

# [***ARTICLE: THE SOUTH PLATTE WELL CRISIS AND BEYOND:evolving alluvial groundwater regulation***](https://advance.lexis.com/api/document?collection=analytical-materials&id=urn:contentItem:5XBK-6JB1-F7VM-S42T-00000-00&context=1516831) [[1]](#footnote-2)1

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**[\*161]**

I. Introduction

Like many western states, ***Colorado*** has struggled to regulate alluvial ground water usage. ***Colorado***'s General Assembly made a decision to incorporate alluvial ground water usage into the prior appropriation system governing the state's surface water in 1969. However, that decision was only the beginning. The purpose of this article is to describe the state's experience in implementing the general assembly's mandate in the South Platte ***River*** Basin - ***Colorado***'s most populous and developed watershed.

**[\*162]**

II. Background

A. The South Platte ***River*** Basin

***Colorado***'s population distribution does not match its water supply. Eighty percent of the state's population resides to the east of the Rocky Mountains along ***Colorado***'s "Front Range," while eighty percent of the state's water resources are located to the west of the continental divide on the "West Slope." [[4]](#footnote-5)4The Front Range relies upon two relatively small ***river*** systems - the South Platte and the Arkansas - to supply its needs, supplemented by approximately 550,000 acre-feet (AF) of annual trans-mountain infusions from the West Slope. [[5]](#footnote-6)5Even with this infusion, the South Platte and Arkansas ***river*** flows pale in comparison to their West Slope counterparts. The ***Colorado*** Division of Water Resources reports that average flows leaving the state in the South Platte ***River*** are 403,400 AF, including transmountain diversions of approximately 400,000 AF. [[6]](#footnote-7)6By comparison, average flows leaving the state in the ***Colorado*** ***River*** are 4,500,000 AF. [[7]](#footnote-8)7

Image 1

Arising in the mountains west of Denver, the South Platte ***River*** serves the most populous areas of the state, located roughly from Denver then north along the Front Range to the border with Wyoming. It drains 18,900 square miles of **[\*163]**area. According to the 2000 census, approximately three million people - or 70 percent of the state's population - live in this basin. [[8]](#footnote-9)8The basin boasts one million acres of the state's most productive irrigated agricultural land, and 1.1 million AF of water storage capacity in twenty-two large reservoirs. [[9]](#footnote-10)9Fertile alluvial soils in the basin produce irrigated corn, alfalfa, sugar beets, pinto beans, and market vegetables. The prevalence of feed and proximity to large markets encourages the development of large feedlot and dairy operations.

Image 2

The South Platte ***River*** is "over-appropriated" and thus governed by senior surface "calls." [[10]](#footnote-11)10Though there are times of "free ***river***" (i.e. when ***river*** water runs in surplus of the amount subject to water rights) in the spring runoff months and following large storm events, for most of the irrigation season the ***river*** serves only water rights with priority dates pre-dating 1900. In the winter months the ***river*** is dedicated to filling reservoirs with priority dates pre-dating 1915. Water rights junior to these dates take water on an as-available basis during times of high flow and/or low demand.

III. Alluvial Well Development in the South Platte ***River*** Basin

Given the high demand for water and the low volume of surface flow, it is not surprising that South Platte water users began to look to the alluvial aquifer **[\*164]**for supplemental supply as soon as technology became available. They were not disappointed. The South Platte Alluvial aquifer holds approximately eight million AF of water in storage. [[11]](#footnote-12)11The ancient South Platte ***River*** and its tributaries, swollen with snowmelt at the end of the last ice age, left robust alluvial deposits ranging in width from two to six miles wide and up to 200 feet deep on the main ***river*** channel. [[12]](#footnote-13)12Alluvial wells installed in the main channel are good producers, providing as much as 5,000 gallons per minute. [[13]](#footnote-14)13These wells are hydraulically connected to the South Platte ***River*** and influence its flows.

Image 3

From the 1930s through the 1950s, agricultural producers were not aware of, or concerned with, the potential effects of well pumping on surface flows. Wells produced crop-saving supplemental water at a reasonable cost. By 2002, there were approximately 8,200 high capacity wells installed in the South Platte alluvium - pumping approximately 500,000 AF of water annually. [[14]](#footnote-15)14

**[\*165]** Image 4

IV. Initial Attempts at Regulation

Despite its leadership role in the development of the prior appropriation system, ***Colorado*** was slow to enact legislation governing groundwater withdrawals. [[15]](#footnote-16)15Other western states addressed the issue in some form early in their development (Territory of Dakota, 1866; Kansas 1891, 1910; Idaho, 1899; Utah, 1903; Nevada and California, 1913; Arizona, 1919). The ***Colorado*** General Assembly took no meaningful action until 1957. [[16]](#footnote-17)16

Statutory schemes enacted by other states frequently recognized a distinction between groundwater flowing in "subterranean streams flowing through known and definite channels" and "percolating waters the course and boundaries of which are incapable of determination." [[17]](#footnote-18)17"Subterranean streams" were made the subject of the prior appropriation system, whereas "percolating waters" were distributed pursuant to a riparian conception of "reasonable use" - independent of the prior appropriation system. [[18]](#footnote-19)18Over time, these states showed a trend towards increasing the amount of groundwater subject to the prior appropriation **[\*166]**system, and decreasing the amount of groundwater labeled as "percolating waters." [[19]](#footnote-20)19Nevertheless, this distinction has been retained by a number of states, most notably California, which continues to recognize a difference between "underground streamflow," governed by the state's prior appropriation system, and "percolating groundwater," governed by an assortment of court-developed doctrines designed to divide available groundwater between overlying landowners. [[20]](#footnote-21)20

In the absence of guidance from the ***Colorado*** General Assembly, ***Colorado*** courts struggled to address the distinction between "underground streams" and the common law conception of "percolating ground water." Early cases like *McClellan v. Hurdle*; [[21]](#footnote-22)21 *Medano Ditch* ***Co****. v. Adams*, [[22]](#footnote-23)22 *Buckers Irrigation Milling and Improvement Company*, [[23]](#footnote-24)23and *Comstock v. Ramsay* [[24]](#footnote-25)24recognized that groundwater flowing in the alluvial aquifer of a stream were subject to the state's system of prior appropriation and could not be diverted to the detriment of senior appropriators. In each of these cases, appellants argued that the groundwater to be diverted was "percolating groundwater," subject to reasonable use by overlying landowners. [[25]](#footnote-26)25Though this doctrine was clearly disfavored by ***Colorado*** courts, the cases were decided upon their own facts, leaving the potential for future argument on the issue. [[26]](#footnote-27)26Finally, in *Nevius v. Smith*, the ***Colorado*** Supreme Court rejected the "percolating waters" argument as "unsound in ***Colorado***" - establishing the assumption that all groundwater is tributary to the state's natural streams, in the absence of proof to the contrary. [[27]](#footnote-28)27The *Nevius v. Smith* doctrine was recited and applied in *Safranek v. Town of Limon*. [[28]](#footnote-29)28 *Safranek* is now the leading case cited for the proposition that all ***Colorado*** groundwater is presumed tributary to a natural stream.

During this period of the state's history, it was not clear whether and to what extent alluvial wells were "water rights" to be administered under the state's system of prior appropriation. Though the pre-1957 courts recognized the assumption that all groundwater was tributary to a natural stream, the state engineer had no express authority to act to curtail the use of wells for the benefit of surface rights. Wells were not adjudicated, so most of them had no decree or priority date. In short, as of 1953, ***Colorado*** was in a "chaotic situation." [[29]](#footnote-30)29

Meanwhile, the rapid development of wells led to overpumping in areas of limited natural water recharge in the South Platte ***River*** basin. Groundwater "mining" conditions developed as well users raced to consume this common **[\*167]**resource. [[30]](#footnote-31)30It became apparent that without regulation, these areas would be mined to exhaustion. Despite the dire conditions, well owners in these areas resisted well regulation, and the ***Colorado*** General Assembly was reticent to impose it. [[31]](#footnote-32)31

In 1953, the general assembly enacted legislation that required well drillers to be licensed and forbade the wasting of water from wells. The legislation also subjected wells to the jurisdiction of the ***Colorado*** Water Conservation Board, though in reality the Board had no authority to curtail production from the wells. [[32]](#footnote-33)32The 1953 Act was a beginning, but it quickly became clear that more regulation was needed.

The general assembly made an attempt to address the mining conditions occurring in South Platte tributaries in 1957. [[33]](#footnote-34)33At the time the bill was passed, there were no restrictions on the issuance of new well permits and no means to control withdrawals - even in locales where water mining conditions had become critical. The bill was intended to address these concerns and to provide a management scheme that could prolong the life of overburdened aquifers.

The bill sought to achieve these ends by two principal means. First, well permits were required for the construction of new wells. Second, the ***Colorado*** Ground Water Commission was created and authorized to establish "Tentatively Critical Ground Water Districts," which are defined as "any areas where, from the information gathered, the withdrawal of ground water appears to have approached, reached or exceeded the normal annual rate of replenishment." [[34]](#footnote-35)34The statute further provided that "the Commission shall immediately close all areas designated as Tentatively Critical Districts to further development of ground water resources." [[35]](#footnote-36)35The Act provided no authority to the state Engineer to prevent groundwater development in areas outside the Critical Districts.

In addition, the Act provided that the landowners in a Critical District could "de-designate" their basin and "opt-out" of the controls imposed by the Act. [[36]](#footnote-37)36This scenario played out in the Kiowa-Bijou Basin, one of the principal areas of concern intended to be addressed by the Act, when the newly created Advisory Board requested de-designation. This "opt-out" provision made the Act largely ineffectual. [[37]](#footnote-38)37

In 1965, the general assembly made its first large scale attempt at regulating alluvial well withdrawals. House Bill 1066 authorized the state engineer to administer surface waters and "underground waters tributary thereto in accordance with the right of priority of appropriation." [[38]](#footnote-39)38House Bill 1066 did not set out specific guidelines for the state engineer to follow with regard to administering surface water and tributary groundwater but required that he adopt rules **[\*168]**and regulations as necessary to accomplish the administrative goals set by the legislature. [[39]](#footnote-40)39

In 1966, the state engineer attempted to exercise his House Bill 1066 authority by curtailing thirty-nine wells in the Arkansas ***River*** basin. The resulting ***Colorado*** Supreme Court decision, *Fellhauer v. People*, would shape the state's alluvial well policy. [[40]](#footnote-41)40After determining that the state engineer's actions amounted to arbitrary and capricious conduct on due process grounds, the *Fellhauer* court seized the occasion to offer an extended discussion of alluvial well policy. The court rejected the argument that both tributary groundwater and surface water should be administered in identical fashion and envisioned a future where the courts were concerned with twin goals of protecting vested rights and "maximum utilization of the water of [the] state." [[41]](#footnote-42)41Sending a clear signal to the general assembly, the court discussed "the new drama of maximum utilization" and its principal dilemma - "how constitutionally that doctrine can be integrated in to the law of vested rights." [[42]](#footnote-43)42Though dicta, the court's statements would shape the general assembly's renewed efforts to regulate alluvial well usage by encouraging lawmakers to recognize the unique hydrologic character and economic importance of alluvial wells.

V. The 1969 Water Rights Determination and Administration Act

Even before the decision in *Fellhauer*, the ***Colorado*** Legislature recognized HB 1066 was not going to be sufficient to adequately administer surface water and tributary groundwater together. In 1967, the legislature passed Senate Bill 407, appropriating $ 50,000 for a two-year investigation and study of the relationships between surface and groundwater to evaluate the need for additional legislation to effectuate integrated administration of surface and groundwater. [[43]](#footnote-44)43

Senate Bill 407 resulted in a study by Morton W. Bittinger & Associates and Wright Water Engineers on the interaction between surface water and ground water in the South Platte Basin (Bittinger Study).

Bittinger Study findings, conclusions, and recommendations include:

*Findings*

\* The average annual water supply within the South Platte ***River*** basin is adequate to meet present requirements. However, because of the wide fluctuations in runoff, the distribution of water availability is far from satisfactory.

\* The groundwater reservoir along the mainstem of the South Platte ***River*** between Denver and the state line contains approximately ten million AF of water. Only a small percentage of this capacity is utilized and this only in a haphazard and unplanned way.

\* Groundwater pumping and transmountain importations have been the major factors in stabilizing water supplies in the South Platte Basin. However, **[\*169]**the pumping of groundwater has caused infringement upon prior surface water rights. Studies indicate that this infringement is not as severe as many have felt it to be.

\* The water supplies of the South Platte Basin are not being utilized or administered as efficiently and effectively as they could be.

\* Deficiencies exist in the completeness and accuracy of water use records. [[44]](#footnote-45)44

*Conclusions*

\* Planned utilization of 10 to 15 percent of the available groundwater storage capacity in the alluvium is reasonably attainable. Use of the groundwater storage capacity can provide more efficient utilization of the total resources of the Basin, reduce shortages, and minimize conflicts between water users. This planned utilization in conjunction with surface water supplies would basically involve a heavier draft upon the groundwater supplies during low runoff years with provision for replenishment of those supplies during years of surplus runoff.

\* To achieve more optimum distribution of water supplies and accomplish desired goals, certain surface water rights should be served from groundwater sources during low runoff periods. Such operations would allow more surface water to be diverted in the upper regions, making greater re-use of return flows possible.

\* Since the groundwater in storage adjacent to the mainstem of the South Platte is currently being used to support the flowing stream, and many users are dependent upon and have rights in the return flow which joins the ***river*** via the groundwater system, provisions must be made to protect these rights and to supply them with alternate sources of water to insure the continued utilization of the groundwater supply. The cost of providing such facilities should be borne by those who benefit.

\* Optimum use of water resources within the South Platte ***River*** Basin cannot be achieved without control of non-beneficial uses or waste of water.

\* Integrated management of groundwater and surface water can be best achieved on an overall South Platte ***River*** Basin basis. [[45]](#footnote-46)45

*Recommendations*

\* It is recommended that legislation should be passed which will allow and encourage the integrated management and administration of groundwater and surface water in the South Platte Basin. [[46]](#footnote-47)46

Following the Bittinger Study and the *Fellhauer* decision, the ***Colorado*** Legislature repealed House Bill 1066 and enacted comprehensive legislation entitled the Water Right Determination and Administration Act of 1969 (the "1969 **[\*170]**Act"). [[47]](#footnote-48)47The 1969 Act was the legislature's attempt to integrate surface and groundwater use and promote the constitutionally mandated protection of vested rights and maximum utilization articulated by the ***Colorado*** Supreme Court in *Fellhauer*. [[48]](#footnote-49)48The 1969 Act intentionally brought all alluvial groundwater within the ambit of the state's prior appropriation doctrine. In order to provide priority dates for the wells, the general assembly allowed well owners a grace period to adjudicate priorities for the wells in the state's water courts. It further required the state engineer to administer the wells in priority in relation to surface rights in the same stream system.

The priority dates for the wells are very junior in relation to the surface water rights in the South Platte and Arkansas basins, where senior surface rights date to the 1850s. As a result, in the absence of intervention, application of the priority system would have resulted in widespread curtailment of the wells during the irrigation season, when the surface flows of these ***rivers*** are reserved for senior priorities. Calls by senior users for regulation vary widely based on ***river*** conditions and demand. In addition, the depletive effect of the wells on surface water flows is not instantaneous, which complicates priority administration. Although a well might be in priority on a given day, that day's allowed well pumping will not impact the ***river*** until some future time. It is impossible to predict whether the delayed depletions will be in priority on any given day in the future.

In the 1969 Act, the general assembly's answer to these issues was a statutory creature called an "augmentation plan." [[49]](#footnote-50)49An augmentation plan is a water court approved plan whereby the well owner provides a water supply to offset out-of-priority depletions caused by the well. [[50]](#footnote-51)50The well owner must secure a water source of sufficient reliability to convince the court (and other water users scrutinizing the plan) that he or she will be able to replace any "out of priority" depletions that affect the ***river***. [[51]](#footnote-52)51The fundamental analysis performed by the court is a comparison of augmentation supplies and anticipated well depletions. The general assembly saw the augmentation plan as a means to allow the continued use of the junior alluvial wells, while integrating them into the surface water priority system. In practice, augmentation plans require well users to acquire or develop additional water supplies to offset anticipated well depletions.

VI. The "Substitute Supply Plan" Era: 1969-2001

Though the 1969 Act called for adjudication of all augmentation plans by the water court, in order to ease the transition, the 1969 Act further provided the ability for the state engineer to approve temporary augmentation plans pending court adjudication of the final plans. [[52]](#footnote-53)52The statute granting this authority was repealed in 1977. [[53]](#footnote-54)53The state engineer's approval of temporary plans would prove to be an issue precipitating a major crisis in 2002.

**[\*171]**In the wake of the 1969 Act, most South Platte well users adjudicated their wells and received priority dates. Some sought court approval of augmentation plans, but the vast majority of South Platte wells sought shelter in state engineer approved "substitute supply plans" - annual administrative approvals that allowed ongoing pumping. Because of the high cost of obtaining the "replacement water" necessary for the adjudication of a permanent plan, the well owners sought strength in numbers. Two major well augmentation groups formed on the South Platte - one under the auspices of the Ground Water Management **S**ubdistrict of the Central ***Colorado*** Water Conservancy District (GMS), and the other a private entity bearing the name "Ground Water Appropriators of the South Platte (GASP).

Neither GMS nor GASP sought a court approved augmentation plan in the 1970s, 80s, or 90s. Though the statute giving the State Engineer express authority to approve temporary plans was revoked in 1977, the state engineer nevertheless continued to review and approve annual "Substitute Supply Plans" for these entities. At the time, the state engineer believed that he had the authority to approve the plans indefinitely. Some South Platte water users questioned his conclusion in this regard, and became increasingly dissatisfied with the approval process, accusing GMS, GASP and the state engineer of providing inadequate replacement of depletions. However, from 1980 to 2000 the South Platte enjoyed twenty of the wettest years of record, blunting criticism and masking supply shortages.

GMS and GASP took different approaches. While both continued to enjoy temporary administrative approvals, GMS set its sights on obtaining augmentation plans approved by water court and worked towards assembling permanent supplies. GASP opted for a less costly route, arranging temporary leases and shorter-term supplies that supported the annual approvals, but were less useful in a permanent augmentation plan.

VII. 2002 Water Crisis

A. A Perfect Storm

South Platte well users sailed into the perfect storm in 2002. First, ***Colorado***'s Supreme Court decided that the state engineer had no authority to approve temporary substitute supply plans. [[54]](#footnote-55)54The court determined that the general assembly had intended that every South Platte well user obtain a water court decreed plan of augmentation, and that he had no authority to approve "Substitute Supply Plans" relied upon by GMS and GASP. [[55]](#footnote-56)55

The state engineer reacted to the *Empire Lodge* decision by promulgating rules that allowed him to continue to approve temporary "replacement plans" - the equivalent of substitute supply plans. The Supreme Court rejected these rules in *Simpson v. Bijou Irrigation Company*, finding that the state engineer had exceeded his rulemaking authority. Consequently, all wells in the South Platte ***River*** Basin must be enrolled in a water court decree augmentation plan **[\*172]**to legally operate. [[56]](#footnote-57)56

Neither GMS nor GASP was ready to go to water court and seek approval of a permanent plan. Furthermore, even if one could be obtained, ***Colorado***'s water court process is such that it would be two to three years at a minimum before a decree could be achieved. As a result, GMS and GASP well users were faced with the prospect of curtailment for two to three years while the groups sought water court approval. Even if a plan could be achieved, GMS did not have enough permanent water supplies assembled to achieve full pumping under a water court approved augmentation plan. It was also uncertain whether GASP had enough long-term supplies to achieve approval of a water court decree at.

In the midst of the legal maelstrom, the South Platte ***River*** basin was hit by severe drought, unmasking supply deficiencies inherent in the GMS and GASP plans and propelling surface water users into an all-out attack on ground water usage. Severe call scenarios dominated the ***river***. In previous years, ***river*** calls had been limited to the irrigation season by a "gentlemen's agreement" among surface water users. As a result, GMS and GASP had not been required to replace well depletions in the winter months. In 2002, as supplies dwindled, storage right users - with rights in South Platte Reservoirs that fill during the winter - placed calls to fill the reservoirs, thereby requiring the augmentation plans to double their supplies or face curtailment.

Image 5

The General Assembly responded to the legal crisis, passing a bill that reinstated the state engineer's authority to approve temporary plans pending water court approval, so long as the wells users had filed an application in water court. [[57]](#footnote-58)57 **[\*173]**GMS filed a water court application and continued to operate under the temporary plan. GASP struggled through one year under the new regime, then voted to dissolve rather than seek a water court approved augmentation plan.

In the wake of dissolution, owners of wells formerly covered by GASP scattered. In locations downstream of Fort Morgan, where call scenarios are less severe and supplies more plentiful, users formed their own well user groups and applied to water court for approval of augmentation plans. GASP members further upstream in the most stressed ***river*** segment approached the Central ***Colorado*** Water Conservancy District (CCWCD), the major augmentation entity in the region and parent of GMS. At former GASP users' urging, CCWCD created the new "Well Augmentation Subdistrict" (WAS) to seek a court approved augmentation plan for them. WAS issued $ 20 million in bonds to purchase permanent water supplies to support the new plan and filed an application in water court.

B. Water Court Decreed Augmentation Plans

After lengthy multi-party negotiations, GMS - the largest and oldest of the remaining augmentation groups - settled out of court with water users opposing its plan and presented a stipulated augmentation plan to the judge. The principal breakthrough facilitating settlement and resulting in a 2005 decree was a concept referred to as a "Projection Tool." [[58]](#footnote-59)58

The GMS plan did not have enough water supplies to cover depletions from pumping its member wells at 100 percent capacity. As a result, there was a need to limit pumping such that depletions would never exceed replacement supply. The Projection Tool is a mechanism described by the decree that facilitates a comparison of anticipated depletions from well pumping with anticipated future supplies. In practice, it is an Excel spreadsheet prepared by GMS' engineering consultants.

On the depletion side, the Projection Tool forecasts the amount and timing of depletions that are expected to affect the ***river*** from metered well pumping that has already occurred. It also has the capability to project anticipated depletions from varying amounts of anticipated pumping. By adjusting the amount of pumping proposed to be allowed, the future depletions can be manipulated. The amount of anticipated pumping is expressed in terms of a percentage of full demand. This "Quota" is the amount that members are allowed to pump. For the purposes of the Projection Tool, it is assumed that there will be a call senior to the wells for every future day for the entire length of the projection. In reality, there may not be a call for every day - there will almost certainly be times when the wells are in priority and do not have to replace their depletions. However, the "year-round call" assumption is considered a prudent, conservative estimate designed to accommodate a worst case scenario.

Depletions are calculated for each well, taking into account consumptive use and return flows, to establish the impact on surface flows. The net depletion for all wells is determined by adding up all the net depletions calculated for each **[\*174]**individual well. No consideration is given to regional aquifer conditions resulting from the operation of wells generally, such as the lowering of ground water tables and resulting elimination of phreatophytes (water loving plant), for example. The decree does not mandate any measurements or monitoring of the alluvial aquifer. Instead, it requires a mathematical calculation of depletions based on analytical equations described by Glover. [[59]](#footnote-60)59The wells are required to replace the calculated depletions in the time and amount that the "Glover" analysis dictates, at a location set forth in the decree.

On the supply side, GMS is allowed to project deliveries of senior rights it owns based on a dry year yield. It may project deliveries from surface storage to the extent that there is water in storage at the time of the projection. Similarly, it may predict groundwater accretions to the extent that water has already been delivered to recharge sites for percolation into the aquifer. It may not assume any deliveries of junior rights in the future.

The length of the GMS projection is seven years. This time period is intended to match the approximate time it takes for the bulk of delayed depletions from pumping the member wells to affect the ***river***. The projection is updated annually by April 15.

This "Projection Tool" methodology was also applied successfully to GASP orphan groups located downstream of Fort Morgan. Since its inception, it has been refined in a series of South Platte decrees and has become the de facto standard for South Platte Augmentation plans. Since the entry of its decree, GMS has been able to declare quotas ranging from 15 to 55 percent of calculated demand.

WAS was not able to settle out of court with senior surface rights owners opposing the application, principally because these opposers believed that WAS did not have enough augmentation supplies to justify the entry of a decree and made multiple motions for dismissal of the application. WAS wells did not receive temporary approval to operate in 2006, and were curtailed. This curtailment was an extreme hardship on well owners and drew attention from national media.

Whereas GMS had been assembling permanent supplies for thirty years, WAS had only four years and limited means. Faced with relatively small amounts of permanent supply, and the reality that available funding was insufficient to allow the large-scale purchase of senior water rights, WAS developed an aggressive program of groundwater recharge designed to capture "free" ***river*** water during times of surplus and re-time it to replace well depletions. WAS' recharge program consists of a series of shallow infiltration basins, generally located on existing ditch systems. When water is available, it is delivered via agreement with the ditch company to the recharge sites, where it is allowed to infiltrate into the alluvial aquifer. The same analytical equations that are used to calculate depletions are then used to calculate "accretions" and predict when these accretions will supplement ***river*** flows. In addition, many of the projects involve the use of alluvial wells to take water from the aquifer and deliver it to the ***river*** to supplement ***river*** flows ("augmentation wells") or take water from the ***river*** and deliver it to recharge sites ("headgate wells"). Operated together, **[\*175]**these facilities give WAS the ability to take water when it is available and retime it to match the pattern of groundwater depletions caused by the member wells used for irrigation.

WAS survived the opposers' efforts to secure dismissal of its application and presented its plan to the court in early 2007. After a six-week trial, the water court awarded WAS an augmentation plan decree, approving a projection tool similar to the GMS decree. [[60]](#footnote-61)60WAS appealed the propriety of requiring current WAS augmentation plan members to replace the depletions caused by well pumping that occurred under GASP *prior* to WAS' formation, but a majority of ***Colorado***'s Supreme Court upheld the trial court's determination that WAS must pay the hydrologic "debt" generated by its predecessor. [[61]](#footnote-62)61As a result, WAS was not able to issue pumping quotas for the first several years of its operation while it repaid its water "debt." Today, WAS issues quotas of 60 percent or more, providing substantial irrigation supplies to its members. WAS continues to purchase senior water rights, develop new storage facilities, and build out its integrated network of recharge basins. In the interim, WAS leases municipal effluent and other fully consumable supplies to supplement the permanent supplies and ensure that all depletions required to be replaced by the water court decree are replaced.

VIII. CASE STUDY - CCWCD WATER SUPPLIES

A review of the infrastructure development by Central ***Colorado*** Water Conservancy District's Groundwater Management and Well Augmentation Subdistricts in the years following curtailment is instructive of the challenges faced by well users and the magnitude of infrastructure required to make augmentations plan work.

A. Surface Water Rights

In response to augmentation mandate of the 1969 Act, Central's Board of Directors began purchasing senior water rights for GMS shortly after the creation of GMS in 1973. This water is used to fill reservoirs, recharge ponds, and provide direct supply to the South Platte ***River***. Some of the earliest stock certificate acquisitions date back to 1880 and earlier. This acquisition process accelerated dramatically following the 2002 well crisis, as WAS (formed in 2004) joined in the GMS' efforts to secure senior water supplies. The district and two subdistricts have assembled a water portfolio that contains rights in twenty-three different ditch and reservoir companies. Senior water rights provide the critical "backbone" of both the GMS and WAS augmentation plans. To a certain extent, augmentation plans as currently decreed are less an exercise in increasing water supplies as they are trading one type of water - senior ditch supplies - for another - well pumping.

**[\*176]**

1. Surface Water Storage Projects - Lined Gravel Pits

Both before and after the 2006 well shutdown, Central constructed numerous reservoirs and gravel pit storage ponds along the Front Range and to the eastern Plains to provide surface water storage capability to its augmentation plans. Of particular pride is Central's Siebring Reservoir located just west of Greeley. The former gravel pit is now the world's first slurry wall lined storage reservoir and has been used as a pattern for other water development projects in the region.

Constructed in partnership with Hall-Irwin Construction, the unique bentonite clay lining allows for below-grade storage with minimal groundwater interaction. Other gravel pit lined storage ponds owned by Central and its subdistricts include La Poudre, Koenig, Nissen, JoDee, Bernhardt, and 83rd Avenue Reservoirs. One of the largest projects still being mined is the Shores Reservoir, which will consist of four interconnected ponds.

Central and its subdistricts have acquired or developed over 40,000 acre-feet of storage supporting its well augmentation activities. These facilities are used to capture available South Platte supplies under junior priorities, to store water from senior rights that has been changed to augmentation use, and to release these supplies to offset well depletions and replace return flows from the changed rights. Storage is critical to the operation of the augmentation plans.

2. Surface Water Storage Project - Chatfield Reservoir

In 1975, Chatfield Reservoir was constructed by the U.S. Army Corps of Engineers (USACE), at the confluence of the South Platte ***River*** and Plum Creek, to control devastating floods like the one that occurred in Denver in 1965. In response to ***Colorado***'s growing demand for water, the USACE determined that Chatfield Reservoir could store an additional 20,600 acre-feet of water without affecting its flood control function. In 1983, Central filed for a water right of 20,600 acre-feet from Chatfield Reservoir in anticipation of additional storage availability.

In 2014, the USACE approved the final Feasibility Report/Environmental Impact Statement for the project, and it is anticipated that water supplies from Chatfield Reservoir will be available to Central and its subdistricts in 2020.

B. Groundwater Recharge Projects

The function of a recharge project is to collect available water, during times of access flows, to allow it to percolate into the adjacent alluvial aquifer. Recharge ponds are an efficient, cost effective method of capturing junior decreed water supplies to percolate underground and then return underground (by way of the shallow alluvial aquifer) to the South Platte ***River*** during times of lower flows. By necessity, the WAS plan in particular relies heavily upon diversion of junior water supplies into retiming projects to support well pumping. The delayed accretive effect of recharge helps blunt the impact of hydrological cycles, however, well pumping is ultimately related to the amount of water stored and recharge, so a prolonged drought could result in decreased pumping levels.

Central and its subdistricts have developed a large network of recharge sites **[\*177]**that enables it to capture South Platte water when available. In many cases, these sites operate in conjunction with local irrigation ditches, such as the Farmers Independent Ditch, Western Mutual Ditch, Platte Valley Irrigation Company, Platteville Irrigating and Milling, Big Thompson Platte ***River*** Ditch, and Slate Ditch. Central is currently constructing a large recharge facility, called the Walker Recharge Project, on the South Platte ***River*** near the towns of Wiggins and Orchard in northeastern ***Colorado***. It will include a pipeline over one mile in length to move water from the ***river*** to recharge sites. It is funded by a $ 15 million loan from the ***Colorado*** Water Conservation Board. Average annual yield from this facility is anticipated to be 14,000 acre-feet.

C. Water Acquisition and Project Support

The water acquisition projects described above were cost-intensive and required the strong financial support of Central's members and taxpayers. Since 2007, Central's taxpayers have approved three tax increases to issue bonds totaling over $ 100 million. In 2018, Groundwater Management Subdistrict (GMS) voters approved a $ 48.7 million increase to fund water acquisition and storage projects through the issuance of additional bonds. This tax increase was approved by a 58-42 percent margin. Central had acquired a $ 20 million and $ 40 million tax increase in the previous decade.

In addition to mil levy increases, well owners in the GMA and WAS plans pay an annual assessment per acre foot of water augmented. Prior to well curtailment, these fees were historically in the range of $ 2.80 per acre foot for GMS. Following well curtailment, the same fees increased to $ 25 per acre-foot. The assessments for WAS, the newly created district serving for GASP wells, were much higher - in the range of $ 35-$ 60 per acre foot because WAS had to build all infrastructure commencing in 2004. Well owners desiring to continue pumping their wells following 2006 had to make significant financial investments in the subdistricts. This was difficult for many well owners - a large number dropped out, unable to sustain the required investment. However, the cost of obtaining augmentation was much less than it would have been if well owners sought to develop their own supplies and augmentation plans. For those well owners with the resources to ride out initial shock, WAS has now restored pumping, and the wells have again become a reliable part of the farm assets.

The strong member and taxpayer support for water acquisition and development projects, for the benefit of Central members, is an indicator of the awareness and commitment to preserve the agricultural economy of the region. This support provides the means for additional water acquisition for both water conservation and well augmentation purposes.

IX. The South Platte ***River*** Alluvial Aquifer Study

In the years immediately following the well crisis, as augmentation and recharge plans multiplied and well users turned their energy and resources towards compliance with the new norm, large-scale investment in infrastructure occurred in all reaches of the ***River***. However, even as these projects took shape, doubts lingered about whether the required augmentation plans were necessary to prevent injury to senior rights. Many believed that as a whole, the plans decreed by the water court resulted in over-augmentation, pushing water **[\*178]**downstream towards the state line and resulting in a net windfall to downstream water users in ***Colorado*** and Nebraska. Well users were required to invest large sums in water acquisition, legal and engineering fees and infrastructure to secure a fraction of the pumping they had enjoyed prior to curtailment. Well user groups became regular visitors to the capital, testifying in the general assembly and seeking audience with the governor to promote measures designed to reduce the burden of transition.

Meanwhile, water users in the South Platte began to notice increases in the water table in some areas. For localities in the basin with unfortunate geography, the rising water table caused significant damage to structures and agricultural fields. These farmers faced the triple frustration of curtailed wells, costly augmentation plans, and damaging high ground water tables. They knew intuitively that the wells had played an important role in maintaining the water table's "status quo' for several generations. Rising water tables were blamed on well curtailment, compensatory increases in surface water diversions (and resulting ditch loss and return flow), and large scale artificial recharge required by the new augmentation plans. Other water users were skeptical of these claims and felt that the new administration was properly generating additional flows for the ***river***, returning it to the state intended by the 1969 Act.

The general assembly responded in 2012 with H.B. 12-1278, intended to assess the effectiveness and fairness of well administration in the South Platte. [[62]](#footnote-63)62The study tasked the ***Colorado*** Water Institute at ***Colorado*** State University to:

\* Evaluate whether current laws and rules that guide water administration in the South Platte ***River*** basin achieve the dual goals of protecting senior water rights and maximizing the beneficial use of both surface water and groundwater within the basin.

\* Identify and delineate areas within the basin adversely impacted by high groundwater levels and to conduct a feasibility-level evaluation of the causes of high groundwater levels in the affected area.

\* Provide information to use as a base for implementation of measures to mitigate adverse impacts in areas experiencing high groundwater levels.

\* Provide information to the General Assembly to facilitate the long-term sustainable use of South Platte water supplies.

\* To what extent augmentation plans are preventing injury to other water rights holders or potentially causing over-augmentation of well depletions.

\* Whether additional usage of the alluvial aquifer could be permitted in a manner consistent with protecting senior surface water rights.

\* To what extent the use of water in the basin could be improved by affording the state engineer additional authority to administer water rights. [[63]](#footnote-64)63

The "1278 Study" was in many ways a follow up to the Bittinger Study of 1967. It's underlying intent was to assess, based on available data, whether and to what extent ***Colorado*** had achieved maximum utilization of the alluvial **[\*179]**groundwater and surface water systems in the South Platte, and, if not, to provide direction for future refinements.

The Water Institute found that in the years immediately prior to the widespread curtailment of wells in the South Platte Basin, consumptive use of groundwater averaged 370,954 acre feet per year, while augmentation averaged 152,798 acre feet per year, a deficit of 218,756 acre-feet per year. [[64]](#footnote-65)64Surface water users saw this data as a confirmation of their historical concerns.

Following the curtailment, augmentation supplies increased dramatically, as much as 230,000 acre-feet per year on a five year average, as well owners constructed numerous recharge sites. [[65]](#footnote-66)65The curtailment of wells and the influx of augmentation supply effected a dramatic change in the water balance - for the years 2008-2012, groundwater consumptive use averaged 238,791 acre feet, and augmentation supply 264,318, a net surplus of 25,257 acre-feet. [[66]](#footnote-67)66Well owners in the basin had rectified the shortfall in augmentation and gone significantly beyond what was necessary to prevent injury to other water users.

Image 6

(From 1278 study, p. 4)

Overall, the amount of groundwater consumptive use in the basin appears to have returned to something approximating pre-curtailment levels. However, this broad conclusion masks significant changes in groundwater use. The study found that augmentation supply was not equally obtainable or evenly distributed through the basin. [[67]](#footnote-68)67As a result, the well curtailment was also unevenly distributed. In District 2, the reach from Denver to Kersey, where augmentation supply is very difficult to obtain due to the presence of senior surface rights and competition for supply from front range municipalities, groundwater consumptive use decreased dramatically from a high of 120,000 acre-feet in 2002 to 40,000 acre-feet in 2012, a drop of 80,000 acre-feet. [[68]](#footnote-69)68In the next downstream reach, District 2, groundwater consumptive use remained stable through the crisis. [[69]](#footnote-70)69And in the furthest downstream reach, Reach 64, located near the state line, groundwater consumptive use actually increased by 10,000 acre-feet per **[\*180]**year during the study period. These conclusions seem to support the comments of upstream well users that the new norm "forced' water downstream to the benefit of downstream water users.

Image 7

(From 1278 study, p. 4)

The Institute found an increased reliance on senior surface rights, particularly in District 2, which was hardest hit by curtailment. [[70]](#footnote-71)70This, combined with wet weather, well curtailment and increases in recharge for augmentation required under the new regime, was the probable cause for damaging high groundwater conditions in areas prone to them. [[71]](#footnote-72)71While damaging high groundwater was not widespread, it was acute in the affected areas, and needed immediate attention. [[72]](#footnote-73)72As ground water levels rise, so does non-beneficial consumptive use by phreatophytes, creating a loss of as much as 250,000 acre-feet per year. [[73]](#footnote-74)73

Consistent with its water balance finding, the study found increasing stream gain during the study period, another indication of the effectiveness of augmentation efforts. [[74]](#footnote-75)74Flows leaving the state were significantly less during the study period than in preceding decades, however, the Institute attributed this to drought conditions in the years 2001-2008 and 2012, rather than a result of well administration changes. [[75]](#footnote-76)75

The Institute made the following recommendations for future action:

1. Mitigation of localized high water table conditions:

*A.*The state engineer or the ***Colorado*** Geological Survey should be delegated responsibility by the general assembly to provide a consultation **[\*181]**to the water court regarding new recharge structures before construction and recommend changes in design or operation when a recharge plan is deemed likely to cause or is causing harm.

*B.*Two pilot projects should be authorized and funded by the general assembly to allow the state engineer to track and administer high groundwater zones for a specified period of time to lower the water table at Sterling and Gilcrest/LaSalle while testing alternative management approaches.

2. Increasing augmentation plan efficiency:

*A.*The state engineer should be directed by the general assembly to promulgate new rules for the S. Platte to:

*1)*Establish a framework for the voluntary movement of excess water supplies between augmentation plans, facilitated by the office of the Division Engineer, including a water bank or pool available for use by augmentation plan users.

*2)*Establish basin specific guidelines for the implementation of administrative curtailment orders pursuant to [*37-92-502(2)(a), C.R.S.*](https://advance.lexis.com/api/document?collection=statutes-legislation&id=urn:contentItem:637R-W883-GXJ9-334R-00000-00&context=1516831) that reduce waste and facilitate efficient management and distribution of available water supplies to storage and recharge water rights in the time and place of their need, in accordance with priority and historic practice. The guidelines should:

*a.*Allow the division engineer to use the administrative call as a management tool to increase system efficiency, decrease waste and maximize diversions for beneficial use;

*b.*Provide for storing water out-of-priority at higher elevation, and managing deliveries to downstream reservoirs as necessary;

*c.*Minimize seniority, frequency and duration of administrative calls to the full extent consistent with the fulfillment of decreed water rights;

*d.*Make use of all available data regarding water supply, including ground water levels, to determine the necessary administrative call date for each reach or sub-reach of the ***river*** and the alluvial aquifer system.

**[\*182]**3) Develop uniform and transparent reporting standards for augmentation plan accounting designed to integrate with basin data collection, modeling and management.

B. Funding should be authorized to provide the Division 1 Engineer with two additional FTEs and greater annual investment in technology upgrades. Additionally, ***Colorado*** DWR needs one additional FTE to focus on data and information services.

3. Implementation of basin-wide management:

*A.*The general assembly should authorize the establishment of a pilot basin-wide management entity with a defined sunset date.

*B.*The CWCB, CDA and DWR should work with USGS to implement the basin-wide groundwater monitoring network outlined in this report.

*C.*The state should cooperate with the S. Platte Basin Roundtable and water organizations in the basin to fund and conduct a helicopter electromagnetic and magnetic survey to produce detailed hydrogeological maps of the S. Platte alluvial aquifer.

*D.*The state should continue strong support for the development and implementation of the SPDSS and strive to improve accessibility, scope, and robust stakeholder processes.

*E.*The state should aggressively begin working with water users and other stakeholders in the S. Platte basin to develop multiple-benefit water storage options.

4. Recommendations to the ***Colorado*** DWR and the CWCB for improved data collection, data management, and data access:

A number of specific recommendations for improving data capture, management, and display are offered to the State based upon our experience on the HB1278 study beginning on page 185 of the report. [[76]](#footnote-77)76

Some of these recommendations were controversial. The concept of increasing state and division engineer discretionary authority to use the administrative "call' to achieve maximum utilization touched a nerve that has been a focal point of debate in ***Colorado*** water administration - namely, the scope and extent of the state engineer's authority. Similarly, the Institute's recommendation that the Basin users explore basin wide management concepts is foreign to many water users' perception of the ***Colorado*** doctrine as a self-implementing system, executed by the state engineer and division engineers by the letter of **[\*183]**water court decrees. At the same time, other water users recall the days of greater state engineer discretionary authority - before the pendulum swung to the conservative - with approval, and believe that the mechanical execution of the priority system, without regard to ***river*** and aquifer conditions and larger systemic operational goals and constraints, has proved to be a mistake.

The controversial nature of the recommendations is indication that the Water Institute is in the right neighborhood. Similar to the Bittinger Study, the 1278 Study challenges the status quo and encourages exploration of concepts that have the potential to move administration closer to the era of Maximum Utilization envisioned by the *Felhuaer* Court and the 1969 General Assembly. It is interesting that the 1278 Study and the Bittinger Study provide similar conclusions and recommendations. Both advocate increased data gathering and analysis, basin wide management, and planned use of the alluvial aquifer. In many ways, the 1278 Study is an updated, more focused version of the Bittinger Study that provides specific "action items' that are relevant in today's legal and political environment. The underlying principles remain the same.

X. Lessons

At the outset of the South Platte well crisis in 2002, there were 8,200 wells permitted to withdraw water from the South Platte alluvium. Today, 3,700 of these wells are not enrolled in any court approved augmentation plan and have been completely curtailed. 4,500 wells are enrolled in augmentation plans and continue to pump, though most of these are partially curtailed. [[77]](#footnote-78)77The direct and indirect economic costs have been conservatively estimated at $ 28 million through 2007, not counting the millions spent on legal and expert witness fees by agricultural water users on both sides ill-situated to bear the burden. [[78]](#footnote-79)78The social cost of failed family agribusinesses and farm communities' long dependent on groundwater cannot be quantified in dollars, but is nonetheless very real to those individuals caught in the crossfire of failed water policy.

The South Platte well crisis illustrates the strengths and weaknesses of ***Colorado***'s water court process. ***Colorado*** water courts are very good at assessing individual cases. The adversarial process allows scrutiny at a level not available in a purely administrative context. In major water matters, water users fund detailed analyses and employ cadres of experts and skilled attorneys to make their point. This "no stone left unturned" approach generally produces good results. In the South Platte Well context, it allowed all water users involved their "day in court." Regardless of whether one agrees with the outcome, it is difficult to argue that either side did not have the opportunity to present all relevant evidence. ***Colorado*** values this approach and is willing to invest large amounts of judicial time and resources to its preservation.

There are negatives to this approach, however. The intense, case driven scrutiny that is a strength can also be a weakness because it fails to allow room for regional planning and management. Rather than approaching the alluvial **[\*184]**well problem on a basin wide basis, it fragmented it into a series of private lawsuits, relegating decision making to piecemeal determinations based upon whatever evidence or engineering approach the litigants emphasized. Decisions regarding appropriate engineering or data assumptions in one case give way to a new and better (or just different) approaches in the next. Each case is re-engineered, in isolation, ignoring broader systemic issues, and at great transaction cost to the applicants and other water users. Cases, once decided, are fixed - even when future scientific developments reveal that the decrees were fundamentally flawed.

The South Platte well crisis suggests that ***Colorado*** has not yet achieved a workable balance between systemic planning and management, on the one hand, and its strong commitment to the adversarial model on the other. Though the dispute was resolved, the resolution came at a high cost. Had there been a means to assess the basin as a whole - including its alluvial aquifer - and determine sustainable yield, the State might have been able to find a way to protect senior water users, allow an appropriate amount of ongoing well usage by all well users, and avoid large scale curtailment.

As populations burgeon and supplies dwindle, water professionals in ***Colorado*** and similarly situated states must find a way to integrate systemic, data driven planning and administration with important ideals of due process, adversarial decision making, and protection of property rights. This 21st century mandate is of critical importance in basins like the South Platte, where users rely upon both surface flows and withdrawals from a large alluvial groundwater system. There have been many great leaps forward already. Wells have been integrated into the priority system governing the South Platte ***River***, as envisioned by the 1969 Act. Senior rights have been protected. And a substantial amount of well pumping has been sustained. These are not small victories.

But much remains to be done. The 1278 Study data suggests that the augmentation required by the sum of the individual augmentation plan decrees is too great, creating windfalls for some water users at the expense of others. Well pumping is an important part of the water balance in some localized areas that historically helped maintain manageable groundwater levels. In these areas, the broad stroke curtailment, which corrected the macro issue, has created an acute local issue. We know far too little about the operation of the aquifer and ***river*** system - more data is needed to confirm the actual impact of well pumping on ***river*** flows by location. We have measurement and analytical tools at our disposal that did not exist in the Bittinger era that could dramatically advance our understanding and guide management. Large scale projects needed to increase efficiency and deliver water to more priorities more often are beyond the resources of individual water users. Our piecemeal, ad hoc adjudication and priority enforcement provides certainty but severely limits the ability for basin management.

The Bittinger Study envisioned a future in which water users could turn to the aquifer in times of need and replenish it in times of plenty. To some extent, we have achieved this vision, in spite of our lack of cooperation, but the fundamental goal expressed the Bittinger Study and inherent in the 1969 Act - "planned utilization of 10 percent to 15 percent of the available groundwater **[\*185]**storage capacity in the alluvium" for the benefit of all water users in the basin - remains elusive. Realizing this broader, reservoir-like use of the alluvial aquifer will require good data, basin wide cooperative management, willingness to explore new methods of effectuating the priority system, and significant commitment to funding for shared infrastructure.

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**End of Document**

1. [1](https://advance.lexis.com/api/document?collection=analytical-materials&id=urn:contentItem:5XBK-6JB1-F7VM-S42T-00000-00&context=1516831)

   ["South Platte Well Crisis, 2002-2010" by P. Andrew Jones, was first published in *The Water Report* #78, August 15, 2010 (see](https://advance.lexis.com/api/document?collection=analytical-materials&id=urn:contentItem:5XBK-6JB1-F7VM-S42T-00000-00&context=1516831) [*www.thewaterreport.com*](http://www.thewaterreport.com)[). This article is an expanded and updated version.](https://advance.lexis.com/api/document?collection=analytical-materials&id=urn:contentItem:5XBK-6JB1-F7VM-S42T-00000-00&context=1516831)

   [↑](#footnote-ref-2)
2. 2

   Partner, Lawrence Jones Custer Grasmick, LLP, Johnstown, ***Colorado***.

   [↑](#footnote-ref-3)
3. 3

   ***Co***-Director, One World One Water Center, Metropolitan State University of Denver.

   [↑](#footnote-ref-4)
4. 4

   *See* Jones, P. Andrew and Cech, Tom, ***COLORADO*** WATER LAW FOR NON-LAWYERS, University Press of ***Colorado*** 2009, Chapter One

   [↑](#footnote-ref-5)
5. 5

   *Id*.

   [↑](#footnote-ref-6)
6. 6

   *Id*.

   [↑](#footnote-ref-7)
7. 7

   *Id*.

   [↑](#footnote-ref-8)
8. 8

   *Id*.

   [↑](#footnote-ref-9)
9. 9

   *Id*.

   [↑](#footnote-ref-10)
10. 10

    "Over-appropriated" means that the amounts granted to existing water rights generally exceed the actual water supply; a "call" by a senior water user is a request to authorities to regulate the ***river*** by shutting off junior water rights owners so that the senior user receives the full amount of their water rights.

    [↑](#footnote-ref-11)
11. 11

    Jones and Cech, Chapter One.

    [↑](#footnote-ref-12)
12. 12

    *Id*.

    [↑](#footnote-ref-13)
13. 13

    *Id*.

    [↑](#footnote-ref-14)
14. 14

    HB 1278 Report, page 1.

    [↑](#footnote-ref-15)
15. 15

    *See*Vranesh, George, ***Colorado*** Water Law, Volume 1, p. 341.

    [↑](#footnote-ref-16)
16. 16

    *Id*.

    [↑](#footnote-ref-17)
17. 17

    *See*  *id*. at 242 (citing 1913 Cal. Stat; 1915 Nev. Stat. 210).

    [↑](#footnote-ref-18)
18. 18

    *Id*.

    [↑](#footnote-ref-19)
19. 19

    *Id*.

    [↑](#footnote-ref-20)
20. 20

    *See* William Blomquist, et al, *Common Waters, Diverging Streams: Linking Institutions to Water, Water Management in Arizona, California, and* ***Colorado****, Resources for the Future*, 2004, pp. 60-62.

    [↑](#footnote-ref-21)
21. 21

    [*33 P. 280 (****Colo.*** *1893)*](https://advance.lexis.com/api/document?collection=cases&id=urn:contentItem:3VW7-5170-0039-401D-00000-00&context=1516831).

    [↑](#footnote-ref-22)
22. 22

    [*68 P. 431 (****Colo.*** *1902)*](https://advance.lexis.com/api/document?collection=cases&id=urn:contentItem:3RRR-27R0-0040-00K2-00000-00&context=1516831).

    [↑](#footnote-ref-23)
23. 23

    ***53 P.334 (Colo. 1898)***.

    [↑](#footnote-ref-24)
24. 24

    [*133 P. 1107 (****Colo.*** *1913)*](https://advance.lexis.com/api/document?collection=cases&id=urn:contentItem:3RRN-0RX0-0040-0363-00000-00&context=1516831)

    [↑](#footnote-ref-25)
25. 25

    *See* e.g., [*Comstock v. Ramsay, 133 P. at 1108*](https://advance.lexis.com/api/document?collection=cases&id=urn:contentItem:3RRN-0RX0-0040-0363-00000-00&context=1516831).

    [↑](#footnote-ref-26)
26. 26

    *Id*.

    [↑](#footnote-ref-27)
27. 27

    ***279 P. 44 (Colo. 1929)***.

    [↑](#footnote-ref-28)
28. 28

    [*228 P.2d 975 (****Colo.*** *1951)*](https://advance.lexis.com/api/document?collection=cases&id=urn:contentItem:3RRM-XMD0-0040-043M-00000-00&context=1516831).

    [↑](#footnote-ref-29)
29. 29

    Vranesh, § 3.5 p. 243.

    [↑](#footnote-ref-30)
30. 30

    "Mining" refers to a situation where the amount of water pumped from an aquifer exceeds water replenishment to the aquifer.

    [↑](#footnote-ref-31)
31. 31

    Vranesh, § 3.5, p. 244-45.

    [↑](#footnote-ref-32)
32. 32

    *See* ***Colo.*** Rev. Stat. § 148-18-1 (2019) et. seq.

    [↑](#footnote-ref-33)
33. 33

    *See* ***Colo.*** Rev. Stat. § 147-19-1 (2019) et. seq.

    [↑](#footnote-ref-34)
34. 34

    ***Colo.*** Rev. Stat. § 147-18-3(7) (2019).

    [↑](#footnote-ref-35)
35. 35

    ***Colo.*** Rev. Stat. § 147-18-3(9) (2019).

    [↑](#footnote-ref-36)
36. 36

    ***Colo.*** Rev. Stat. § 147-18-3(11) (2019).

    [↑](#footnote-ref-37)
37. 37

    Vranesh, § 3.5, p. 247.

    [↑](#footnote-ref-38)
38. 38

    A Survey of ***Colorado*** Water Law, Denver Law Journal, 1970, Volume 47, Number 2, p. 324.

    [↑](#footnote-ref-39)
39. 39

    *Id.*

    [↑](#footnote-ref-40)
40. 40

    [*447 P.2d 986 (****Colo.*** *1968)*](https://advance.lexis.com/api/document?collection=cases&id=urn:contentItem:3RX4-1Y50-003D-90XB-00000-00&context=1516831),

    [↑](#footnote-ref-41)
41. 41

    [*Id. at 994*](https://advance.lexis.com/api/document?collection=cases&id=urn:contentItem:3RX4-1Y50-003D-90XB-00000-00&context=1516831).

    [↑](#footnote-ref-42)
42. 42

    *Id.*

    [↑](#footnote-ref-43)
43. 43

    Vranesh at 260.

    [↑](#footnote-ref-44)
44. 44

    Adapted from Vranesh at 260-261 quoting Morton W. Bittinger & Associates & Wright Water Engineers, Report on Engineering Water Code Studies for the South Platte ***River*** 3, 4 (August 1968).

    [↑](#footnote-ref-45)
45. 45

    *Id*.

    [↑](#footnote-ref-46)
46. 46

    *Id.*

    [↑](#footnote-ref-47)
47. 47

    *See* [***Colo.*** *Rev. Stat. § 37-92-101*](https://advance.lexis.com/api/document?collection=statutes-legislation&id=urn:contentItem:61P5-WY01-DYDC-J3FM-00000-00&context=1516831) (2019) et. seq.

    [↑](#footnote-ref-48)
48. 48

    Vranesh at 265.

    [↑](#footnote-ref-49)
49. 49

    *See* [***Colo.*** *Rev. Stat. § 37-92-103(9)*](https://advance.lexis.com/api/document?collection=statutes-legislation&id=urn:contentItem:689F-SY73-CGX8-03R2-00000-00&context=1516831) (2019); [***Colo.*** *Rev. Stat. § 37-92-302*](https://advance.lexis.com/api/document?collection=statutes-legislation&id=urn:contentItem:61P5-WY01-DYDC-J3G0-00000-00&context=1516831) (2019); [***Colo.*** *Rev. Stat. § 37-92-305*](https://advance.lexis.com/api/document?collection=statutes-legislation&id=urn:contentItem:61P5-WY01-DYDC-J3G3-00000-00&context=1516831) (2019).

    [↑](#footnote-ref-50)
50. 50

    *Id.*

    [↑](#footnote-ref-51)
51. 51

    *Id.*

    [↑](#footnote-ref-52)
52. 52

    *See* [*Empire Lodge Homeowners Ass'n v. Moyer, 39 P.3d 1139, 1150-1152 (****Colo.*** *2001)*](https://advance.lexis.com/api/document?collection=cases&id=urn:contentItem:44PW-3160-0039-4363-00000-00&context=1516831).

    [↑](#footnote-ref-53)
53. 53

    *Id.*

    [↑](#footnote-ref-54)
54. 54

    [*Empire Lodge Homeowners Ass'n v. Moyer, 39 P.3d 1139, 1150-1152 (****Colo.*** *2001)*](https://advance.lexis.com/api/document?collection=cases&id=urn:contentItem:44PW-3160-0039-4363-00000-00&context=1516831).

    [↑](#footnote-ref-55)
55. 55

    *Id.*

    [↑](#footnote-ref-56)
56. 56

    [*69 P.3d 50 (****Colo.*** *2003)*](https://advance.lexis.com/api/document?collection=cases&id=urn:contentItem:48GW-CRR0-0039-44HJ-00000-00&context=1516831).

    [↑](#footnote-ref-57)
57. 57

    See [***Colo.*** *Rev. Stat. § 37-92-308*](https://advance.lexis.com/api/document?collection=statutes-legislation&id=urn:contentItem:61P5-WY01-DYDC-J3G7-00000-00&context=1516831) (2019).

    [↑](#footnote-ref-58)
58. 58

    *See* Findings of Fact, Conclusions of Law and Decree of the Water Court, Case No. 02CW335, Division One Water Court, June 3, 2005.

    [↑](#footnote-ref-59)
59. 59

    Glover, Robert E., 1977, Transient Ground Water Hydraulics, Water Resources Publications.

    [↑](#footnote-ref-60)
60. 60

    *See* Findings of Fact, Conclusions of Law and Decreee of the Water Court, Case No. 03CW99, Division One Water Court, May 14, 2008.

    [↑](#footnote-ref-61)
61. 61

    [*Well Augmentation Subdistrict of Central* ***Colorado*** *Water Conservancy Dist. v. City of Aurora, 221 P.3d 399 (****Colo.*** *2009)*](https://advance.lexis.com/api/document?collection=cases&id=urn:contentItem:7X58-H3W0-YB0K-Y019-00000-00&context=1516831).

    [↑](#footnote-ref-62)
62. 62

    H.B. 12-1278.

    [↑](#footnote-ref-63)
63. 63

    *Id*.

    [↑](#footnote-ref-64)
64. 64

    1278 Study, P. 83.

    [↑](#footnote-ref-65)
65. 65

    *Id*.

    [↑](#footnote-ref-66)
66. 66

    *Id*.

    [↑](#footnote-ref-67)
67. 67

    *Id* at 3.

    [↑](#footnote-ref-68)
68. 68

    *Id*.

    [↑](#footnote-ref-69)
69. 69

    *Id*. at 3-4.

    [↑](#footnote-ref-70)
70. 70

    *Id*. at 3.

    [↑](#footnote-ref-71)
71. 71

    *Id.* at 8.

    [↑](#footnote-ref-72)
72. 72

    1278 Study.

    [↑](#footnote-ref-73)
73. 73

    *Id.*

    [↑](#footnote-ref-74)
74. 74

    *Id.* at 7.

    [↑](#footnote-ref-75)
75. 75

    *Id.* at 8.

    [↑](#footnote-ref-76)
76. 76

    *Id.* at 13-14.

    [↑](#footnote-ref-77)
77. 77

    *See* Thorvaldson, Jennifer and Pritchett, James, Some Economic Effects of Changing Augmentation Rules in ***Colorado***'s Lower South Platte ***River*** Basin: Producer Survey and Regional Economic Impact Analysis, ***Colorado*** Water Resources Research Institute, July 2007.

    [↑](#footnote-ref-78)
78. 78

    *Id*.

    [↑](#footnote-ref-79)