

DENVER BASIN AQUIFERS
MORE THAN YOU PROBABLY WANT TO KNOW!

Henry D. "Hank" Worley

hank.worley@pcisys.net

September 30, 2019

I. What and where are the Denver Basin aquifers?

1. Four sandstone aquifers (in some locations) in descending from surface downward as follows: Dawson, Denver, Arapahoe, Laramie-Fox Hills. Each of the aquifers is separated by impervious rock layers such as shale. In some parts of northern Douglas County, there is an Upper Dawson aquifer and a Lower Dawson aquifer, but not in southern Douglas County, El Paso County, or Elbert County.
2. Non-renewable. The water in all of the Denver Basin aquifers is non-renewable, meaning that the water pumped out is not replaced by new water intruding into the aquifers – at least, not in a time scale that is useful for humans. For all practical purposes, once the water is pumped out of the aquifer, it's gone forever – at least from that aquifer. Pumping water from non-renewable sources is called "water mining."
3. Location: The LFH extends from Greeley on the north to Colorado Springs on the south, and as far east as Limon. Due to erosion, the upper aquifers are smaller in size. See Figure 1. At the intersection of Shoup and Black Forest Roads, all four aquifers exist.
4. Due to erosion, all of the Denver Basin aquifer "outcrop" somewhere. At these outcrop locations, water seeps out of them. Some of that water makes its way into nearby streams, which provide the water for surface water rights which date back as far as the 1860's.

II. Who is entitled to use Denver Basin water?

1. For the most part, the owner of the overlying land, or someone acting with the owner's permission, are the only ones entitled to obtain a well permit for, a decree (or Determination of Water Right, in designated ground water basins) for, and to pump water from the Denver Basin aquifers. A water right has certain legal characteristics that the landowner doesn't possess simply by virtue of owning the overlying land.

III. Characteristics of a water right and how to obtain one. A water right is a vested property right, similar but not identical to one's ownership interest in real property. If one owns the overlying land, and the right to appropriate the Denver basin water underlying that land (which would not be the case if it was reserved or conveyed by the prior surface owner, or conveyed by the current surface owner), then the owner can obtain a water right by one of three methods:

1. Constructing a well into a Denver Basin aquifer on property s/he owns pursuant to a valid well permit;
2. By obtaining a decree adjudicating the water right from the appropriate water court (in Greeley for the South Platte basin and in Pueblo for the Arkansas River basin), or
3. Only in the Designated Ground Water Basin, by obtaining a Determination of Water Right by the Colorado Ground Water Commission. The adjudications and determinations are functionally equivalent, though there are differences in the way they are obtained.
 - A. Prior July 6, 1973, a person could "appropriate" ground water underlying a property other than the land the person owns. If the person drilled a well prior to

that time, the State Engineer determined the radius of a circle around the well, based on the specific yield of the aquifer and the depths of the saturated thickness of the aquifer. If the circle overlapped onto a different person's property, as sometimes occurred, then the owner of the well also owned the right to all of the water within the circle, including on the other person's land. This is not common, but it happened to me once in my practice.

4. Amount: The amount of water available to be adjudicated underlying property is determined by multiplying the acreage times the saturated thickness of the aquifer (the presumptive thickness at any location can be obtained using the State Engineer's database under "Aquifer Determination Tool" times the specific yield of the aquifer (presumptively 0.2 for Dawson, 0.17 for Denver and Arapahoe, and 0.15 for Laramie-Fox Hills). For example, the amount of water which can be adjudicated from the Dawson aquifer under a 10 acre lot, with a saturated thickness of 300 feet, would be $10 \times 300 \times 0.2 = 600$ acre feet. Under the state's one percent annual limitation, the annual amount cannot exceed 6.0 acre feet, except when used to "catch up" after periods when annual pumping was less than the allowed amount. Thus, if in year one after getting a decree you didn't pump any water, in year two you could pump 12 acre feet. Pumping less than the full annual amount is called "water banking."
5. Cost and timing of adjudication. Without an accompanying plan for augmentation, the cost of an adjudication will probably be between \$2,000 and \$3,000. If a plan for augmentation is included, the cost will typically be between \$5,000 and \$6,000 unless it is opposed by someone. If it is opposed by the usual suspects (occasionally, Colorado Springs Utilities or Kettle Creek, LLC for plans for augmentation which are located close to Pine Creek High School), that will not diminish the likelihood of success, but will increase the time and cost. In an ideal situation where there are no statements of opposition the adjudication can be completed in as little as six month, though more time is more common. If statements of opposition are involved, it typically (but not always) will still take less than a year.
6. Benefits of adjudication. Creation of a vested property right. Thus, if the law changed to provide a means of appropriation other than ownership of the overlying land, vested property rights will be protected but a landowner who hasn't adjudicated his/her water rights will be subject to the new law. In addition, vested property rights can be condemned by a public entity only upon the payment of fair compensation.
7. Detriments of adjudication. Other than the cost involved, I can think of only one. If a landowner has 35 acres or more, the landowner can obtain an exempt well permit for a well in a not nontributary aquifer without a plan for augmentation. However, if the adjudication is of all of the water in the NNT aquifer, the State will not approve an exempt well permit for that property. However, this isn't actually a downside of adjudication; if enough water is exempted from the adjudication, the State Engineer will issue a permit for an exempt well. Thus, if you own 40 acres and the Dawson aquifer underlying the property is 300 feet deep, that equates to $40 \times 300 \times 0.2 = 2400$ acre feet, or 24 acre feet annually. By deleting 3.0 acre feet annually from the application, and obtaining a decree which allows annual pumping of only 21 acre feet annually, the State Engineer can approve an exempt well permit for 3.0 acre feet annually.

IV. Conveyancing of Denver Basin water rights.

1. All water rights, not just Denver Basin water rights, must be conveyed using deeds. As with real property, water rights may be owned by individuals, by companies, and by multiple persons as either joint tenants or tenants in common. Water rights can be conveyed in the same deed as one which conveys real property. Though title companies can and often do prepare deeds for use in real estate closings, they are not allowed to draft deeds for conveyances of water rights. A water rights attorney should be employed to draft water deeds; I have seen experienced real property attorneys screw up water deeds.
2. Water rights can also be conveyed through the “appurtenances” clauses typically found in deeds to real property, even where they are not specifically enumerated, e.g., “Blackacre with all its appurtenances” can, in appropriate circumstances, include the conveyance of water rights. An “appurtenance” is something which is commonly thought to “go with” the real property. For water deeds for use in new subdivisions, I used to indicate that the water rights conveyed to the purchaser of the lot would henceforth be considered “appurtenances” to that lot, so that they would pass to new purchasers as part of the real property deed, even if they weren’t specifically mentioned. So far, I have been unaware of any dispute about the validity of such provisions.
3. Generally, other than the example above, I would not rely on an appurtenance clause because it is frequently uncertain whether a water right is or is not appurtenant to land. 4. There are four different kinds of deeds, each of which contain different warranties regarding the title of the property being conveyed. They are general warranty deed, special warranty deed, bargain and sale deed, and quitclaim deed. A general warranty deed offers the most protection to the buyer and the most risk to the seller, followed by a special warranty deed and then a bargain and sale deed. At the end of the list is quitclaim deeds, which offer very little protection to buyers and maximum protection to sellers.

V. “Nontributary” vs. “not nontributary.” Unlike aquifers comprised of sand and gravel as you would find along stream such as Fountain Creek, the Arkansas River and the South Platte River, the “tight” nature of the sandstone comprising the Denver Basin aquifers means that water passes through them far more slowly than occurs in shallow alluvial (sand and gravel) aquifers along streams. In 1985, the legislature defined these terms generally as follows:

1. Nontributary. In nontributary aquifers, there is virtually no connection between such aquifers and the streams on the ground’s surface. Thus, pumping from such aquifers has virtually no impact on the flow of such streams, unlike well constructed in alluvial aquifers. If you own the right to water in a nontributary aquifer, and apply for a well permit, it should be issued so long as the claimed uses are not speculative. For example, a well permit which states that the water will be used for cooling purposes in a nuclear power plant probably would not be approved. Such well permits should be issued even if no water right has been adjudicated.
2. Not-nontributary. This unfortunate nomenclature resulted from a statement in a statute which described the water from such aquifers as being “water which is not nontributary,” and the description stuck. There is a connection between not nontributary aquifers and the surface streams, so that over lengthy periods of time, pumping “not nontributary” aquifer will adversely impact the flow of surface streams, thus diminishing the amount of water to downstream owners of surface water rights and alluvial (shallow) ground water rights. In order to pump not nontributary water from a Denver Basin aquifer, one must usually devise a methodology for replacing the water to the stream that would have occurred if not for the well pumping. This is called a plan for augmentation outside of designated

ground water basins, and must be approved by the water court. Inside designated basins, this is called a replacement plan and is approved by the Colorado Ground Water Commission. Not nontributary water comes in two flavors: “four percent,” and “actual depletion.”

- A. “Four percent water.” Outside of designated ground water basins, not nontributary “four percent” water must be the subject of a plan for augmentation.. The effect of pumping any not nontributary water is extremely delayed. Pumping an acre foot in year one might not have any effect on any stream for a decade or more, and then, the diminution of stream flow of that one acre foot that would have seeped out of the aquifer where it “daylights” may spread out over many decades. For four percent water, one must replace to the affected stream system 4% of the water pumped annually, and replace the (computer modeled) actual depletions after pumping ceases. Inside designated ground water basins, there is no requirement to obtain approval of a replacement water in order to pump four percent water.
 - B. “Actual depletion” water. Also require approval of a plan for augmentation which replaces actual (computer modeled) depletions annually and those “lagged” depletions which occur for centuries after pumping ceases. Replacement plans are required for “actual depletion” water inside designated basins, but importantly, there is no requirement to replace depletions which continue to occur after pumping ceases. That is not the case outside of designated basins, and that can be a very important difference.
3. Not-nontributary well pumping. Unless one has a permit for an “exempt” well outside of designated groundwater basins, or a permit for an analogous “small capacity well” inside a designated ground water basins, one must obtain approval of a plan which will replace the depletions to the nearby streams which are caused by pumping water from not nontributary aquifers. These plans are called “augmentation plans” outside of designated groundwater basins, and are called “replacement plans” inside of designated groundwater basins. Augmentation plans must be approved by a water court, either the South Platte water court in Greeley or the Arkansas River water court in Pueblo. Replacement plans are approved by the Colorado Groundwater Commission. The requirements are generally similar, though there are a couple of important differences, like no post-pumping replacement requirement within designated ground water basins.
 4. Exempt wells and small capacity wells.
 - A. There are two types of exempt wells, which as previously noted are only for wells on property located outside of designated basins. Exempt wells never require augmentation plans or replacement plans.
 - B. One kind of exempt well allows pumping from a well only for ordinary indoor household purposes if the property on which it is located is less than 35 acres and the property boundaries were created prior to June 6, 1973.
 - C. Another kind of exempt well is for properties which are 35 acre or larger. They can be approved for up to three homes, for irrigation of up to one acre of land, and for non-commercial livestock watering. In recent years, the State Engineer’s office has somewhat expanded the use of water from such wells to allow limited commercial irrigation water from exempt wells. Note that there is no statutory or regulatory limit on the amount of water that can be pumped annually.

- D. In designated ground water basins, small capacity well permits on 35 acre or larger land parcels can be obtained for the same uses as for the analogous exempt well, except that small capacity wells may not pump more than 3.0 acre feet annually. C. If you wish to have a well in a not nontributary aquifer but do not meet the above requirements for exempt or small capacity wells, you must first obtain approval of a plan for augmentation outside of designated basins, or a replacement plan inside designated groundwater basins. Oh, yeah, except for “not nontributary – four percent wells within designated basins. I think. VI. Plans for augmentation/replacement plans.

VI. Plans for augmentation/replacement plans.

1. Why a plan for augmentation to pump water from a not nontributary aquifer if there is a nontributary aquifer just below it? The answer is expense. A plan for augmentation may cost \$6,000 and a 500 foot well may cost around \$15,000. A well into a deeper nontributary aquifer might cost \$45,000 or even \$60,000. In addition, in a subdivision, only one plan for augmentation is needed for however many wells are planned, so that expense, unlike the expense of well construction, is not repeated.
2. How do plans for augmentation usually function?
 - A. Increasing levels of depletions. When one pumps a well in a not nontributary aquifer, the stream depletions caused by pumping that well are very delayed. So if you pump one acre foot of water annually for 300 years, by the 300th year, the amount of stream depletions, as established by computer models created by the State Engineer, might only be 0.2 or 0.5 acre foot annually, depending on location. If pumping is terminated in the 300th year, the stream depletions caused by the prior years of pumping will slowly decrease on an annual basis, but will continue for centuries.
 - B. Replacement of depletions during pumping. The water that is pumped doesn't magically disappear forever. A significant amount of it will make its way to the same stream that it would have reached it if had not been pumped, but had eventually exited the aquifer where it outcrops. Those “return flows” can be used to replace depletions during the pumping period. Septic system return flows are one example of return flows. Landscape irrigation return flows can be used in addition, but I chose to craft augmentation plans so that the amount of septic system return flows was always adequate to replace the depletions during pumping. This results in less record keeping for the owner of the augmented well or wells.
 - C. Replacement of post-pumping depletions.
 - i. Amount. The obligation to replace the depletions that continue to occur after cessation of pumping. The amount is determined by taking the total amount of not nontributary water that was pumped during the pumping period, and subtracting from that the amount of depletions which were replaced during the pumping period. Example: one pumps 200 acre feet of NNT water during the pumping period. Using information supplied by the State Engineer, one can determine that the amount of depletions which are replaced during the pumping period is 12 acre feet. (Total

return flows will be much higher during the pumping period, but the amount necessary to replace depletions is only 12 acre feet.) Thus, the amount of water which must be replaced after cessation of pumping is 300 acre feet minus 13 acre feet, or 187 acre feet. (Actually, $187 / 0.98$, or 190.8 – don't ask!).

- ii. Method. The most common method of providing for replacement of post pumping depletions is to provide in the decree that adequate water from a deeper, NT aquifer will be reserved for that purpose. When pumping the NNT aquifer permanently ceases, the then-owner or owners of the NNT well(s) will be obliged to construct a very expensive well in the NT aquifer and pump very small amounts of water into a leach field or something similar for eons to come.
- iii. Huh? Really? Yes. Whether pushing the cost of the deep wells onto your great-great grandchildren is ethical is something that I have pondered, but haven't come to a conclusion. 300 years is a long time from now, and we can't anticipate what will happen in the interim. If I don't sleep at night, it's not because I obtained approval of around 100 plans for augmentation which include this requirement.

D. When crafting a plan for augmentation, I had to make sure: (a) that the amount of water to be pumped was adequate for a 300 year supply; (b) that the amount of return flows during the 300 year pumping period were adequate to replace depletions in the 300th year; and (c) that there was sufficient nontributary water to replace post-pumping depletions. Someone smarter than me may have devised a computer program to figure these things out, but I did it using a calculator and pretty simple math – but one needs still needs to know how to do it!

III. More on well permits – some redundant (sorry, but it was easier to leave it all in than to figure out what was redundant).

1. Definition of a “subdivision:” For our purposes, a subdivision can be described as a division of land into separate parcels, any one of which resulting parcels is smaller than 35 acres.
2. “Exempt wells” outside of Designated Basins. For lots which are smaller than 35 acres and were subdivided prior to June 6, 1973, an owner of such a lot can today apply for and obtain a well permit which allows indoor uses only. For land parcels which are 35 acres or larger, one may obtain a well permit for an “exempt well” which allows water usage for the indoor cooking and sanitary uses inside up to three dwellings, the irrigation of up to one acre of land for non-commercial uses, and for non-commercial livestock – chickens, horses, llamas, cows, etc. There is no statutory limitation on the amount of livestock one may maintain, but it was intended to be for the reasonable uses of the family(ies) living on that parcel.
3. “Small capacity wells” inside designated groundwater basins. Very similar to “exempt wells” but located inside a designated basin. Maximum annual withdrawals of 3.0 acre feet.
4. Augmented wells. These can be permitted for any beneficial use, consisted with the terms of the decree or Determination of Water Right. However, I believe that Upper Black Squirrel Creek Designated Ground Basin rules limit annual pumping for home sites to 0.5 acre foot annually.

5. Non-exempt or large capacity wells. In terms of Denver Basin wells, the terms apply to those wells pumped from a nontributary aquifer. The State allows pumping of one percent of the amount decreed per year, but in an El Paso County subdivision, the County requires that no more than one-third of one percent be pumped annually, to provide a 300 year water supply for the subdivision. Notwithstanding the nomenclature, a large capacity well may in fact be limited to less annual pumping than a small capacity well.
6. A well permit application costs \$100. A well permit is good for one year, and may be extended an additional year. If a well is not constructed within that period, a new permit application, and a new fee, will be required.

VII *Issues of injury. (Added 10/02/19)*

1. *Many people are concerned that the construction of wells near their own wells may result in a lowering of the water table in their well. That is a legitimate concern, but by design (i.e., due to the fact that these aquifers are not being replenished) if pumping occurs over long periods of time, the water table in the aquifer will be lowered, and that is not an -injury that one can base a lawsuit on.. C.R.S. 37-90-137(4)(c) provides: “**Material injury to vested nontributary groundwater rights shall not be deemed to result from the reduction of either hydrostatic pressure or water level in the aquifer.**” In other words, while one can generally sue for a material injury to one’s water rights, by definition a reduction in the water table due to the lawful pumping of a permitted well does not constitute “material injury.” Of course, if a person is pumping water illegally, due to failure to comply with the terms of the permit (e.g., pumping more than the permitted amount) or due to pumping a well which is either unpermitted or was for which the permit is invalid for some reason, one could seek relief from the Division of Water Resources or the water court on that basis.*
2. *To prevent undue influence by pumping one well on the water level in another well, another part of C.R.S. 37-90-137 provides spacing requirements. It is beyond the scope of this paper to go through them in detail. Generally, though, a large volume well may not be constructed within 600 feet of another well in the same aquifer.*
3. *The best way to prevent a decline in the water table in one’s own well is to construct your well so it goes to the bottom of the aquifer. That way, at a minimum, no other nearby well in the same aquifer will be deeper than yours so it can’t suck the water from deeper than the bottom of your well. Sometimes, though, cost considerations make this option impractical. A 1,000 foot deep well will typically cost considerably more than twice as much as a 500 foot deep well for reasons described below.*
4. *And this advice obviously doesn’t help anyone who already owns a fairly shallow well.*
5. *Usually, if your well wasn’t constructed to the bottom of the aquifer, and you begin to experience problems like the well is pumping some sand, it is possible to be issued a permit for a replacement well in the same aquifer. Obviously, if the*

problem is because the water table has been lowered, the new well needs to be drilled deeper than the old well.

VIII How deep to drill a well.

1. SEEK INPUT FROM THE WELL DRILLER!
2. Generally, a well no deeper than approximately 600 feet can cost far less per foot drilled because plastic can be used for the casing. Steel casing, which is far more expensive than plastic, must be used for the entire well if the well is deeper than approximately 600 feet. Big cost difference!
3. If you are constructing a well which passes through one aquifer to get to the one you want to withdraw water from, the entire well must be cased with steel even if it is less than 600 feet deep.
4. In reference to a later statement about protecting your water supply, other things being equal, a deeper well is better than a shallower well. The proper depth requires one's own cost/benefit analysis.

IX Miscellaneous.

1. El Paso County's 300-year rule requires developers to show sufficient water for a subdivision for 300 years. What criteria is used make that determination? Basically, the State Engineer's office examines the developer's proposed water supply, including the water rights decree and, if applicable, the plan for augmentation or replacement plan, for accuracy, and the proposed water demands of the subdivision. If the water supply is accurate, and is sufficient to meet the anticipated 300 year water demands, the State will issue a finding of sufficiency which is sent to the county.
2. About a decade ago, realtors were charged with completing and filing "Change of Ownership" forms when ownership of a well changed hands. This was intended to give the Division of Water Resources better track of who owns what, and also allows them to contact the proper owner in the event of a problem with the well (such as it being used to pump more water than it is permitted for). I do not believe that there is any penalty associated with failing to do so, and that the oversight can be corrected at any time without penalty.
3. Should Black Forest establish a well monitoring program? This is beyond my ability as an attorney to answer.
4. Why are there limits on the amount of rainwater we can collect? (Especially now that Colorado has just allowed rural well owners to collect all the rain from their home's roof.) Though leakage from the Denver Basin aquifers at points of outcrop represent a small (very small) fraction of the water in the streams of the State, the vast majority of stream flow in the State comes from precipitation. The State Engineer is afraid that allowing unlimited "harvesting" of rainfall on one's property may result in diminution of stream flow to the injury of the very senior water rights of surface water users. I have spoken to engineers who believe that the amount of water which could be so captures is infinitesimally small and would not have a material impact on the flow of streams, but that is the State's rationale.

5. When a property owner requests and receives annexation, does he have to surrender water rights to the city? That is up to the municipality. I believe that the answer is generally “yes,” though.

RESOURCES:

Note: Though I practiced water law for over 30 years, and Denver Basin groundwater issues were a major part of my focus, I have retired and relinquished my license to practice law. Nothing herein is intended to constitute legal advice.

Disclaimer: The outline regarding Denver Basin aquifers and well permitting issues by retired attorney Henry Worley represents his understanding of such issues as of the date of his retirement. While this provides an overview of the Denver Basin aquifers and issues related to those aquifers, it is not intended to provide legal advice regarding any particular situation. Anyone with significant water rights issues is strongly urged to contact an attorney who is competent in such matters.

Attorneys. An individual can probably muddle through an adjudication without outside help, but I don't think it would be feasible for most individuals to attempt to obtain approval of a plan for augmentation or replacement plan. Attorneys should also be used for the drafting of deeds and of covenants, if required for your situation. If you need an water rights attorney, I can suggest five firms/names, in no particular order:

- John Cyran at Confluence Water Law, LLC in Denver, 303.746.3802;
- Gary Crosby (non-attorney) at Petrock & Fendel P.C. in Denver, 303.543.0702;
- Chris Cummins or David Shohet at Monson, Cummins & Shohet, LLC in Colorado Springs, 719.471.1212;
- Julianne Woldridge at MacDougall & Woldridge, P.C., in Colorado Springs, 719.520.9288; Stuart Corbridge at Vranesh & Raisch, LLP in Boulder, 303.443.6151

Groundwater geologist. For designated ground water basins such as Black Squirrel Creek, a groundwater geologist's expertise can be very helpful. Julia Murphy of Groundwater Investigations lives in the Black Forest; her phone number is 719.495.0661. Because Determinations of Water Rights are conducted by the Colorado Ground Water Commission rather than a court, an attorney is not required in order to represent an applicant.

Employees of the Division of Water Resources. Though occasionally I disagreed with employees of the Division of Water Resources, for the most part I found them to be knowledgeable and very helpful; true public servants. Though the following list is not exhaustive, it identifies some of the people who were helpful to me in the past:

Water Commissioner in Colorado Springs: Doug Hollister: 719.227.5291

Water Division 2 in Pueblo: Rachel Zancanella: 719.542.3368

State Engineer's Office in Denver: Caleb Foy: 303:866.3581

Well drillers. I represented Timothy Kunau of Kunau Drilling in the past, and he referred work to me when he could. As a result, I am partial to him, though there are others who presumably are also competent.

Kunau Drilling's phone number is 719.683.3720. P.S. I am aware that there is a negative review of Kunau Drilling on the internet. I do not know the circumstances that led to that negative review, but Kunau Drilling has probably completed hundreds of wells without complaint.