in the early 1950's marked a

climatic cycle and that subsequent changes did not occur at times, in the amounts and in the manner that would parallel changes in rates of groundwater withdrawals. Moreover the changes in measured diversions for each of the selected ditches were readily explainable by known changes in available reservoir water supplies, changes in winter irrigation practices, changes in ditch operations and, in the case of the Amity Ditch, changes in winter storage in John Martin Reservoir subsequent to 1943. Protestants met the inconclusive evidence of the State with rather persuasive evidence that no significant reduction in ditch diversions have in fact occurred in the post-well period. The testimony of George Reyher, a director of the Fort Lyon Canal, showed that the Fort Lyon Company has an unfilled or partially filled decree in the river throughout most of each irrigation season; that river depletions, if any, should be visible by a steady reduction in the Fort Lyon diversions; and that the records of the company show cyclical changes in available supplies but no progressive decline in diversions during the period when well diversions were increasing. The records of the ditch company showed that average diversions during the 1930's were 1.93 acre feet per acre; during the 1940's were 2.44 acre feet per acre; during the dry 1950's were 2.12 acre feet per acre; during the 1960's (following the rapid increase in wells in the 1950's) were 2.35 acre feet per acre; and during the early 1970's were 2.43 acre feet per acre. During this period the irrigated acreage under the Fort Lyon Canal remained the same.

* * *

DECREE

WHEREFORE, IT IS ORDERED, ADJUDGED AND DECREED that the proposed Amendment to Rule 3 of the Rules and Regulations Governing the Use, Control and Protection of Surface and Groundwater Rights in the Arkansas River and Tributaries be disapproved and be of no force and effect and that the existing 1973 Rules and Regulations continue to be in effect except as provided herein;

* * *

Done this 1st day of December, 1976.

BY THE COURT:

/s/ William L. Gobin
WILLIAM L. GOBIN,
ACTING WATER JUDGE

* * *

Appendix Item 3

Excerpts from Colorado Exhibit 1203
(pages 1-8 and Table 2)

A-29

An Evaluation of the Value of Water Estimates Contained in the Kansas Experts Report

by

Richard M. Adams
Professor of Agricultural and Resource Economics
Oregon State University

[Pages 1-8]

Introduction

The value of water in alternative uses is a topic of long standing research and policy importance. In much of the arid western U.S., water supplies are insufficient to meet competing demands. Historically, water was allocated across competing uses via legal or institutional means, rather than by markets. In the absence of market price information from which to ascertain the use value of water, resource economists developed techniques to infer water values. This has lead to a rich literature on the value of water in a number of uses, including irrigated agriculture. These inferred values, in turn, have been used in policy debates concerning the efficiency of alternative water allocations.

The numerical estimates generated by economic assessments, including those involving water resources, can be affected by a variety of factors. These include the measurement techniques employed, the nature of the data and the types of assumptions made by the analyst. Thus, one would not expect two studies of the same issue to yield identical numerical estimates. However, no one expects central tendencies in the estimates as long as the

models and data accurately reflect the real world processes being studied. That is why it is important in evaluating the credibility of any empirical study to compare the results with those from similar studies. Such comparison is considered a standard procedure in scientific research and is expected in the peer review process used to select manuscripts for publication in scientific journals.

The extant literature on water use and values, with numerous site-specific studies of the value of water in the production of a range of crops, can be used in judging the plausibility of the damage estimates contained in the Kansas report. In this report, I compare the values for water implied by the Kansas experts with previous studies of similar crops. Based on this review and comparison, I conclude that the Kansas estimates for the value of water are three to four times higher than the consensus of water use values from previous studies. This calls into question the validity of the damage estimates claimed in Section C of the Kansas report. As discussed below, it is my judgement that the excessively high values for water implied by the Kansas experts arises from the crop yield production relationships employed in Section C of the Kansas report.

The Value of Water

Value in economics is tied to the concept of willingness to pay. For an individual, the value of an item is equal to what he/she is willing to pay for it in monetary terms or in terms of what they must give up to obtain that item; i.e., to obtain more of one good requires that the consumer give up a unit of some other good. This concept of

willingness to pay is also related to the notion of "demand" and the elicitation of demand curves. Specifically, a demand curve can be viewed as a marginal willingness to pay curve for the item (the term "marginal" refers to the value of the next or incremental unit demanded). This marginal willingness to pay declines with units consumed, hence for most goods the demand curve is downward sloping.

In agriculture, water is an input into the process of producing a crop. Water is not consumed because it provides any direct utility to the farmer but because it adds to the profits realized from the production of the crop. Thus, a farmer's demand for irrigation water is a derived demand. That is, the value (or willingness to pay) is derived from the demand for the product that the farmer is selling. Thus, the willingness of a wheat farmer to pay for a unit of water is affected by the price the farmer receives for his wheat. This is a fact that is well documented in the real world. For example, one sees increased pumping of ground water when crop prices rise and reduce pumping of ground water when prices fall, everything else being equal. Similarly, one sees farmers with surface irrigation supplies expending more on irrigation system improvements to enhance the productivity of their water during periods of high crop prices.

At given crop prices, it is possible to map a relationship between water demanded (used) in agricultural production and the price (cost) of obtaining the water. As with other demand curves, this curve is the marginal willingness to pay curve. This demand curve for an input such as water is also referred to as a Marginal Value Product curve, because it traces out the marginal value product of

water as the quantity used changes. In economic theory, it is generally assumed that an individual farmer's behavior will not affect the price of his output nor the cost of obtaining inputs, thus the main determinant of the marginal value product of water is the marginal productivity of that increment of water. The role of the marginal productivity of water in determining value (or willingness to pay) is important is this discussion of the Kansas estimates, which I will return to later.

Using these economic concepts, agricultural economists have estimated the demand for and value of water to agriculture. Based upon hypotheses suggested by the theory of demand, one expects that as more water is applied, the value of the water (or willingness to pay for it) declines. Also, the higher the crop value (price), the higher the willingness to pay for water. Thus, one expects that the value of water in the production of strawberries or tomatoes for the fresh market will exceed the value of water in the production of low value crops such as wheat or grain sorghum.

Table 1 reports estimates of the per acre foot values for water from a number of studies performed at several locations across the western U.S. (adopted from Gibbons). This table reports marginal values of water for specific crops. Since these studies were performed in different years (and hence would be affected by the crop price in a particular year) they are adjusted by the Index of Prices Received by farmers for that crop or crop group. As is evident from the table, the marginal value of water is higher for high valued crops than for low valued crops. For example, the range of values for wheat is from $8 to $50, for grain sorghum it is from $3 to $40 and for alfalfa

it is $10 to $42. Conversely, values in cotton range from $36 to $127, for sugar beets from $32 of $127 and for fresh vegetables the values are in excess of several hundred dollars per acre foot.

* * *

Comparison of Kansas Experts Estimates with Existing Studies

The evidence from the studies reported in Table 1 is that the marginal value of water to agriculture for the types of crops grown in the Garden City area of Kansas is in the range of $20 to $40 dollars per acre foot of applied water. One means to judge the validity of the Kansas damage estimates associated with stateline depletions to surface water flows is to compare the results implied by the Kansas analysis to the water values generated for similar crops in other settings. How then do the values in Table 1 compare with those implied by the Kansas experts?

The Kansas report does not specifically enumerate the marginal values for water. However, these values can be generated from the data and tables provided in Section C of the report. To make such a comparison, I calculate the value of water two ways. The first way is to use the column on "Crop Production Loss" reported in Table C8 of the Kansas report. This dollar value per year is divided by the headgate depletions (applied water) for that year reported in Table C2 of the Kansas report. This calculation leads to a lower bound estimate of the value of water implied by the Kansas report, because it does not include deficiency payments received for wheat and grain sorghum during some years of this time period. These values are then placed in constant dollars by adjusting

nominal values report in Table C8 by two indices, the Producer Prices Received Index (PRI) and the Consumers Price Index (CPI). By placing the values in constant dollars, estimates for one year, say 1950, can be compared with estimates in another year, such as 1994. The PRI is the more conservative of the two adjustment procedures, given that agricultural commodity prices tend to move both higher and lower over this time period, rather than the constant upward movement observed in the CPI. These values are reported in Table 2.

The second way I calculated the value per unit of water from Table C8 is to use the estimates of annual additional pretax profit ("Before Tax Total") reported by the Kansas experts, which includes the deficiency payments for wheat and grain sorghum. Since deficiency payments are a component of the value of the water in a given year, they should be accounted for in the calculation, via the yield averaging method used to calculate such payments. However, I did not have access to the spread sheets used by the Kansas experts to calculate deficiency payments in each year. Therefore, I used the estimates of annual before tax profit from Table C8 which includes stationary values for deficiency payments. As was the case with the use of the "Crop Production Loss" data, these estimates are then divided by applied water (stateline depletions) for each year to arrive at an annual value of water. These nominal values are then placed in constant dollars via the two adjustment procedures. The results of these calculations are reported in Table 3.

Tables 2 and 3 report the values for each year, in nominal dollars and in adjusted dollars, for the two calculation procedures. In both tables, the average of the 45 years for

each column of values is also reported at the bottom of the appropriate column. What one sees is that for the unadjusted (nominal) columns, the value per acre foot of water implied by the Kansas analysis is approximately $65 per acre foot without deficiency payments (Table 2) and $70 with such payments (Table 3). For the CPI adjusted columns, the value is $203 per acre foot without deficiency payments and $233 with the payments. Finally, for the PRI adjusted columns, the value is $109 per acre foot without the payments and $129 per acre foot with deficiency payments. Using the most conservative of these calculated values from Tables 2 and 3 of $109 per acre foot (the PRI adjusted value without deficiency payments) as a benchmark for the reasonableness of the Kansas estimates, one sees that this value is about four times the values found in the literature cited in Table 1 for these crops. Using the CPI adjustment, the Kansas estimates are almost eight times greater than the values for water found in the contemporary literature. Finally, if one were to take the value per acre foot implied by the compounded values reported in the last column of Table C8 from Section C of the Kansas report, the value is almost $700 per acre foot.

Why are the Kansas Estimates So Much Higher than Previous Studies?

The large differences in values per unit of water between published studies and those implied by the analysis in Section C of the Kansas report are important because they raise fundamental questions regarding the damages claimed by Kansas from crop production losses. One explanation for such differences is that there is some

unique combination of soils, climate, topography and agricultural management that makes water much more productive in this section of Kansas than in Texas, California, Arizona, the Pacific Northwest or virtually any other place in the western U.S. However, in my opinion, the high values for water implied by the Kansas report are not valid and are instead an artifact of the procedures used by Kansas in arriving at the damages reported in Section C.

The procedure used by the Kansas experts to estimate damages from the stateline depletions by Colorado is quite simple and differs from the "with and without" type of analysis one usually finds in such resource or project evaluations. The critical step in this calculation is the yield assumptions employed by Kansas. To calculate the value of water in the Kansas report, the authors assume a linear relationship between ET and crop yield. Specifically, the authors assume that an acre inch of ET translates into a yield gain of approximately 4.5 bushels of wheat, 9 bushels of sorghum and .15 tons of alfalfa (these coefficients are lower for earlier years and higher for more recent years). This linear relationship also imposes a constant marginal productivity for water. While a general linear relationship between ET and yield may be valid for some crops in experimental settings, it is important to understand that this is essentially a frontier concept. That is, to achieve (and more importantly, to sustain) this relationship, assumes that there are no other limiting inputs and that water applications are perfectly timed to meet water demand by the crop. In actual agricultural irrigation management, it is often difficult to time applications with that precision, particularly under

surface irrigation conditions. The constant marginal productivity assumption imposed by the Kansas experts also means that the last increment of water applied has the same productivity or contribution to profit as the first increment of water. This combination of a large and constant crop yield response to water leads to an unrealistically high value for the water. As Bernardo and Whittlesey note, in reference to the linearity assumption, "Determining crop yields in response to water supplies is in fact much more complicated, involving the timing of applications and availability, for example"

Summary

The high values claimed by Kansas for the stateline surface water depletions are inconsistent with the range of water values found in the literature for the typs [sic] of crops grown in this region. Besides the disagreement with other studies, these high implied values for water are also inconsistent with observed economic behavior within the study area. Specifically, one would expect that water of such high (and constant) marginal value would generate a range of behaviors on the part of farmers, including the conversion to wells throughout the study area. Indeed, one would expect every acre of farm land to be irrigated by wells, given that the value of water implied by the Kansas report is many times higher than the costs of pumping reported by the Kansas report.

Based on my approximately thirty years of academic research, teaching and editing experienced in the area of resource economics, it is my judgement that the damages claimed by Kansas in Section C are three to four times

higher than justified. This opinion is supported by comparison with previously published studies and by the economic behavior of the farmers actually engaged in agriculture in the region. This suggests that the damage claims for crop production losses arising from stateline surface water depletions should be reduced by two thirds to three fourths from the estimates reported in Section C of the Kansas report.

Table 2. Value of Water, per acre foot

Year	Crop Production Loss[1]	Depletions of Headgate Delivery (AF)[2]	Marginal/Average Value of Water **with no adjustment** (Nominal Dollars)	Marginal/Average Value of Water Using **Prices Received for All Crops** as an Adjuster (***1997*** **$**)[3]	Marginal/Average Value of Water Using **CPI** as an Adjuster (***1998*** **$**)[4]
1950	2,547	61	42	110	282
1951	17,891	362	49	115	309
1952	15,067	262	58	132	352
1953	45,153	621	73	186	442
1954	59,473	1,241	48	122	290
1955	101,510	2,512	40	108	245
1956	114,689	2,460	47	122	279
1957	38,834	1,028	38	103	218
1958	43,458	1,233	35	97	198
1959	8,640	256	34	93	188
1960	102,294	3,052	34	93	184
1961	77,601	2,132	36	99	198
1962	45,661	1,174	39	103	209
1963	80,979	2,149	38	97	200
1964	93,957	2,621	36	92	188
1965	86,591	2,669	32	87	167
1966	16,798	446	38	97	188
1967	11,430	358	32	87	155
1968	123,132	3,909	31	86	147
1969	46,793	1,437	33	92	144
1970	66,264	1,697	39	107	163
1971	74,076	1,763	42	107	169
1972	123,349	2,095	59	141	229
1973	123,261	1,185	104	162	380
1974	202,131	1,728	117	143	385
1975	247,855	2,482	100	135	301
1976	346,442	4,231	82	114	234
1977	228,746	3,195	72	101	192
1978	360,501	4,076	88	119	220
1979	375,229	3,817	98	120	220
1980	98,448	803	123	139	242
1981	126,173	1,219	104	109	185
1982	234,143	2,074	113	132	190
1983	39,500	348	114	125	185
1984	30,613	305	100	103	157
1985	-	-			
1986	48,886	980	50	66	74
1987	6,823	100	68	91	98
1988	60,723	609	100	110	137
1989	74,396	820	91	96	119
1990	119,256	1,614	74	82	92
1991	171,333	2,132	80	92	96
1992	167,943	2,233	75	86	87
1993	90,772	999	91	102	102
1994	133,678	1,551	86	94	94
Total		72,039			
Average of Marginal Values			65	109	203

[1] These values are taken from Table C8 of Kansas experts reports. Values *exclude* deficiency payment losses.

[2] These values are taken from Table C2 of Kansas experts reports.

[3] Index of prices received by farmers was obtained from the USDA National Agricultural Statistics Service, *Agricultural Statistics* (various years from 1964 to 1999). This index is from a table titled: Prices received by farmers: Index numbers by groups of commodities and parity ratio, United States. The index is an aggregate of all crops, and was converted to a base of 1997=100.

[4] The CPI was obtained from the Bureau of Labor Statistics home page: http://stats.bls.gov/top20.html. The CPI for All Urban Consumers with a base year of 1967=100 was converted to 1998=100.

Appendix Item 4

Excerpts from R.T. Vol. 200
December 21, 1999
(Direct Examination of Richard Adams)

[Pages 33 to 35, 43-44]

* * *

[33] Q. WHERE DID YOUR RESEARCH LEAD?

A. BECAUSE OF MY RESEARCH IN ENVIRONMENTAL ECONOMICS AND PUBLICATION THAT I – SEVERAL PUBLICATIONS THAT CAME OUT ABOUT THAT TIME, I WAS CONTACTED BY THE EPA AND ASKED IF I WOULD DIRECT A FAIRLY LARGE INTERDISCIPLINARY PROGRAM THAT THE EPA WAS CREATING AT THAT TIME TO DO A DAMAGE ASSESSMENT OF THE AIR POLLUTION ON CROPS IN THE UNITED STATES.

THE MOTIVATION FOR THIS IS THAT EPA IS REQUIRED BY CONGRESS TO ISSUE REGULATIONS TO CONTROL CERTAIN POLLUTANTS, WHICH ARE CALLED CRITERIA POLLUTANTS. ONE OF THOSE IS OZONE. AND EPA IS REQUIRED EVERY FIVE YEARS TO UPDATE THEIR STANDARD OR AT LEAST JUSTIFY THEIR STANDARD TO THE CLEAN AIR SCIENCE ADVISORY COMMITTEE AND OTHER OVERSIGHT BOARDS.

IN ORDER TO EXAMINE THIS ISSUE, EPA DECIDED THAT THEY NEEDED A FAIRLY LARGE STUDY OF THE EFFECTS OF AIR POLLUTION ON CROP DAMAGES IN – OR EXCUSE ME – THE EFFECTS OF AIR [34] POLLUTION ON CROPS, AND ALSO THEY WISHED TO HAVE AN ASSESSMENT DONE OF THE DAMAGES OR THE LOSSES DUE TO AIR POLLUTION.

Q. WHERE DID YOU CARRY OUT YOUR STUDY FOR EPA? AT THE UNIVERSITY OF WYOMING?

A. NO, I DID NOT. EPA HAS A LAB IN CORVALLIS. IT'S CALLED THE CORVALLIS ENVIRONMENTAL RESEARCH LABORATORY. THAT'S THE LABORATORY THAT DOES ECOLOGICAL RESEARCH OR, IN THIS CASE, PLANT SCIENCE RESEARCH FOR THE EPA. SO THEY SUGGESTED THAT I MOVE TO CORVALLIS TO DIRECT THIS PROJECT.

SO WE MOVED TO CORVALLIS, I BELIEVE, IN THE SUMMER OF 1981. I RETAINED MY EMPLOYMENT AT THE UNIVERSITY OF WYOMING. I WAS ON WHAT IS CALLED AN INTERGOVERNMENTAL PERSONNEL LAB APPOINTMENT, WHERE WYOMING WAS REIMBURSED FOR MY EXPENSES BY THE FEDERAL GOVERNMENT, AND I SPENT TWO YEARS IN CORVALLIS, HELPING TO ESTABLISH THIS PROGRAM WHICH WAS GIVEN THE NAME NATIONAL CROP LOSS ASSESSMENT NETWORK, OR NCLAN.

Q. DID YOU STAY IN CORVALLIS?

A. WE DID. AT THE END OF THE TWO-YEAR ASSIGNMENT, IT WAS CLEAR THAT THIS PROJECT WAS GOING TO GO ON FOR MANY MORE YEARS, AND ALSO AT THAT TIME THE DEPARTMENT OF AGRICULTURAL AND RESOURCE ECONOMICS AT THE OREGON STATE UNIVERSITY HAD A POSITION OPEN FOR A WATER RESOURCE ECONOMIST OR SOMEONE WHO WOULD DO SOME WORK IN WATER [35] RESOURCES, AND I APPLIED FOR THAT POSITION AND WAS HIRED IN AUGUST OF 1983 AS AN ASSOCIATE PROFESSOR.

* * *

Q. DID YOU CONTINUE WORKING FOR EPA AT OREGON STATE?

A. EPA CONTINUED TO PROVIDE GRANT MONEY TO ME THROUGH OREGON STATE UNIVERSITY, AND I CONTINUED TO PROVIDE SOME GUIDANCE OR DIRECTION ON THEIR NCLAN PROGRAM, BUT, OF COURSE, I WAS NOW AN EMPLOYEE AT OREGON STATE UNIVERSITY, AND I HAD OTHER RESEARCH INTERESTS THAT I WAS ALSO PURSUING.

* * *

[43] Q. DO YOU WANT TO POINT OUT ANY OF YOUR MORE IMPORTANT CONSULTING PROJECTS IN YOUR RESUME?

A. CERTAINLY.

* * *

I HAVE WORKED FOR – ANOTHER ONE I WOULD POINT TO THAT I THINK IS RELEVANT TOO – THE REGULATORY PROCESS FOR OZONE IS THE CONSULTANCY [44] WITH BIOSPHERICS, INCORPORATED. THIS WAS ACTUALLY MONEY FROM THE ENVIRONMENTAL PROTECTION AGENCY. I HAVE BEEN – I WAS ASKED TO WRITE THE CHAPTER ON VEGETATION AND ECOSYSTEM DAMAGES IN THE OZONE CRITERIA DOCUMENT, AND I HAVE DONE THIS SUBSEQUENTLY. I BELIEVE I'VE WRITTEN THE LAST TWO – IN THE LAST TWO CRITERIA DOCUMENTS, I HAVE WRITTEN THE CHAPTERS ON VEGETATION DAMAGES.

THESE DOCUMENTS THEN GO THROUGH A VERY STRENUOUS REVIEW PROCESS BY INDUSTRY BECAUSE THE IMPLICATIONS OF THESE SORTS OF DOCUMENTS ARE QUITE PROFOUND FOR INDUSTRY. IF THE EPA RATCHETS DOWN THE REGULATION, THIS IMPOSES SOME FAIRLY HIGH COSTS IN INDUSTRY. SO IT'S A FAIRLY CONTENTIOUS PROCESS IN WHICH YOU HAVE TO - YOU KNOW, YOUR RESEARCH IS CRITIQUED BY PEOPLE WITH OPPOSING VIEWS. MY CHAPTERS HAVE SURVIVED THIS REVIEW PROCESS. AND I GUESS I WOULD ADD THAT BASED UPON OUR RESEARCH, EPA DID TIGHTEN THE SECONDARY STANDARD FOR OZONE FROM .12 PARTS PER MILLION TO, I BELIEVE, .10 PARTS PER MILLION.

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Appendix Item 5

Excerpts from R.T. Vol. 200
December 21, 1999
(Cross Examination of Richard Adams)

[Pages 121-22, 146-51]

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[121] Q. WHAT THAT MEANS IS THAT YOU HAVE QUANTIFIED HERE, IN GENERAL, VALUES THAT, AS A MATTER OF PRINCIPLE, ARE GOING TO BE LOWER THAN THE VALUES THAT ARE RELEVANT FOR THIS STUDY?

A. FIRST OF ALL, LET ME CORRECT SOMETHING. I HAVEN'T QUANTIFIED ANY OF THESE, MR. DRAPER. THESE ARE NOT MY STUDIES. I'M REPORTING THEM AS A SYNTHESIS. THIS IS A SYNTHESIS OF EXISTING LITERATURE. AND, SECONDLY, I CAN'T ANSWER THAT THEY'RE NECESSARILY GOING TO BE LOWER, BECAUSE I SAID THIS IS AN EMPIRICAL ISSUE.

AS WE KNOW, MOST OF THESE STUDIES THAT ARE REPORTED HERE ARE FROM WELLS. THESE ARE IN IRRIGATION CONDITIONS WHERE THEY HAVE A WELL. THE CONDRA, ET AL, STUDY, FOR EXAMPLE, HAS A WELL. THESE PEOPLE WOULD HAVE BETTER TIMING ON THEIR WATER. WATER WOULD PROBABLY BE MORE PRODUCTIVE.

SO IT'S DIFFICULT TO SAY THAT BECAUSE ONE IS SHORT RUN AND THIS SITUATION IN KANSAS IS SHORT-SHORT RUN DOES NOT NECESSARILY TRANSLATE INTO THE FACT THAT THESE VALUES ARE GOING TO BE HIGHER – OR EXCUSE ME – THAT THE VALUES IN KANSAS ARE GOING TO BE HIGHER THAN THESE SHORT-RUN VALUES.

THIS IS AN EMPIRICAL QUESTION THAT TURNS UPON A NUMBER OF FACTORS, INCLUDING THE

FACT THAT THESE STUDIES THAT I HAVE TAKEN FROM THE [122] LITERATURE TEND TO BE STUDIES IN WHICH FARMERS HAVE WELLS OR HAVE WATER THAT THEY CAN TIME IN SUCH A WAY AS TO MAXIMIZE THE POTENTIAL OF THE WATER.

Q. BUT YOU DID NOT INCLUDE ANY SHORT-SHORT-RUN CASES IN YOUR TABLE NO. 1; ISN'T THAT RIGHT?

A. THAT IS CORRECT, BECAUSE I COULD NOT FIND ANY. I HAVE ONE, AS I THINK I MENTIONED EARLIER, IN THE TEXTUAL MATERIAL IN MY REPORT THAT I THINK WOULD QUALIFY IN THAT SETTING. BUT THERE ARE VERY FEW STUDIES OF THE SHORT-SHORT-RUN TYPE IN THE LITERATURE.

* * *

[146] Q. BUT IF YOU'RE LOOKING AT THE VALUE THAT FARMERS WOULD PAY FOR WATER, THAT WOULD RELATE TO THE VALUE THAT THEY ACTUALLY RECEIVE FROM THE USE OF THAT WATER FOR AGRICULTURAL PURPOSES, WHICH WOULD CORRESPOND TO THE AFTER-TAX VALUE; ISN'T THAT RIGHT?

A. AGAIN, WE'RE TRYING TO DEAL WITH COMPARING APPLES AND APPLES IN MY ANALYSIS, AND I THINK BY USING A BEFORE-TAX TOTAL, THAT THAT WAS AN APPROPRIATE COMPARISON TO THOSE WITHIN THE LITERATURE.

NOW, WE CAN TALK ABOUT WILLINGNESS TO PAY, AND I THINK THAT'S A VERY GOOD SUBJECT TO BRING UP. WHEN WE TALK ABOUT WILLINGNESS TO

PAY FOR WATER, ONE OF THE IMPORTANT ATTRIBUTES OF THAT WILLINGNESS TO PAY – FOR EXAMPLE, IF WE TALK ABOUT THE CALIFORNIA WATER MARKET, THE FARMERS SHOWING THE WILLINGNESS TO PAY FOR THE WATER – THAT WATER THAT THEY ARE PAYING FOR IS DELIVERED AS THEY NEED IT. THEY'RE GETTING A FIXED, FIRM SUPPLY WHEN THEY NEED IT SO THEY CAN APPLY IT AT A PERFECT TIME.

AND WE KNOW IN TERMS OF WILLINGNESS TO PAY FOR WATER, IF WE LOOK AT THE CALIFORNIA WATER MARKET, THAT FARMERS IN THE '92 AND '94 DROUGHT WERE PAYING $100 FOR WATER TO APPLY TO VERY HIGH-VALUE CROPS AND IN SOME CASES, AS WE NOTED IN THE EXHIBIT THAT YOU INTRODUCED [147] YESTERDAY, THAT IN THE BROADVIEW IRRIGATION DISTRICT, THAT FARMERS WOULD NOT PAY THE $175 AN ACRE FOOT, WHICH WAS THE CALIFORNIA WATER PRICE IN '75, EVEN TO IRRIGATE VERY HIGH-VALUE CROPS.

THE ONLY VALUE THAT WE HAVE IN THAT CASE SHOWS THAT THEY WERE BUYING PUMP WATER FROM AN ADJACENT DISTRICT AT $100 AN ACRE FOOT. THAT'S WATER THAT ARRIVES WITH PERFECT TIMING TO APPLY TO CROPS LIKE TOMATOES THAT HAVE A GROSS VALUE OF OVER $2,000 AN ACRE, TO APPLY TO COTTON WITH A GROSS VALUE OF OVER $1,000 AN ACRE, AND TO OTHER CROPS SUCH AS ALFALFA, WHICH HAS A YIELD OF 8 TO 10 TONS PER ACRE AS OPPOSED TO 4 IN YOUR AREA.

SO WE CAN SEE THAT THE WILLINGNESS TO PAY IS AFFECTED BY MANY FACTORS BESIDES JUST THE TAXES. AND, AGAIN, USING YOUR EXAMPLE FROM YESTERDAY, THE WILLINGNESS TO PAY AS DEFINED IN THE MARKETPLACE FOR WATER – AGAIN, ARRIVING AT A PERFECT TIME – IS LESS THAN THE VALUE THAT YOUR KANSAS EXPERT REPORT SAYS IS THE VALUE OF WATER ON LOW-VALUE CROPS WITH LOW YIELDS.

Q. YOU WERE HERE, WERE YOU NOT, WHEN WE AGREED – PROFESSOR WICHELNS AND I – THAT THE INTRASEASONAL VALUE THAT HE QUOTED THERE WAS IN THE $150 TO $160 RANGE?

A. I WENT BACK AND LOOKED AT HIS REPORT, SIR, AND IT TURNS OUT THAT WHEN PROFESSOR WICHELNS DID [148] HIS CONVERSION, HE DID IT BACKWARDS IN HIS PAPER. THE PRICE FOR WATER THAT WAS OFFERED IN 1991 THROUGH THE CALIFORNIA WATER BANK – THE BUY PRICE, BEING THE PRICE AT WHICH YOU COULD BUY IT, WAS $175 AN ACRE FOOT. THE SELL PRICE, IF YOU WERE TO SELL WATER TO THE BANK, WAS $125. THE DIFFERENCE WAS CARRIAGE WATER, WHICH WAS WATER THAT WAS NEEDED TO MEET THE STREAM FLOW CONDITIONS IN THE DELTA.

HE HAD 216 PER MEGALITER. A MEGALITER IS ACTUALLY LESS THAN AN ACRE FOOT. SO HE CONVERTED IT THE WRONG WAY. IT SHOULD HAVE BEEN ABOUT $150 FOR A MEGALITER. SO IF WE DO THE CONVERSION ON HIS NUMBERS IN HIS ARTICLE WHERE I BELIEVE HE HAD $123 PER MEGALITER

FOR ACTUAL PURCHASES FROM AN ADJACENT IRRIGATION DISTRICT AND DO THE RIGHT CONVERSION, IT'S $100 AN ACRE FOOT IS WHAT THEY WERE PAYING IN THE BROADVIEW DISTRICT FOR WATER TO IRRIGATE CROPS THAT HAVE A GROSS VALUE OF ABOUT TEN TIMES THE VALUE IN SOUTHWEST KANSAS.

Q. DID YOU FIND OTHER MISTAKES IN PROFESSOR WICHELNS' WORK?

A. NO, I DID NOT. THAT'S A COMMON PROBLEM WHEN AMERICAN ECONOMISTS HAVE TO CONVERT TO METRIC UNITS. I'VE DONE IT MYSELF.

* * *

[149] SPECIAL MASTER: PROFESSOR ADAMS, DID YOU LOOK AT THE PRICES FOR THE DROUGHT WATER BANK IN CALIFORNIA FOR ANY OF THE EARLIER YEARS? MY RECOLLECTION IS THAT WATER WAS SOLD IN '76 - THERE WAS A VERY SEVERE DROUGHT IN CALIFORNIA IN '76. I MAY NOT BE REMEMBERING THIS RIGHT, BUT WATER WAS SOLD FROM THE DROUGHT WATER BANK MORE THAN JUST IN 1992, AND I JUST WONDERED IF YOU LOOKED AT ANY OF THE OTHER PRICES.

THE WITNESS: I DIDN'T. JUST PRIOR TO COMING DOWN HERE, YOUR HONOR, I DID ASK PROFESSOR HOWITT TO SEND ME SOME DOCUMENTS ON THE CALIFORNIA WATER BANK.

SPECIAL MASTER: THERE'S A REPORT THAT'S OUT ON THE CALIFORNIA WATER BANK THAT HAS ALL OF THE PRICES WHICH THE STATE PAID TO BUY

THE WATER. IT HAS THE CARRIAGE LOSSES WHICH PEOPLE HAD TO ABSORB –

THE WITNESS: THAT IS CORRECT.

SPECIAL MASTER: – AND THEN THE [150] PRICES WHICH PEOPLE PAID TO GET THE WATER.

THE WITNESS: THAT'S CORRECT, YOUR HONOR. I THINK IT'S BY MCJONES – OR JESSERICK.

SPECIAL MASTER: WELL, THERE'S AN OFFICIAL REPORT OUT BY THE DEPARTMENT OF WATER RESOURCES.

THE WITNESS: I THINK THAT MAY BE HIS. I THINK HE'S A DEPARTMENT OF WATER RESOURCES EMPLOYEE.

* * *

BUT IN ANSWER TO YOUR QUESTION, YOUR HONOR, I DID LOOK AT A RECENT PUBLICATION THAT REPORTED THE VALUES IN THE '91 WATER BANK, THE '92, AND THE '94. IN THE '91 WATER BANK – AND YOU'RE WELL AWARE OF HOW THE BANK OPERATES. BUT IT STATES A PRICE, A SELL PRICE AND A BUY PRICE. AND THE SELL PRICE, WHAT THE FARMERS RECEIVED BY SELLING WATER IN '91 WAS $125 AN ACRE FOOT. THE DEPARTMENT OF WATER RESOURCES WAS INUNDATED WITH WATER. FARMERS WERE VERY HAPPY TO SELL WATER TO THEM AT THAT PRICE.

IN '92 AND 94 THEY LOWERED THE VALUE. [151] THE WATER BANK SET A PRICE AT $100 – EXCUSE ME

– $76 TO SELL, AND TO BUY FROM FARMERS, IT WAS AT $50 AN ACRE FOOT.

BUT MY POINT, IN RESPONSE TO MR. DRAPER'S COMMENT ABOUT WILLINGNESS TO PAY FOR WATER, IS WE DO HAVE SOME REAL WORLD EVIDENCE ABOUT WILLINGNESS TO PAY FOR WATER. AND AS I SAID EARLIER IN MY COMMENTS, THIS IS ONE OF THOSE COMMON SENSE/ECONOMIC INTUITION VALUES THAT ONE COULD USE IN ASSIGNING VALUES IN THIS CASE.

IF FARMERS IN CALIFORNIA WERE ONLY WILLING TO PAY $100 IN THE MIDST OF A SEVERE DROUGHT IN '91 TO SAVE TOMATOES, COTTON, AND MELONS, WHICH, AS I SAY, HAVE VALUES OF UP TO TEN TIMES HIGHER THAN THE VALUE OF THE GROSS REVENUE OF WHEAT IN SOUTHWEST KANSAS, IT'S ONE OF THOSE PIECES OF EVIDENCE THAT I THINK SUGGESTS RATHER STRONGLY THAT A VALUE OF $109 AN ACRE FOOT IN KANSAS IS NOT REASONABLE.

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Appendix Item 6

Excerpts from R.T. Vol. 203
January 12, 2000
(Direct Examination of Norman Whittlesey)

[Pages 102-108, 114, 117-118]

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[102] MR. DRAPER: I WOULD ASK THAT WE NOW TAKE OUT PLAINTIFF'S EXHIBIT 1017, AND I WILL HAND YOU ONE, YOUR HONOR. THIS IS A NEW EXHIBIT. AND I THINK WHILE WE'RE GETTING OUT EXHIBITS, IT MIGHT BE GOOD TO GET OUT TWO OTHERS. THAT'S DEFENDANT'S EXHIBIT 1203 AND PLAINTIFF'S EXHIBIT 1070.

SPECIAL MASTER: TEN WHAT?

MR. DRAPER: SEVENTY.

Q. PROFESSOR, WHAT IS PLAINTIFF'S EXHIBIT 1017?

A. EXHIBIT 1017 IS A "REVIEW OF AN EVALUATION OF THE VALUE OF WATER ESTIMATES CONTAINED IN THE [103] KANSAS EXPERTS REPORT, EXPERT REPORT PREPARED FOR THE STATE OF COLORADO BY RICHARD M. ADAMS," AND THIS IS A REVIEW PREPARED BY NORMAN K. WHITTLESEY, OCTOBER 15, 1999.

Q. YOU ARE THE AUTHOR?

A. YES, SIR.

Q. NOW, THE EVALUATION BY RICHARD M. ADAMS, IS THAT DEFENDANT'S EXHIBIT 1203?

A. YES.

Q. AND IN PLAINTIFF'S EXHIBIT 1017, DID YOU MAKE AN ANALYSIS OF PROFESSOR ADAMS' WORK?

A. YES, I DID.

Q. HOW DID YOU GO ABOUT DOING THAT?

A. WELL, PROFESSOR ADAMS' APPROACH TO HIS REPORT WAS TO COLLECT VALUES OF WATER FROM PUBLISHED LITERATURE OVER SOME HISTORIC PERIODS AND FROM VARIOUS REGIONS OF THE WESTERN UNITED STATES.

Q. HE DID A LITERATURE REVIEW?

A. IN ESSENCE, THAT WAS HIS REPORT. IT WAS A LITERATURE REVIEW INTENDED TO COMPARE WATER VALUES FROM THE PUBLISHED LITERATURE WITH THOSE WHICH HE DEVELOPED FROM THE MEASURE OF KANSAS DAMAGES FOR CROP LOSS FROM THE KANSAS REPORT.

Q. NOW, IN THE CROSS-EXAMINATION OF PROFESSOR ADAMS, HE AND I DEVELOPED WHAT IS MARKED AS PLAINTIFF'S EXHIBIT 1070. DO YOU HAVE THAT?

A. YES, I DO.

Q. WHAT IS THE RELEVANCE OF PLAINTIFF'S [104] EXHIBIT 1070 TO THE ANALYSIS IN PROFESSOR ADAMS' REPORT?

A. IN A VERY ABSTRACT SENSE, WHAT IS SHOWN IN EXHIBIT 1070 IS AT LEAST THREE POSSIBLE MEASURES OF WATER VALUE THAT CAN BE DERIVED BASED ON, IN THIS CASE, THE DEFINITION OF TIME HORIZON, LONG RUN AND SHORT RUN AND WHAT'S CALLED A SHORT-SHORT RUN IN THIS

CASE AND WHAT I REFERRED TO IN MY REPORT AS AN INTRASEASONAL SITUATION.

IN GENERAL, THE DEFINITION OF "LONG RUN" IN ECONOMICS IS THAT ALL COSTS ARE VARIABLE. SO WE'RE STARTING FROM A POSITION IN WHICH THERE ARE NO INVESTMENTS AND MAKING OR COLLECTING INFORMATION OR MAKING AN ANALYSIS ABOUT A DECISION, IN THIS CASE, PERHAPS REGARDING WHETHER TO IRRIGATE OR DEVELOP IRRIGATION.

AND SO IN SUCH A SITUATION, IF ONE IS CONSIDERING THE POSSIBILITY OF DEVELOPING A NEW IRRIGATION PROJECT IN THE DESERT, LET'S SAY, WHERE THERE'S NO CROPLAND AND NOTHING THERE THAT WE CAN, SAY, DRILL WELLS AND START IRRIGATING, WE HAVE TO CONSIDER AS THE RETURNS TO THE WATER, OR THE NET VALUE OF THE WATER, NOT ONLY ALL OF THE COSTS OF PRODUCTION – THE USUAL VARIABLE COSTS OF FERTILIZER AND MACHINERY AND SEED AND SO ON – BUT ALL THE FIXED COSTS OF THE DEPRECIATION AND CAPITAL ASSOCIATED WITH MACHINERY AND IN ADDITION TO THE COST OF [105] OBTAINING THE WATER.

NOW, THERE'S A COUPLE OF WAYS ONE CAN DO THAT. BUT NEVERTHELESS, WHAT WE'RE TALKING ABOUT IN THE LONG RUN IS A VALUE OF WATER THAT IS NET OF TOTAL COSTS, FIXED AND VARIABLE COSTS. AND BECAUSE WE ARE ACCOUNTING

FOR WHAT SHOULD BE ALL COSTS IN THAT SETTING, WE WOULD EXPECT THE VALUE OF WATER TO BE LOWEST OF THOSE POSSIBILITIES THAT EXIST.

THE NEXT AND WHAT I CALL SHORT RUN AND WHAT IS LABELED AS SHORT RUN IN THIS CASE IS NORMALLY THAT WHICH IS OBSERVED IN THE LITERATURE AS DEVELOPED BY AN ECONOMIST WITH BUDGET STUDIES OR LINEAR PROGRAMMING OR NONLINEAR PROGRAMMING IN WHICH THE VARIABLE COSTS OF PRODUCTION OF CROPS ARE PART OF THE ANALYSIS AND HENCE BECOME SUBTRACTED FROM THE GROSS VALUE OF WATER FOR CROP PRODUCTION. AND IN THAT SENSE, WE GET WHAT IS LABELED AS A MIDDLE VALUE OF WATER OR SOMETHING THAT WOULD BE BETWEEN THE LOWEST AND THE HIGHEST.

THE SHORT-SHORT RUN, OR WHAT MIGHT BE VIEWED AND WHAT I TERM THE INTRASEASONAL SETTING, IS THAT OF – LET ME BACK UP AND SAY ONE MORE THING ABOUT THE SHORT RUN JUST SO IT'S CLEAR. AND THAT IS THAT IN GENERAL WHAT THAT IMPLIES IS THAT THE QUANTITY OF THE WATER AVAILABLE TO THE FARM IS KNOWN AT THE BEGINNING [106] OF THE SEASON SO THAT ALL DECISIONS ABOUT INPUT COSTS ARE ABSOLUTELY KNOWN AND THAT ONE CAN THEN OPTIMIZE, IN ECONOMIST'S TERMS, THE USE OF THAT WATER IN DERIVING THE HIGHEST POSSIBLE VALUE IN CROP PRODUCTION.

AND THE SHORT-SHORT RUN, OR THE INTRASEASONAL CASE, WE ARE TALKING ABOUT THE

CONDITIONS THAT EXISTED IN WESTERN KANSAS IN THE DITCH SERVICE AREA WHERE CROPS WERE ESTABLISHED, CROPS WHICH WERE DROUGHT TOLERANT IN LARGE PART – WHEAT, SORGHUM, AND ALFALFA – BUT WOULD ALWAYS RESPOND TO WATER. AND WE'RE DESCRIBING THE INCREMENT OF YIELD THAT WOULD HAVE BEEN ACHIEVED IF THE WATER WERE APPLIED TO THESE GROWING CROPS.

SO WE ARE NOT CONCERNED ABOUT THE EFFECTS OF THE VARIABLE OR THE FIXED COSTS BECAUSE THE CROP IS ALREADY THERE. THE ONLY MARGINAL COSTS THAT BECOME RELEVANT AT THIS POINT ARE THOSE ASSOCIATED WITH THE APPLICATION OF THE ADDITIONAL WATER, OR THE IRRIGATION COST, AND THE ACCOUNTING FOR THE HARVEST OF THE ADDITIONAL CROP. SO IN THIS CASE, WE ARE GOING TO SUBTRACT FROM GROSS REVENUE ONLY THE MARGINAL COSTS ASSOCIATED WITH THAT INCREMENT OF WATER AND PRODUCTION. AND IN THIS CASE, WE WOULD GET THE HIGHEST VALUE OF WATER IN THE RANGE OF THE THREE THAT WE DESCRIBED HERE.

[107] Q. IN MAKING COMPARISONS WITH REGARD TO WATER VALUES, IS IT IMPORTANT TO KNOW WHICH TIME HORIZON YOU'RE DEALING WITH IN EACH CASE?

A. YES, IT IS. AND IT WOULDN'T, FOR EXAMPLE, BE APPROPRIATE TO USE A LITERATURE VALUE FOR A SHORT-RUN OR A LONG-RUN CONDITION OR SET OF ASSUMPTIONS AND THEN SAY THAT THAT

COMPARES TO THE INTRASEASONAL VALUE THAT WE ARE ASSESSING IN THIS CASE.

THE INTRASEASONAL VALUE IS NOT UNLIKE – I BELIEVE I HEARD THE LANGUAGE IN THE COURT HERE AT SOME POINT IN REVIEW OF SOME ARTICLE ABOUT WATER VALUE IN CALIFORNIA THAT WAS NEEDED TO FINISH THE CROP, AND IT HAD A VERY HIGH VALUE. I DON'T REMEMBER WHICH IRRIGATION WE WERE TALKING ABOUT OR WHO WAS TALKING ABOUT IT. BUT THAT'S THE NATURE OF WHAT WE'RE TALKING ABOUT HERE IS GETTING MORE OUT OF THE EXISTING CROP.

Q. DID YOU ANALYZE PROFESSOR ADAMS' REPORT, DEFENDANT'S EXHIBIT 1203, TO DETERMINE WHETHER ANY OF THE VALUES THAT HE REPORTED THERE WERE COMPARABLE TO THE INTRASEASONAL VALUES THAT WE ARE DEALING WITH IN THIS CASE?

A. YES, I DID.

Q. LET ME ASK YOU TO TURN TO TABLE 1 IN DEFENDANT'S EXHIBIT 1203. THAT'S JUST AFTER PAGE 9.

SPECIAL MASTER: TABLE 3?

MR. DRAPER: TABLE 1.

[108] Q. DOES THIS TABLE SHOW SOME OF THE SOURCES THAT PROFESSOR ADAMS COLLECTED?

A. YES, IT DOES.

Q. DID YOU DETERMINE WHETHER ANY OF THE SOURCES CITED FOR THE WATER VALUES ASSOCIATED WITH WHEAT, GRAIN SORGHUM, OR ALFALFA – DID YOU DETERMINE WHETHER ANY OF THOSE WERE COMPARABLE TO THE INTRASEASONAL TIME HORIZON THAT WE'RE DEALING WITH IN THIS CASE?

A. YES. I DID REVIEW ALL OF THE LITERATURE THAT IS REPRESENTED BY THE CROPS AND THEIR RESPECTIVE VALUES IN THAT TABLE. AND IN ALL CASES BUT ONE, THE VALUES WERE REPRESENTATIVE OF WHAT I WOULD DESCRIBE AS SHORT RUN WITH ONLY ONE – AND THEN A – ACTUALLY, LET'S SEE. LET ME BE SURE I DON'T MISSPEAK. YEAH, THAT'S TRUE. AND THEN THE ONE VALUE – THERE'S ONE SET OF VALUES OR ONE REFERENCE FROM WASHINGTON STATE UNIVERSITY THAT RELATED TO AN IRRIGATION DEVELOPMENT PROJECT IN SOME NONIRRIGATED PARTS OF THE STATE THAT WOULD HAVE TO BE DESCRIBED AS A LONG-RUN VALUE.

SO IN SUMMARY, ALL OF THE VALUES IN THE TOP HALF OF THIS TABLE RELATING TO WHEAT AND SORGHUM AND ALFALFA ARE OF A NATURE WHICH WOULD NOT BE DIRECTLY COMPARABLE TO THOSE BEING DETERMINED OR THE TYPE OF ANALYSIS BEING CARRIED OUT IN THE KANSAS CASE.

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[114] Q. BEFORE WE LEAVE THE ADAMS REPORT, DO YOU HAVE ANY OTHER CONCERNS WITH REGARD TO THE ANALYSIS IN THAT REPORT?

A. YES, SIR, I DO. I GUESS WHAT I WOULD SUGGEST IS THAT WE TURN TO TABLE 2, WHICH IS THE NEXT TABLE IN THAT REPORT.

Q. IS THAT THE SECOND TO THE LAST PAGE OF DEFENDANT'S EXHIBIT 1203?

* * *

[117] SPECIAL MASTER: WHAT ABOUT THE FIRST FOUR COLUMNS OF THAT TABLE 2 WHERE HE TAKES THE PRODUCTION LOSS AND DIVIDES IT BY THE DEPLETIONS AND COMES UP WITH A MARGINAL VALUE OF THE WATER NOT ADJUSTED? IS THAT A PROPER [118] METHODOLOGY, DO YOU THINK, OF DETERMINING THE VALUE OF WATER, LET'S SAY, FOR 1950 AT $42 AN ACRE FOOT? FORGET THE ADJUSTMENTS FOR A SECOND.

THE WITNESS: YEAH, IN – YES. I WOULD NOT DISAGREE WITH THAT APPROACH. WHAT WE'RE SAYING IS THAT THERE WAS $2,547 OF CROP VALUE CREATED WITH 61 ACRE FEET OF WATER AND THE AVERAGE OF THAT – AND SINCE WE'RE DEALING WITH A LINEAR RESPONSE FUNCTION, IT IS ALSO A MARGINAL VALUE – IS APPROPRIATE. BUT WE MUST REMEMBER THAT IT IS AN INTRASEASONAL VALUE. IT IS NOT A SHORT RUN THAT'S NET OF PRODUCTION COSTS OR A LONG-RUN VALUE THAT'S NET OF WELL DEVELOPMENT COSTS OR SOMETHING OF THAT SORT. IT IS THE INTRASEASONAL VALUE FOR THAT YEAR.

SPECIAL MASTER: OKAY. I UNDERSTAND THAT.

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Appendix Item 7

Excerpts from R.T. Vol. 204
January 13, 2000
(Cross Examination of Norman Whittlesey)

[Pages 122-24]

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[122] Q. OKAY. THANK YOU. LET'S TURN TO TABLE A14 OF KANSAS EXHIBIT 1001. THIS TABLE SHOWS THE PUMPING COSTS FOR DEEP NATURAL GAS WELLS IN THE AMAZON SERVICE AREA; IS THAT RIGHT?

A. THAT'S CORRECT.

Q. NOW, IF YOU WOULD JUST FLIP BACK FOR A MOMENT TO TABLE A6, IT IS CORRECT, IS IT NOT, THAT THE AMAZON CANAL WELLS – THE WELLS IN THE AMAZON CANAL SERVICE AREA – HAD THE GREATEST HISTORIC PUMPING LIFTS IN THE 1950S OF ANY OF THE DITCHES IN KANSAS; IS THAT CORRECT?

A. APPARENTLY THAT'S TRUE, YES, IN THE '50S AT LEAST, YES.

Q. SO IF WE WANT TO LOOK AT COSTS IN 1950, THE AMAZON DITCH IS A GOOD EXAMPLE TO CHOOSE FOR DEEP NATURAL GAS WELLS BECAUSE NATURAL GAS WELLS IN THE AMAZON DITCH SERVICE AREA WILL HAVE THE HIGHEST PUMPING COST PER HOUR IN 1950 – IS THAT RIGHT? – BEING THE DEEPEST, HAVING THE MOST LIFT?

A. WELL, THEY'D BE VERY CLOSE TO THOSE OF THE GREAT EASTERN AND THE FARMERS DITCH, BUT THEY MIGHT BE SLIGHTLY HIGHER ON AVERAGE. I DON'T KNOW.

[123] Q. WELL, WOULD YOU AGREE THAT THEY HAVE THE MOST LIFT AND THEREFORE UNDOUBTEDLY WOULD HAVE THE MOST COST TO LIFT WATER?

A. IF YOU'RE TALKING SPECIFICALLY ABOUT 1950, YES.

Q. YES. YES, I'M TALKING ABOUT 1950.

A. OKAY.

Q. LET'S FOCUS ON THAT.

A. OKAY.

Q. OKAY. NOW, IF WE LOOK AT TABLE A14 IN EXHIBIT 1001 AND IF WE LOOK AT TABLE A14 IN EXHIBIT 892, IT APPEARS TO ME THAT IN 1950, THE COST TO PUMP AN ACRE FOOT OF WATER IN THE AMAZON DITCH WAS $3.77 IN YOUR ORIGINAL REPORT; IS THAT CORRECT?

A. YES.

Q. AND WHAT WAS THE COST IN YOUR REVISED TABLE A14?

A. IT'S SHOWN TO BE $2.28.

Q. OKAY. I HAVE HERE – AND I'M NOT GOING TO ASK YOU TO GET IT OUT, TO AVOID MORE PAPER SHUFFLES, BUT IN COLORADO TABLE CO-A14 IN PROFESSOR WICHELNS' REPORT, EXHIBIT 1096, WE HAVE A COST PER ACRE FOOT FOR THE AMAZON DITCH EXAMPLE OF $1.27. SO $1.27 NOW COMPARES TO YOUR VALUE OF $2.28.

A. OKAY.

Q. NOW, CERTAINLY $2.28 IS CLOSER TO $1.27 THAN $3.77, WHICH WAS YOUR ORIGINAL AMOUNT. I THINK WE COULD AGREE UPON THAT. IS THAT FAIR?

[124] A. YES.

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Appendix Item 8

Excerpts from R.T. Vol. 205
January 14, 2000
(Cross Examination of Norman Whittlesey)

[Pages 111-113]

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[111] Q. YOU TESTIFIED ON WEDNESDAY THAT NONE OF THE VALUES SHOWN ON TABLE 1 OF PROFESSOR ADAMS' REPORT WERE COMPARABLE TO THE VALUES THAT ARE IMPLIED IN YOUR ANALYSIS BECAUSE WITH ONE EXCEPTION THEY ARE ALL SHORT-RUN VALUES; IS THAT RIGHT?

A. YOU'RE REFERRING TO HIS TABLE 1?

Q. YES. MY RECOLLECTION, PROFESSOR, WAS THAT YOU SAID THEY ALL APPEARED TO BE SHORT-RUN VALUES [112] EXCEPT FOR ONE STUDY THAT YOU FELT WAS A LONG-RUN VALUE.

A. I BELIEVE THAT'S TRUE IN REGARDS TO THE CROPS THAT –

Q. OF INTEREST?

A. – WE'RE CONCERNED ABOUT. I DIDN'T INVESTIGATE THE VEGETABLE CROPS AND OTHERS.

Q. THAT WAS MY RECOLLECTION, THAT YOU LIMITED IT TO THE THREE CROPS OF INTEREST HERE.

A. YES.

Q. DO YOU HAVE AN EXAMPLE OF A STUDY THAT HAS CALCULATED VALUES OF WATER THAT ARE COMPARABLE TO THE KANSAS VALUES OF WATER? SINCE YOU CRITICIZED THE VALUES PROFESSOR ADAMS CHOSE, ARE YOU AWARE OF A STUDY THAT WOULD PRODUCE VALUES THAT ARE

COMPARABLE TO THOSE WHICH YOU PURPORT TO GENERATE IN THE KANSAS ANALYSIS?

A. WELL, THE CONTEXT OF SUCH VALUES WOULD BE REPRESENTED BY – AND I DON'T HAVE THE EXHIBITS IN FRONT OF ME, BUT I RECALL – AND PERHAPS IT WAS DURING PROFESSOR WICHELINS' TESTIMONY – THAT THERE WERE VALUES DESCRIBED TO, SAY, FINISH A CROP, WHICH WOULD BE, IN MY INTERPRETATION, TO BE ADDED TO GROWING CROPS. AND IN THAT CASE, THAT WOULD BE AN EXAMPLE OF WHAT I'M DESCRIBING.

Q. THAT WAS, I THINK, THE WICHELNS AND CONE PAPER – C-O-N-E – AND THAT INVOLVED THE IRRIGATION DISTRICT IN THE SAN JOAQUIN VALLEY?

[113] A. THAT'S THE ONE I RECALL, I BELIEVE.

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Appendix Item 9

Excerpts from R.T. Vol. 208
January 20, 2000
(Direct Examination of Richard Adams)

[Pages 49-51, 59-63, 67-70]

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[49] Q. DO YOU HAVE A COPY OF KANSAS EXHIBIT 1001?

A. I DO.

Q. THAT IS THE SUPPLEMENT TO THE KANSAS EXPERT REPORTS TESTIFIED TO BY PROFESSOR WHITTLESEY; IS THAT CORRECT?

A. THAT IS CORRECT. IT'S AUTHORED BY PROFESSOR WHITTLESEY AND DAVID B. WILLIS, DATED OCTOBER 15, 1999.

Q. OKAY. COULD YOU LOOK AT TABLE A14 OF THAT EXHIBIT, PLEASE.

A. YES, SIR.

Q. THESE ARE THE REVISED COSTS TO PUMP FROM A DEEP NATURAL GAS WELL IN THE KANSAS ANALYSIS; IS THAT RIGHT?

A. THAT IS MY UNDERSTANDING, THAT THESE WERE REVISED SUBSEQUENT TO THE TIME THAT I WROTE MY ORIGINAL REPORT THAT WE'VE BEEN DISCUSSING THIS MORNING AND IN MY EARLIER TESTIMONY.

Q. YOU COMPARED THE COSTS TO PUMP AN ACRE FOOT OF WATER FROM THE ORIGINAL TABLE A14 TO THE VALUES IN YOUR TABLE 2. IS THAT HOW YOU DID YOUR ORIGINAL ANALYSIS?

[50] A. AS I STATED, I USED TWO LINES OF INQUIRY, AND ONE WAS USING VALUES IN THE LITERATURE. THE SECOND WAS THE COMPARISON

BASED UPON COMMON SENSE OR ECONOMIC INTUITION. AND IF I RECALL IN MY TESTIMONY LAST MONTH, I STATED THAT I NOTICED IN THE KANSAS REPORTS THAT THE COST OF PUMPING AN ACRE FOOT OF WATER IN THIS AREA IN 1950 WAS APPROXIMATELY $3.77, AND THE NOMINAL VALUE OF THAT WATER AS IMPLIED BY THE KANSAS ANALYSIS WAS SOMETHING IN EXCESS OF $42 PER ACRE FOOT.

BASED UPON THAT COMPARISON, I BELIEVE I TESTIFIED THAT IT STRUCK ME AS EXTREMELY ODD THAT THE FARMERS WOULD NOT HAVE DRILLED WELLS GIVEN THAT DIFFERENTIAL BETWEEN POTENTIAL PROFIT AND THE COST OF PUMPING WATER. I NOW SEE THAT THIS COST OF PUMPING HAS BEEN REDUCED TO ABOUT HALF OF THAT, OR NOT QUITE HALF, SAY 60 PERCENT OF THAT INITIAL 3.77. IT'S NOT [SIC] REPORTED AS 2.88 PER ACRE FOOT.

Q. YOU MEAN 2.28?

A. OR 2.28. I'M SORRY. 2.28 PER ACRE FOOT.

SPECIAL MASTER: FOR 1950?

THE WITNESS: FOR 1950. SO THE VALUE OF WATER REMAINS AT 42. THE COST OF PUMPING AN ACRE FOOT OF WATER HAS FALLEN, ACCORDING TO KANSAS' ANALYSIS, TO $2.28, AND THAT, I BELIEVE, BUTTRESSES OR REINFORCES MY EARLIER OPINION ABOUT THE INCENTIVE THAT FARMERS [51] WOULD HAVE HAD TO HAVE DRILLED A WELL, GIVEN THAT WATER WAS AVAILABLE UNDER THEIR LANDS AND GIVEN THAT INSTITUTIONALLY THERE

WERE NO RESTRICTIONS ON WELL DRILLING, I BELIEVE, UNTIL 1978.

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[59] Q. COULD YOU LOOK AT TABLE 1 OF YOUR REPORT, PLEASE, WHICH IS DEFENDANT'S EXHIBIT 1203.

A. YES, SIR.

Q. PROFESSOR WHITTLESEY SAID THAT THE PUBLISHED VALUES OF WATER IN THE ECONOMICS LITERATURE WERE WITH ONE EXCEPTION ALL SHORT-RUN VALUES OF WATER AND WERE NOT COMPARABLE TO THE VALUES OF WATER ESTIMATED BY THE KANSAS ANALYSIS. AND WHEN I REFER TO "PUBLISHED VALUES," I REFER TO THOSE SHOWN ON TABLE 1 AND DESCRIBED IN THE BODY OF YOUR REPORT.

DO YOU AGREE WITH PROFESSOR WHITTLESEY?

A. I AGREE. AND I BELIEVE I STATED THIS IN MY CROSS TO MR. DRAPER THE LAST TIME I TESTIFIED, THAT I WOULD CHARACTERIZE ALL OF THESE EXCEPT FOR ONE AS SHORT-RUN VALUES.

Q. DO YOU BELIEVE THAT – WELL, PROFESSOR WHITTLESEY WAS ASKED IF HE COULD CITE TO AN [60] EXAMPLE OF AN INTRASEASONAL VALUE OF WATER COMPARABLE TO THE VALUES OF WATER IN THE KANSAS ANALYSIS, AND HE CITED TO THE VALUES OF WATER IN THE WICHELNS AND CONE PAPER AS AN EXAMPLE OF INTRASEASONAL VALUES.

DO YOU AGREE THAT THE VALUES IN THE WICHELNS AND CONE PAPER ARE INTRASEASONAL VALUES?

A. I BELIEVE THEY ARE –

SPECIAL MASTER: WHICH PAPER IS THAT?

MR. ROBBINS: I'LL GET THAT FOR YOU. 1066, YOUR HONOR. THE WICHELNS AND CONE PAPER, WHICH IS PLAINTIFF'S EXHIBIT 1066.

SPECIAL MASTER: IT'S PLAINTIFF'S?

MR. ROBBINS: PLAINTIFF'S, YES, SIR. IT WAS INTRODUCED BY MR. DRAPER IN CROSS-EXAMINATION OF PROFESSOR WICHELNS.

SPECIAL MASTER: ALL RIGHT.

BY MR. ROBBINS:

Q. AS I RECALL, HE REFERRED TO THE TERN "FINISHING" WATER OR SOMETHING OF THAT SORT. DO YOU AGREE THAT THE VALUES IN THIS PAPER ARE INTRASEASONAL VALUES?

A. THE WAY PROFESSOR WHITTLESEY HAS DEFINED IT, THEY ARE COMPARABLE IN THE SENSE THAT THESE ARE VALUES OF WATER THAT WOULD BE AVAILABLE TO FINISH A CROP.

[61] Q. THEY WOULD BE SIMILAR TO THE MARGINAL VALUES THAT HAVE BEEN DISCUSSED IN THIS CASE?

A. THEY WOULD BE SIMILAR. I WOULD INTERPRET THEM AS MARGINAL VALUES. AND, AGAIN, I

THINK THEY FALL IN THE GENERAL DESCRIPTION OR DEFINITION THAT PROFESSOR WHITTLESEY IS USING.

Q. IF THE VALUES OF WATER CITED IN THE EXHIBIT 1066 ARE, IN FACT, INTRASEASONAL VALUES OF WATER, DO YOU DRAW ANY CONCLUSION FROM THE COMPARISON OF THOSE VALUES AND THE VALUES DERIVED IN THE KANSAS ANALYSIS?

A. I FIND THIS PAPER TO ACTUALLY BE QUITE USEFUL IN THAT SECOND LINE OF INQUIRY THAT I'M APPLYING HERE, AND THAT IS THE ONE I'VE LABELED "ECONOMIC INTUITION" OR "COMMON SENSE" OR A "REAL-WORLD TEST."

THAT PAPER BY PROFESSOR WICHELNS AND HIS COAUTHOR, MR. CONE, IS A PAPER THAT LOOKS AT THE BEHAVIOR OF FARMERS IN AN IRRIGATION DISTRICT IN THE SAN JOAQUIN VALLEY DURING THE 1992 DROUGHT. AND, AGAIN, AS I STATED IN MY – I BELIEVE IN CROSS-EXAMINATION THE LAST TIME I WAS ON THE STAND, THE VALUES IN HERE ARE INSTRUCTIVE, IN THIS CASE, BECAUSE WHAT THEY SHOW IS THAT IN 1992, FARMERS IN THIS DISTRICT HAD AN OPTION. THEY WERE SHORT OF WATER. THEY NEEDED WATER TO FINISH THE CROPS.

THEY HAD AN OPTION TO BUY WATER FROM THE [62] CALIFORNIA WATER BANK OR TO BUY WELL WATER FROM A NEIGHBORING DISTRICT. CALIFORNIA WATER BANK WATER WAS AVAILABLE AT $175 AN ACRE FOOT. THEY ELECTED NOT TO BUY

THAT. INSTEAD, THEY PURCHASED WATER FOR $100 AN ACRE FOOT FROM AN ADJACENT DISTRICT.

THE IMPLICATION I DRAW FROM THAT IS THAT FARMERS IN THIS AREA, WHICH, AGAIN, IS AN AREA THAT, AS WE DISCUSSED LAST TIME, HAS HIGH-VALUED CROPS IN THE CROP MIX, INCLUDING TOMATOES, MELONS, COTTON, AND THOSE THREE CROPS HAVE GROSS VALUES IN EXCESS OF $1,000 AN ACRE. THE FARMERS WERE WILLING TO PAY $100 TO BUY WATER. THEY WERE NOT WILLING TO PAY $175.

SPECIAL MASTER: WELL, IS THAT ACCURATE? THEY DIDN'T PAY $175 BECAUSE THEY COULD GET IT FOR $100. THAT'S NOT SURPRISING, IS IT?

THE WITNESS: WELL, CERTAINLY NOT, BUT THEY BOUGHT A CERTAIN AMOUNT OF WATER AT $100 AN ACRE FOOT. I DON'T KNOW AT WHAT POINT THEY STOPPED BUYING WATER, BUT I THINK THE $100 WOULD BE A LOWER BOUND IN THIS CASE.

THE POINT IS, AGAIN, THAT THE VALUE OF THE WATER TO THESE FARMERS IS SOMETHING BETWEEN $100 AND $175 IN THIS PARTICULAR SETTING FOR THE VERY HIGH-VALUED CROPS. AND COMPARING THAT TO THE VALUES REPORTED IN THE KANSAS EXPERT REPORT, [63] THEIR VALUE AVERAGED OVER THAT 50-YEAR PERIOD OR 45-YEAR PERIOD WAS ABOUT $109.

SO I BELIEVE THAT SOME OF THESE VALUES THAT WE FIND IN THE REAL WORLD AND IN THIS

CASE IN THE EXAMPLE OF THE CALIFORNIA WATER BANK WOULD SUGGEST THAT IT'S UNLIKELY THAT FARMERS WOULD BE WILLING TO PAY THE SAME AMOUNT OF MONEY IN KANSAS ON CROPS THAT HAVE A GROSS VALUE THAT IS APPROXIMATELY 10 TO 20 PERCENT OF THE GROSS VALUE OF SOME OF THESE OTHER CROPS THAT FARMERS IN CALIFORNIA WERE GROWING.

BUT I WOULD ALSO POINT OUT THIS WATER THAT THESE FARMERS WERE BUYING IS WATER THAT WAS AVAILABLE ON DEMAND, SINCE IT WAS WELL WATER, AND THAT WOULD TEND TO MAKE IT MORE VALUABLE THAN SURFACE WATER BECAUSE IT WAS BEING MADE UP THROUGH DEPLETIONS TO SURFACE-WATER-ONLY LANDS WHICH WOULD NOT ARRIVE IN A NECESSARILY TIMELY FASHION. SO YOU WOULD EXPECT THIS WATER TO BE SOMEWHAT MORE VALUABLE SIMPLY – IF ONLY BECAUSE IT'S AVAILABLE ON AN AS-NEEDED BASIS.

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[67] Q. AND DURING THAT TIME, IN YOUR VIEW, THE RELATIONSHIP OF WATER VALUE TO COST OF PUMPING REMAINED IN THE 10 TO 20 TIME DIFFERENTIAL?

A. AS I STATED EARLIER, THAT IS CORRECT. IT VARIES FROM A NINEFOLD DIFFERENTIAL UP TO SOMETHING IN SOME CASES SLIGHTLY IN EXCESS OF TWENTYFOLD.

ANOTHER ISSUE THAT PROFESSOR BARRY RAISED THAT, AGAIN, CONCEPTUALLY I AGREE

WITH IS THAT FARMERS DON'T ALWAYS HAVE INFORMATION ABOUT PROFITABILITY OF INVESTMENTS. HOWEVER, IN THIS CASE, FARMERS, AGAIN, HAD 28 YEARS IN WHICH TO OBSERVE THE BEHAVIOR OF THEIR NEIGHBORS, AND WE KNOW IN AGRICULTURE THAT THERE'S A RAPID DIFFUSION OF TECHNOLOGY. FARMERS ARE ASTUTE AND WILL STUDY WHAT THEIR NEIGHBORS ARE DOING IN TERMS OF CULTURAL PRACTICES AND OTHER ADAPTATIONS THAT PERHAPS FARMERS OR NEIGHBORS MAY MAKE, AND THEY WILL MIMIC THEM IN ORDER TO REMAIN COMPETITIVE.

SO WHILE IN 1950 – THROUGH THE EARLY YEARS THE FARMERS MAY HAVE BEEN SKEPTICAL ABOUT THE POTENTIAL BENEFITS OF WELLS, YOU'D THINK 28 YEARS IS AN ADEQUATE TIME FOR FARMERS TO OBSERVE THE BENEFITS OF WELLS IF THEY WERE AS GREAT AS IMPLIED IN THE DIFFERENTIAL BETWEEN THE VALUES THAT KANSAS IS CLAIMING FOR WATER AND THE COST [68] THAT KANSAS IS PROVIDING FOR OBTAINING THE WATER.

ANOTHER FACTOR THAT I BELIEVE PROFESSOR BARRY MENTIONED IS RISK, AND HE ALSO STATED THAT IRRIGATION IS A RISK-REDUCTION STRATEGY, WHICH I DEFINITELY AGREE WITH. IF YOU IRRIGATE, YOU REDUCE THE VARIABILITY OF YIELDS, AND YOU REDUCE THE VARIABILITY OF REVENUE, AND THAT'S GENERALLY HOW WE MEASURE RISKS IN AN AGRICULTURE SITUATION. IRRIGATION REDUCES THAT.

BUT I BELIEVE HE WENT ON TO SAY THAT SOME FARMERS, BECAUSE OF THEIR AVERSION TO RISK, THEY MAY DECIDE THAT THEY DON'T WANT TO TAKE A CHANCE ON COMMITTING THEIR CAPITAL TO A PARTICULAR INVESTMENT BECAUSE THEY AREN'T SURE OF THE RETURN. AND, AGAIN, I WOULD AGREE THAT RISK-AVERSE PEOPLE MIGHT BEHAVE DIFFERENTLY THAN A RISK NEUTRAL OR A RISK TAKER.

HOWEVER, RISK-AVERSE PEOPLE - BECAUSE THEY'RE RISK AVERSE DOES NOT MEAN THEY WILL NOT ACCEPT RISK. IT SIMPLY MEANS THAT THEY HAVE TO HAVE A HIGHER REWARD TO ACCEPT THAT RISK. AND AS I LOOK AT THIS DIFFERENTIAL, WHICH IS IN A SENSE THE REWARD FOR TAKING THE RISK OF PUTTING IN A WELL, THE MAGNITUDES ARE, AS WE'VE BEEN DISCUSSING, 9 TO 20 TIMES HIGHER THAN THE COST, AND THAT, AGAIN, WOULD SUGGEST TO ME THAT EVEN RISK-AVERSE PEOPLE COULD BE PERSUADED TO INVEST [69] IN A WELL WHEN CONFRONTED WITH SUCH A POTENTIAL PROFIT GAIN FROM THAT ACTION.

Q. LOOKING AGAIN AT TABLE 1 OF YOUR EXHIBIT 1203, YOU HAVE ACKNOWLEDGED, I BELIEVE, THAT THE VALUES WHICH YOU HAVE SHOWN ON THE TABLE ARE IN LARGE PART SHORT-RUN VALUES, NOT NECESSARILY INTRASEASONAL VALUES; IS THAT RIGHT?

A. THAT IS CORRECT. I BELIEVE I -

Q. DO YOU CONSIDER THEM, HOWEVER, TO BE USEFUL, NONETHELESS, AND IF SO, HOW OR WHY?

A. I DO CONSIDER THEM TO BE USEFUL. THEY ARE PART OF THE EVIDENCE I USED IN COMING TO THE OPINION THAT THE WATER VALUES ESTIMATED BY THE KANSAS EXPERTS WERE UNREASONABLY HIGH. THESE VALUES THAT I'VE REPORTED HERE COME FROM A RANGE OF SETTINGS AND OVER A DIFFERENT PERIOD OF YEARS. I'VE CORRECTED FOR THE YEARS BY ADJUSTING THESE BY THE P.R., PRICES RECEIVED, INDEX.

WHAT THESE VALUES TELL ME IS THAT COLLECTIVELY WE HAVE A RANGE OF WILLINGNESS TO PAY ESTIMATES IN THE LITERATURE. AGAIN, THESE REPRESENT FARMERS' WILLINGNESS TO PAY FOR WATER. AND THESE VALUES VARY FROM FAIRLY LOW VALUES IN SOME SETTINGS UP TO HIGHER VALUES FOR THE SAME CROP. AS I STATED IN MY ORIGINAL TESTIMONY, I DID NOT ANCHOR OR BASE MY OPINION ON ANY PARTICULAR VALUE IN THE LITERATURE. I WAS SIMPLY LOOKING AT THE RANGE OF VALUES TO SEE [70] WHAT OTHER STUDIES HAD DETERMINED FARMERS WOULD BE WILLING TO PAY FOR WATER.

SOME OF THESE STUDIES ARE IN AREAS WHERE THEY ARE USING WELL WATER. HENCE, THE TIMING WOULD BE BETTER THAN IN THE SURFACE-WATER-ONLY LANDS. SOME OF THESE ARE FROM AREAS WHERE THE YIELDS ARE HIGHER. SO YOU WOULD EXPECT THE VALUE TO BE HIGHER. CONVERSELY, IN THE KANSAS AREA WE HAVE AREAS THAT ARE UNDER A DEPLETION SITUATION. SO THAT WOULD MITIGATE IN THE OTHER DIRECTION.

THAT'S WHY YOU DON'T WANT TO PIN YOUR SEARCH FOR THE TRUTH ON ANY ONE VALUE. YOU HAVE TO USE SOME COMMON SENSE, THINK ABOUT HOW THESE WERE DERIVED OR DETERMINED, AND SEE HOW REPRESENTATIVE THEY ARE OF THE CONDITIONS UNDER WHICH YOU'RE DEALING. SO IF I LOOK AT THE BIASES OR THE EFFECTS OF CERTAIN THINGS THAT MAKE THESE NUMBERS HIGHER – I DIDN'T MEAN "BIAS" – IF I LOOK AT FORCES THAT MIGHT CAUSE SOME OF THESE ESTIMATES TO BE HIGHER IN SOUTHWEST KANSAS, I SHOULD ALSO LOOK AT THE CONDITIONS THAT MIGHT MAKE THE SOUTHWEST KANSAS VALUES HIGHER, AND I TRIED TO DO THAT BY CONSIDERING THAT, EVEN THOUGH THE YIELDS IN SOUTHWEST KANSAS ARE MUCH LOWER THAN OTHER AREAS, THEY ARE IN THIS DEFICIT STATE. SO THE WATER WOULD BE SOMEWHAT HIGHER.

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Appendix Item 10

Excerpts from R.T. Vol. 208
January 20, 2000
(Cross Examination of Richard Adams)

[Pages 97-99]

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[97] Q. LET'S TALK ABOUT YOUR TABLE 1.

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Q. . . . YOUR TABLE 1 LISTS A NUMBER OF LITERATURE SOURCES THAT YOU LOCATED IN YOUR LITERATURE SEARCH; ISN'T THAT RIGHT?

A. YES, SIR.

Q. AND WE ARE IN AGREEMENT NOW THAT NONE OF THE VALUES THAT YOU LIST IN TABLE 1 ARE INTRASEASONAL OR SHORT-SHORT-RUN VALUES THAT ARE COMPARABLE TO THE VALUES THAT ARE RELEVANT TO THIS CASE?

A. I BELIEVE WHAT I HAVE TESTIFIED TO, MR. DRAPER, IS THAT THE VALUES REPORTED HERE WOULD BE CLASSIFIED OR CHARACTERIZED BY AN ECONOMIST AS SHORT-RUN VALUES, BUT I ALSO BELIEVE THAT I STATED THAT, IN A GENERAL SENSE, THESE VALUES MAY BE USED TO GET AN UNDERSTANDING OF THE VALUES FOR WATER ON THESE TYPES OF CROPS.

[98] I'LL GO ON FURTHER AND REVIEW WHAT I SAID EARLIER TODAY, AND THAT IS THAT IN DETERMINING WHETHER THESE VALUES WERE REASONABLE IN THIS SORT OF COMPARISON, I TRIED TO RECOGNIZE THAT THERE WERE FACTORS THAT WOULD BOTH INCREASE AND DECREASE THESE VALUES RELATIVE TO THE INTRASEASONAL VALUES IN KANSAS. AS I STATED, THESE VALUES IN

MANY CASES WERE COMING FROM STUDIES WHERE THEY WERE BASED UPON WELL IRRIGATION AND WOULD HAVE HAD A TIMELY SUPPLY OF WATER. THAT WOULD TEND TO MAKE THE VALUES HIGHER. THAT'S ALSO CONSISTENT WITH THE FACT THAT SOME OF THESE STUDIES HAD HIGHER YIELDS. AT THE SAME TIME, I STATED THAT THESE VALUES DO NOT REFLECT PERHAPS A DEFICIT STATUS OF THE SOME OF THE LANDS IN SOUTHWEST KANSAS.

SO I WAS USING MY JUDGMENT AND EXPERIENCE IN STATING THAT THERE'S OFFSETTING OR COUNTERVAILING INFLUENCES HERE AND THAT COLLECTIVELY YOU CAN LOOK AT THESE NUMBERS AND GET A SENSE OF WHAT WATER MIGHT BE WORTH. EVEN THOUGH THESE ARE SHORT-RUN VALUES, THEY HAVE SOME INFORMATION TO SHED ON THIS QUESTION OF WHAT WOULD WATER BE WORTH IN SOUTHWEST KANSAS.

Q. IT'S ALSO YOUR TESTIMONY, IS IT NOT, THAT THE AMOUNT BY WHICH THE INTRASEASONAL VALUES WILL BE HIGHER THAN THE SHORT-RUN VALUES IS NOT KNOWN?

A. I BELIEVE I STATED IT WAS AN EMPIRICAL QUESTION [99] AS TO WHETHER THE VALUE WOULD BE X DOLLARS OR Y DOLLARS HIGHER.

Q. BUT IT WOULD BE HIGHER, WOULDN'T IT?

A. IT COULD BE, OR THEY COULD POSSIBLY BE THE SAME, BUT THEY WOULD PROBABLY BE HIGHER, AND I BELIEVE I TESTIFIED TO THAT

UNDER CROSS . . . AND I DID STATE THAT CONCEPTUALLY I WOULD AGREE THAT THE INTRASEASONAL WOULD BE HIGHER THAN THE SHORT RUN, WHICH WOULD BE HIGHER THAN THE LONG RUN.

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