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Groundwater Management: Lessons from Colorado v. Kansas

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GROUNDWATER MANAGEMENT
LESSONS FROM *KANSAS v.COLORADO*

My topic involves groundwater management and the lessons learned from *Kansas v. Colorado*. I suppose the first and most basic lesson for groundwater management learned from *Kansas v. Colorado* is that merely because a party has the burden of proof in a case alleging that groundwater pumping has depleted streamflow no longer means that party will necessarily lose. That wasn't always the case, as Rachael suggested yesterday.

A century ago, in *Kansas v. Colorado*, 206 U.S. 46, 106-07 (1907), the U.S. Supreme Court noted that the ditches that diverted from the Arkansas River in Colorado were decreed to divert much more water than the average flow that came out of the mountains at Canon City and that some amount of water diverted from the Arkansas River and applied to irrigation by those ditches subsequently added to the flow of the river by seepage—what today we generally call "return flow"—but said "the extent to which seepage operates in adding to the flow of a stream . . . is something proof of which must necessarily be almost impossible." *Id.* at 107 (emphasis added). Indeed, the Court went on to say: "The underground movement of water will always be a problem of uncertainty." *Id.* That's still true today except the range of the uncertainty has been greatly reduced.

The Court's statements reflected the state of the science of groundwater hydrology in the early 20th century and for quite some time thereafter. As we have heard from previous speakers the common-law rules governing the use of groundwater that developed in the 19th century, whether it was the absolute right of capture or the reasonable use doctrine, were based on the difficulty of determining the rate and direction of movement of groundwater. In the 19th century, courts in many jurisdictions concluded that the movement of groundwater was simply too mysterious and difficult to determine to settle disputes between competing users, and courts therefore simply allowed landowners to withdraw whatever they could from beneath their land without regard to the impact on neighboring owners (or surface streams) or limited withdrawals to "reasonable" uses, which generally meant any beneficial use as long as it was on the overlying land. As often happens in the law, these rules tended to harden into legal doctrines that became difficult to change even when the science of groundwater began to make the underlying basis of these legal doctrines obsolete, even absurd.

But even in pure prior appropriation states in the west, where the effect of return flows in adding to the flow of surface streams was obvious, the difficulty of proving the impact of groundwater withdrawals on surface flows was a daunting task, and for many years, most surface right owners were simply not prepared or willing to take on the burden of proof to establish that groundwater withdrawals were depleting surface flows. Although Colorado's Supreme Court established a presumption that groundwater was tributary in the 1951 case of *Safranek v. Limon*, there was very little litigation between senior surface rights and junior wells during the 1950s and 1960s when a dramatic increase in well development occurred in the South Platte, Rio Grande and Arkansas River Basins.

Even when I was a young lawyer in the Colorado Attorney General's Office in the early 1970s, judges tended to be skeptical of groundwater experts, particularly if they worked for the State Engineer. On several occasions the Court acknowledged the reality of impacts on surface flows caused by wells but declined to permit the wholesale curtailment of irrigation wells, in cases like *Fellhauer*, *Atcheson Topeka*, and *Alamosa LaJara*. At Mr. Littleworth correctly observed on Wednesday data on groundwater withdrawals was often limited, groundwater computer models were just beginning to be developed, and the analog models developed by the U.S. Geological Survey, using resistors and capacitors to simulate groundwater flow, were cumbersome and inflexible. The assumptions that went into analytical solutions of groundwater flow equations were often puzzling to judges and an easy source for cross-examination.

Then a revolution in the science of groundwater occurred, which was stimulated by the development of relatively inexpensive, powerful computers and computer models that could simulate the flow of groundwater in an aquifer and the effects of well pumping using digital solutions. Today we can prove, with relative ease, that the pumping and consumption of groundwater in an alluvial aquifer that is tributary to a surface stream will ultimately deplete the flow of that stream, and computer models are a generally accepted method to determine those impacts, despite the assumptions and complex equations used in those models. As Mr. Littleworth said in his First Report in *Kansas v. Colorado*: "The computer modeling process is widely used and accepted. Indeed, it seems that no major water problem can now be solved without a model, . . ." First Report at 231 (July 1994). The timing, location and amount of impacts from pumping in an alluvial aquifer may be open to dispute, but the fact that impacts will occur is not. And I think Mr. Littleworth was correct when he said that models are now so widely accepted that they will normally overcome a *Daubert/Kumho Tire* challenge.

You have already heard from Dr. Maddock about groundwater-surface water interactions on Wednesday morning and from Mr. Littleworth on Wednesday afternoon about modeling and expert witnesses. So I will not attempt to further discuss the matters included in their papers except to observe that you should carefully assess how a model was developed, how it was applied, the sufficiency, and accuracy of the data input into the model, the number and operation of calibration factors used in the model, the number of parameters where estimates are substituted for actual data, the sufficiency of the model's ability to replicate historical conditions, the uniqueness of the model's calibration, the existence of model verifications, and finally, the reasonableness of the conclusions drawn by the model's developer. Don't ever let a modeler tell you that the model will produce the true answer, learn about the error.

The second basic lesson from *Kansas v. Colorado* relevant to groundwater management is that failure to collect basic data on groundwater withdrawals will almost certainly lead to disagreements about the amount of groundwater withdrawals and how groundwater is used, and a State that fails to collect the data on pumping will probably not get the benefit of the doubt. That was certainly the case in *Kansas v. Colorado*. Until Colorado began collecting extensive data on groundwater pumping and the acreage irrigated by groundwater, it had to live with the assumptions made by the Kansas experts. The lesson is therefore: Collect data on groundwater use. Real data is better than assumptions that your opponent's experts will make.

However, before I discuss methods to measure groundwater and acquire data to manage groundwater that Colorado has adopted, a few points about groundwater use should be understood. First, the use of groundwater has become an economic necessity for many farmers involved in agriculture today. Crop genetics and economics have created a need for a reliable water supply that can be applied precisely when the crop requires it, rather than when Mother Nature and man's allocation systems might allow it. Growing a higher value water sensitive crop can mean the difference between survival and failure in today's agricultural economy.

Groundwater wells can provide the reliability and timing that is crucial for growing many higher value crops. As many of you in the audience today are aware, this pressure to use groundwater in agriculture is not unique to Colorado, or even to the western states. Farmers in the midwest and in the southeast are turning to irrigation systems dependent on groundwater to meet crop demands at critical times.

Second, in most areas in Colorado, a large percentage of the farmers who use groundwater also have surface supplies, and the use of groundwater does not necessarily mean that additional acreage is being irrigated. In the Arkansas Basin of Colorado, there was not a significant increase in the number of acres being irrigated as the result of well development; but, as Mr. Littleworth determined, and the Supreme Court affirmed, the use of groundwater resulted in an increase in the amount of water actually consumed in growing crops on those acres to the detriment of usable river flows into the State of Kansas.

From the perspective of Colorado, all of our significant rivers and streams are subject to interstate compacts or equitable apportionment decrees. While these compacts and decrees guarantee Colorado an equitable apportionment of interstate rivers and streams, they place limits on the consumptive use that Colorado can make of those waters, most of which originate in Colorado, for the benefit of downstream states. However, the methods used to apportion the flows of interstate rivers vary. The South Platte Compact utilizes a priority date cutoff during the irrigation season during times of low flow to limit consumption within Colorado; the Rio Grande Compact utilizes an inflow/outflow methodology contained in tables of relationships that, in effect, specify the quantity of consumption that Colorado is entitled to make. The Colorado River Compact apportions consumptive use to the Upper and Lower Basins, but adds a running average delivery obligation at Lee's Ferry, which limits consumption in the Upper Basin to waters in excess of that needed to meet the delivery obligation to the Lower Basin. The Arkansas River Compact placed a limit on the amount of consumption that can occur in Colorado by prohibiting new developments that materially deplete the flows of the river that were usable in Kansas. In each instance, downstream states are entitled to the expectation that they will receive the quantities of water apportioned to them after Colorado's consumption has occurred.

At some basic level it should not matter to a downstream state how an upstream state chooses to consume the water apportioned to it, whether through surface diversions or groundwater pumping so long as the quantity of water available to the downstream state remains the same. However, the reality is that it is generally easier to measure and monitor surface diversions. The challenge for Colorado and for other states that have had groundwater development in river basins that have been apportioned pursuant to interstate compacts is to manage the use of groundwater to ensure that the consumptive use in the basin does not exceed the amount that was apportioned under the compact. It may mean, as it has in the Arkansas, that the total acreage irrigated in a basin must reduced offset depletions caused by well pumping to protect a neighboring state's interest.

In the case of the Arkansas River Basin, the Colorado State Engineer has now adopted rules and regulations that limit the use of groundwater in the Basin to wells operated under replacement plans approved by the State and Division Engineers or plans for augmentation approved by Water Courts. These plans require replacement of depletions that would injure senior surface rights in Colorado or that create depletions to usable Stateline flows. The rules and regulations take two forms.

The first set of rules, referred to as the Measurement Rules, require measurement of groundwater withdrawals in the basin. This information is important from the perspective of Kansas to determine compact compliance, but it is also important to Colorado and its well users. This is because pumping does not necessarily match the assumptions used by engineers to estimate groundwater pumping. Irrigation wells on a working farm may not be as efficient as an engineer might assume. And groundwater may not be applied in the manner engineers might assume. Only about half of the wells in the Arkansas Valley were actually in use when an inventory was completed. And groundwater is not spread uniformly across the farm because emphasis is given to high-value crops; and, at least in the Arkansas Valley, most farms have lower value, more drought-tolerant crops that receive water only when it's available. Knowing how much water is actually being pumped not only permits a more accurate assessment of the impact from that pumping on surface flows, but it allows for a more accurate representation of the hydrology of the basin in computer modeling studies.

Colorado's Measurement Rules require that all wells in the Arkansas Basin except very small exempt wells, be equipped with a totalizing flow meter that has been properly calibrated, or be rated to determine a power conversion coefficient that allows the calculation of the amount of water pumped from the well using power records. The power conversion coefficient, or PCC, represents the number of kilowatt-hours consumed in pumping an acre-foot of groundwater from a particular well, which can vary depending upon the pumping water level and the age and efficiency of the pump and motor. The advantage of the PCC method is that pumping can be calculated from power records. Colorado's General Assembly has authorized the State Engineer to require power companies to submit records of power used to pump groundwater directly to the State Engineer. If those records are provided in computer readable form on a monthly basis, which is not difficult for most power companies, it is relatively easy to take the power records from the well, match them with the PCC for the well, and determine the amount of water pumped by each well in that month. In a state where the budget crisis is an ongoing reality, the ability to obtain power data electronically to calculate pumping, rather than employ meter readers to read totalizing flow meters on an ongoing basis, is a significant benefit. Power records also provide an effective means to monitor whether wells that are not supposed to be pumped are being used.

The second set of rules adopted by the Colorado State Engineer is commonly referred to as the Use Rules. The Use Rules provide standards by which the owners and operators of wells must replace injurious depletions that result from the pumping of their wells. The Use Rules rely upon presumptive stream depletion factors to calculate stream depletions from pumping, which are based on the recognition that consumption of groundwater will vary depending on the total water supply available to a farm and will vary depending on the method of applying groundwater. For example, when a well is used as a sole source of water supply to irrigate a field, using flood irrigation methods typical in the Arkansas River Valley, the presumption is that 50% of the water pumped is consumed. However, for groundwater pumped from a well and delivered through a sprinkler system, the presumption is that 75% is consumed.

The Use Rules also require that the well owner, acting alone or through an organization, estimate projected pumping for the coming year and demonstrate that there is adequate replacement water to replace depletions in accordance with the Rules during the year. The Use Rules also require assurance that depletions in future years will be replaced, either through demonstrating that permanent replacement supplies are available or by providing a cash bond or other security to permit the State to purchase supplies in the event that the well owners are unable to do so. A cash bond might not work in some basins, but water has been generally available for purchase in the Arkansas River Valley. In this manner the Use Rules recognize the hydrologic reality that while a significant amount of a well's depletion to the surface stream may occur in the year in which the pumping takes place, the delayed depletions can influence the system for a number of years into the future. Any successful plan to manage groundwater use by replacing injurious stream depletions has to provide water not only in the year in which the pumping occurs, but in every year thereafter when a depletion will occur. Almost all wells operating today in the Arkansas belong to one of the three replacement organizations and pay significant assessments each year in order to fund the purchase of replacement supplies.

A third lesson from *Kansas v. Colorado* that is relevant to groundwater management is that GIS systems now provide a convenient method to combine geographical mapping with information such as well locations, ownership information, whether a particular field is irrigated with groundwater, and the type of irrigation method used.

One of the keys to fair and adequate groundwater management involves the acquisition of accurate data on irrigated acreage and the use of groundwater. Colorado, spurred on by the Kansas litigation, has interviewed every operator of a farm unit that uses groundwater in the Arkansas Valley to verify how groundwater is used, including the mapping of each field that receives groundwater, identifying the wells that are used to irrigate the field and the method of irrigation, determining whether surface water is used, and, if so, the source of surface water. The GIS system is also used to identify fields that have been removed from irrigation because the water is now being used to replace depletions, and to present information in convenient maps that can be taken to the field by water commissioners and other administrative officials, including officials from Kansas, to review and verify water use practices. When taken together with Colorado's databases on surface diversions and pumping, the GIS system can be used to paint a clear picture of how and where water is being used in the Arkansas Valley and how and where groundwater is being applied.

I did not make copies of the Measurement Rules or the Use Rules, but would direct you to the Colorado Division of Water Resources website, where you can read them and print them out if you would like. Just type in "Colorado Division of Water Resources" into your favorite search engine.

A fourth lesson from *Kansas v. Colorado*, and one I've previously alluded to, is that managing groundwater use can present significant challenges for water administration officials that were not contemplated at the time many compacts were negotiated. The importance of reliable water supplies for agriculture, municipalities, and other uses, often makes groundwater use incredibly attractive. At the same time, the consequences of groundwater use, including the impacts of withdrawals on surface stream flows, must be understood and recognized. If groundwater use is to continue in Colorado, at a minimum, we need to manage groundwater use to ensure that it does not result in depletions to the flows of interstate rivers that will violate interstate compacts or equitable apportionment decrees by depriving our neighbors of the share of river flow to which they are entitled. I hope the lessons from *Kansas v. Colorado* will be instructive for other states as well.

I have called the Arkansas River Compact the best compact and the worst compact that Colorado has entered into. It is the best compact because it apportioned the benefits of John Martin Reservoir, a large federal reservoir that was built on the channel of the Arkansas River, without placing any restriction on diversions by existing water users, except for a limitation on the improved or prolonged functioning of existing works. And, it did not place any specific limit on future beneficial development in the basin in Colorado unless the development would deplete flows usable in Kansas. It is the worst compact, at least from the standpoint of the state officials who are charged with enforcement of its provisions, because it provides no quantitative standard to determine whether future developments, including the improved or prolonged functioning of existing works, are in compliance with the Compact. The lack of a quantitative standard makes it a real challenge for water officials to determine if groundwater pumping and replacement plans are adequate to ensure compliance with the Compact, but the Measurement Rules and the Rules are an effort to do that, and I would encourage those in other river basins, in Colorado and elsewhere, to look at these rules as examples of how groundwater can be managed to protect senior surface rights and to comply with an interstate compact.