waterrights DNR <waterrights@utah.gov>

Cedar City Water Recycle/Recharge Opportunity

1 message

Peter Grimshaw <pagrims@gmail.com> Mon, Jan 30, 2017 at 11:24 AM
To: waterrights@utah.gov

Attached are two documents which discuss how Cedar City can help solve a a healthy portion of the Cedar Valley water crisis. Document #1 is a short summary. # 2 is the full write-up.

Peter Grimshaw

2 attachments

 # 1 Cedar City's Big Water Opportunity01222017.docx
17K

#2 Cedar City Has an Opportunity to Solve a Big Chunk of Its Water Problem 12282016.docx
46K

1 - Cedar City's Big Fresh Water Opportunity (Summary)

January 25, 2017

By Peter Grimshaw

This is a proposal that, if adopted, could cut Cedar City's need for finding and importing culinary water from new sources by about 50 percent and save the city and conservation district many millions of dollars.

The single best and least expensive additional source of fresh, potable water in Cedar Valley is not fresh, new water. It is the 2.6 million gallons of sewer effluent (water) that is processed through the Cedar City wastewater treatment plant northwest of Enoch on an average day. Through additional treatment, this water can become pure—more pure—and better tasting than the water Cedar City presently delivers to its residential customers. This is not an idle claim. Other cities have been doing it for years.

We can recycle our water and drastically reduce our need for "new" water.

We need to change our thinking about sewer water. Why? Because we have so much of it, we can do so much with it and, by reusing it, we can have an extremely cost-effective way to secure our future water needs. What we need is a little ingenuity and creative thinking. What we need is to change the way we think about water.

How much wastewater does Cedar City discard each year?

Imagine that a large, rectangular water tank has been built in the SUU football stadium. It covers the entire playing field from goal line to goal line and from sideline to sideline. It is about as tall as Square Mountain (well over a half mile high).

Fill this tank to the top and you have approximately the amount of wastewater that Cedar City discards each and every year. In 2016, it was about 3,000 acre feet (or over 950 million gallons). That is about 55 percent of the culinary water Cedar annually pumps from the aquifer.

So, how could Cedar City reuse its water? It could add additional technology (microfiltration, reverse osmosis, ultraviolet disinfection) to its wastewater treatment facility to further purify the sewer water. It could then use the purified water to

recharge the underground aquifer from which it could be re-pumped and reused over and over and over and....

That is the opportunity. Using IPR (Indirect Potable Recharge) techniques, we can stabilize our water future with a very reasonable investment—a fraction of the cost of bringing west desert water into the valley. (And stop saying, "yuck.")

How Big is the Opportunity?

The 2.6 million gallons per day (2,915 acre feet per year) is equal to about 55 percent of the water Cedar City pumps annually (5,347 acre feet) to satisfy the needs of its culinary water customers.

We could be cleaning our water and replenishing the aquifer with fully 55 percent of the culinary water we pump annually. It could then be re-pumped and repeated used, basically, forever. Today we just dump it on the ground many miles from where we pump it and in an area where there is no reported problem with the water table (and where it wouldn't matter much if there was).

Cities in the U.S. and elsewhere, including Big Spring, Texas and Wichita Falls, Texas are recycling their wastewater successfully. *(For more information, potential contacts and some interesting reading on direct potable reuse (DPR) and indirect potable reuse (IPR) of water [what I recommend for Cedar City], Google "big spring texas water reuse" or "wichita falls texas water reuse".)*

The Yuck Factor has been overcome elsewhere and can be here.

Cedar City has an exceptional opportunity to recharge the aquifer directly through dried springs and wetlands located in the #2 critical area of the aquifer (Enoch) at a point only about 4 miles from the waste treatment plant and within 2 miles of Cedar City's north water mainline along I-15. Up to 20 million gallons of Coal Creek water were used this past Fall in a small, but highly successful recharge test in this area. Where water came up, it can go down. In huge quantities and very rapidly.

A Superior Alternative to Trading or Bringing in Water from Outside Sources

We should recycle our sewer water rather than spend hundreds of millions of dollars trying to find, develop and pump-in water from other sources many miles away. Those sources should be reserved for later. Only when we maximize the use of the water that we have should we look elsewhere.

The idea of trading effluent for Quichapa area water rights is marginal at best. It would waste over 40 percent of the available water and take it entirely out of the city's control.

Document # 2 gives greater detail and more supporting data.

#2 - Cedar City Has a Unique Opportunity to Solve a Big Chunk of Its Present and Future Water Problems

By

Peter Grimshaw

January 25, 2017

We need to change the way we think about water in Cedar Valley. We need to think innovatively and come up with creative and practical ideas that work, but that do not carry excessive costs.

To date, most efforts by local water managers have been to find and import fresh water from new sources. Used water has been ignored. Yet high-quality used water is available to us in huge quantities and can be purified and recycled repeatedly at a fraction of the cost of bringing in fresh water from long distances. We're talking about wastewater...sewer effluent.

By purifying and recycling its wastewater, Cedar City could decrease its annual demand for new culinary water by 50 percent or more virtually forever.

Before you say, "Yuck," consider that other cities are doing this and are delivering to homes purified, recycled wastewater that is more pure and tastes better than the new water they mix it with in their culinary water systems.

Background

We have had an almost insatiable appetite for fresh, cheap, new water, which we use in enormous amounts here in Cedar Valley. For example, in Cedar City the average person uses 222 gallons of water per day (yearly average). This is an incredible amount of water, especially in an arid environment. It is over twice the national average (estimated to be 80-100 gallons per day per person). You can argue that we need more because it doesn't rain much here. And I can argue that we should us less because it doesn't rain much here, and we have very limited water resources. More conservation is in order.

But conservation by city folk is a small part of the opportunity. The agricultural interests in this valley use the vast majority of our water. They need to find ways to conserve water rather than to expand its use. This is made difficult by government laws and statutes that incent landowners to use water on their land or see its value plummet as their taxes leap.

That said, this paper is about an opportunity for Cedar City to invest in a concept that could provide a solid foundation for its water supply for many years to come.

Our Water Problems

The state engineer says water users are annually pumping 33 percent more water from the Cedar Valley underground aquifer than can be sustained. We need to fix the problem or they will fix it for us. (*The irony is rich. We cuss our national elected officials for running up the national debt. And rightly so. But, percentage-wise, the Cedar Valley underground aquifer annual water-pumping deficit makes the national debt run-up rate look puny indeed!)*

The water table is dropping, the east valley and bench springs and the sub-irrigated meadows were continually wet for thousands of years, but have been dry since the 1980's. Ground subsidence is in evidence as the aquifer slowly collapses.

To date, only one (unoccupied) subdivision has had fissures (due to the aquifer problem) and has needed to be condemned. Maybe the next subsidence problem will involve homes and people—not just building lots and improvements. The consequences of a sinking water table go far beyond not having enough water in the future. Our objective should not just be to stabilize the water level in the aquifer, but to raise it, so that chance of further ground subsidence is reduced and we have enough water to provide for future growth and prosperity.

These problems can be approached in a number of ways:

- Use less water
- Find more water
- Recharge the aquifer
- Use our water more efficiently
- Recycle our water

Changing the Way We Think About Our Water

Let's take a look at water from a different perspective. Consider this: Water is not something to use once and then discard. We can retain much of our water and reuse it over and over again. We need to recycle our water rather than use and discard it (as we do now).

The Nature of Water

Water is a wonderful thing. It does not wear out. We use it to clean all kinds of things so that we can reuse them. But we rarely think about actually cleaning the water itself so that we can reuse it repeatedly. We need to change the way we think about dirty water. Dirty water is really just pure water that is temporarily carrying contaminants. It can be purified and reused.

Our Big Opportunity

The single greatest additional source of fresh water in Cedar Valley is the 2.6 million gallons of sewer water that is processed through the Cedar City Wastewater Treatment Facility northwest of Enoch on an average day. Through additional treatment, this water can be cleaned to become pure—more pure and better tasting—than the water Cedar City presently delivers to its residential customers. This is not an idle claim. Other cities are doing it.

It can then be used to recharge the underground aquifer.

For decades, our sewer wastewater has been partially decontaminated and released onto the desert surface. Some of it finds its way into the aquifer and a great deal of it simply evaporates. There is no plan to ever process and reuse this water within the city's culinary water system. Why not? The Yuck Factor? Maybe. Perhaps it is simply because no one thought of it.

We need to change our thinking about sewer water. Why? Because we have so much of it, we can do so much with it and, by reusing it we can, in an extremely cost-effective way, we can secure much of our future water need.

How Would We Do This?

Cedar City would add additional technology to the wastewater treatment facility that would further purify the sewer water (microfiltration, reverse osmosis, ultraviolet disinfection). It would pump the purified water about 4 miles to a natural recharge point in northeast Enoch where it would be released into the underground aquifer from which it could be re-pumped and reused. This cycle could then be repeated over and over and over and....

That is the opportunity. Using IPR, Indirect Potable Recharge, techniques, we can stabilize our water future.

How much wastewater does Cedar City discard each year?

Imagine that a large, rectangular water tank has been built in the SUU football stadium. It covers the entire playing field from goal line to goal line and from sideline to sideline. It is about as tall as Square Mountain (well over a half mile high).

Fill this tank to the top and you have approximately the amount of wastewater that Cedar City discards each and every year. In 2016 it was about 3,000 acre feet (or over 950 million gallons). That is about 55 percent of the culinary water Cedar annually pumps from the aquifer.

A Superior Alternative to Bringing in Water from Outside Sources

We need to recycle our sewer water instead of spending hundreds of millions of dollars trying to find, develop and pump-in water from other sources many miles away. Those sources should be reserved for later. Only when we have maximized the use of the water that we have access to right here in the valley should we look elsewhere.

How Big is the Opportunity?

The 2.6 million gallons of treated effluent per day (2,915 acre feet per year) is equal to about 55 percent of the water Cedar City pumps annually (5,347 acre feet) to satisfy the needs of its culinary water customers. *And the percentage should stay about the same as our water use grows.*

We could be cleaning and recharging the aquifer with fully 55 percent of the culinary water we pump annually and keep doing it, basically, forever. Today we just dump it on the ground many miles from where we pump it and in an area where there is no reported problem with the water table (and where it wouldn't matter much if there was).

Projections of how much new water would need to be found could virtually be cut in half because we would be reusing over half continually.

A number of cities in the U.S. and elsewhere, including Big Spring, Texas and Wichita Falls, Texas are recycling their wastewater successfully. *(For more information, potential contacts and some very interesting reading on direct potable reuse (DPR) and indirect potable reuse (IPR) of water [what I recommend for Cedar City], Google "big spring texas water reuse" or "wichita falls texas water reuse.")*

Some Fundamental Issues to Think About

1. Should we invest the money to further purify our sewer water so that it can be used to recharge the aquifer?
2. Should we invest more money to transfer the water to a place where aquifer recharge can occur?
3. How much money is involved?
4. Can the "Yuck Factor" be overcome?
5. Are these the best options for spending our water development and conservation dollars?
6. Is purifying and recharging the aquifer the best use of our wastewater or are other options better?

Let's look at them individually.

1. Should we invest the money to further purify our sewer water so that it can be used to recharge the aquifer?

My answer is, "Yes." Cedar City needs to thoroughly investigate doing this as soon as possible for a number of reasons.

- The technology is in place. Other cities do it to solve their water shortage needs. It is working elsewhere and can work here.
- This is not an expensive solution, and, in the long run, investing now will prove to be very cheap indeed.
- Today, we are in trouble water-wise in this valley and we have been for years. We use far more water than our ecosystem will support under present water management policies and practices.
- Cedar City is the biggest pumper in the specific areas where the aquifer is in the most serious trouble (the Enoch and Quichapa areas). The city has the greatest responsibility to help fix the problem since so much of the aquifer depredation in these critical areas can be attributed to the city's pumping.

- The vast majority of our water system infrastructure is in these critical areas as well. Bringing more water to our city through existing infrastructure will be very beneficial practically and financially.
- Water is reusable and we need to reuse it. We can ill afford to discard so much reusable water, at our present wasteful rate, in a valley that is starved for water resources.
- Water is a finite resource in this valley and we need to treat it as such. Everyone depends upon the water. If a person or entity is causing a problem (or if they can help contribute to solving the general problem) they have an obligation to step up and help. Future growth and prosperity depends largely upon our water resources. The common good should be served.
- We have a social responsibility. I wonder if every resident of Cedar City wants to continue to wear the label "I am a Water Polluter?" You could call this an emotional or sensational claim. It is not. Everyone who flushes a toilet is a polluter.
    - Those who wash their hands or their dishes, take showers or use garbage disposals in this city pollutes fresh, pure water.
    - We then send it into a sewer system that only partially decontaminates it before dumping it back into the environment in a condition that is far more polluted than when we took it from pipe or tap.
      This is legally acceptable. But doing this ignores a huge opportunity to reuse the water. Where is the innovation and creativity in our water management? In a valley with the critical water needs that we have, we need to step up and do the right thing. The polluters (all of us) should bear the burden of cleaning the water so that we can reuse it.
    - We can afford to do this. We can spread the cost around. There are about 30,000 residents in Cedar City who use an average of 222 gallons of water per day, much of which they pollute. We have hotels and restaurants, businesses and industries that send huge amounts of wastewater to the plant for treatment.
    - Each of those who send polluted water to the plant can pay their fair share. It will not be all that difficult to calculate a reasonably accurate wastewater contribution amount and collect more from those who contribute more. We do it now with our water bills. We can do it with wastewater bills.

- The city could bond and add the implementation costs to sewer bills—which would go up modestly to pay to remedy the mess we make of our water. Deservedly so. There may be state or federal money available to help. This would not be a new tax. It would simply be payment for services the city provides to us to help clean up our personal pollution.
- Enoch residents and others on the common sewer system could also pay their fair share in similar manner.

2. Should we invest more money to transfer the purified wastewater water to a place where aquifer recharge can occur?

Again, my answer is "Yes." Cedar City could hardly have a better set-up for using purified, sewer plant effluent to recharge one of the aquifer's two most critical areas.

- There is a natural recharge opportunity that is just 4 miles from the sewage treatment facility; one that is easy (cheap) to pump to; and which requires minimal development—get the water there and it disappears into highly receptive soil and ground holes that connect directly with the aquifer.
- Water released at this location recharges directly into the critical Enoch area of the aquifer.
- It is located only 2 miles from the main water line that transfers water (pumped in Enoch) to Cedar City, and it is within a few hundred yards of Enoch's water lines.
- The pipeline from plant to recharge point would be constructed across open rangeland. The land has very minor elevation-gain for the first three miles and a down-slope over the last mile.
- The natural recharge area is along the lower, north Enoch bench where a series of springs flowed and hundreds of acres of sub-irrigated wetlands grew for eons of time until the water table began dropping in the 1960's and 1970's (largely due to the increased pumping by Cedar and Enoch cities). It is highly receptive to vast amounts of water and connects directly to the aquifer.
- A limited, but very successful, recharge experiment was done in thes area this past Fall that showed the enormous potential of this recharge area:
    - After the state engineer's meeting in January, 2016, the landowner suggested that local governments use several miles of his water

system (and the Union Field water company's ditch) to bring winter water from Coal Creek to test the feasibility of recharging the aquifer in this area (after the 2016 crop growing season ended).

- Valley government entities and the landowner cooperated to install about 1,000 feet of additional pipe to enable the water to reach potential recharge areas.
- The test, though inexpensive and limited, was highly successful. Water disappeared into an old spring about 20 feet from the pipe for over three days (at a rate of between 350 and 500 gallons per minute) before any surface water appeared in any other location. There are about one half mile of these natural holes, which are the dried springs.
- There are also hundreds of acres of old wetlands. In the recent test, water was also diverted to the surface of these now dry wetlands at the same flow rate and rapidly disappeared. Up to 20 million gallons of water was returned to the aquifer in a short time with a less than 1 percent of the ground surface being used to absorb the creek water. The rate at which the land could absorb water is unknown but the area is so vast, and the number of dried springs so many, that it is highly unlikely the volume of treated water would remain long on the surface.

The bottom line is that such natural recharge points are few and far between. Many aquifer recharge programs require well drilling or the creation of sink basins, neither of which would be necessary in this area.

Summarily, the recharge area is very close to the treatment plant, easy to pump to, and directly connected to the aquifer in its second most critical area. It is also relatively close to both Enoch and Cedar fresh water infrastructure. These factors make this project one of the easiest and cheapest purify-and-recharge opportunities anywhere. More study is needed, of course. But the potential is very high.

3. How much money would need to be invested?

Compared to the numbers that are being thrown around to develop west desert water, the investment would be minimal—perhaps 10-15 percent of the $250 million for that project. The engineers and contractors would need to come up with a real number.

A number of cities in the U.S. and elsewhere, including Big Spring, Texas and Wichita Falls, Texas are recycling their wastewater successfully. *(For more information, potential contacts and some very interesting reading on direct potable reuse (DPR) and indirect potable reuse (IPR) of water [what I recommend for Cedar City], Google "big spring texas water reuse" or "wichita falls texas water reuse".)*

These two cities each spent $13 million+ for the additional treatment technology, equipment and facilities needed to achieve the level of purification necessary for their respective programs. Wichita Falls spent about $1 million per mile for their 12+ mile (above ground) pipeline. If those numbers were relevant to our situation, our project could initially cost $20 million or less.

If it solves a good portion of Cedar City's water problem—say half—going forward, it will prove to be a bargain. The west desert's $250 million is for much larger quantities than we are talking about but, as stated above, *by recycling our water, the need to find and import new water could drop by 50+ percent on an ongoing basis regardless of the growth factor.*

4. Can the "Yuck Factor" be overcome?

Will people drink and otherwise use water that they know once was flushed down someone's toilet?

I answer "Yes," because I believe the facts and rational thinking will win over the emotional, knee-jerk reactions of irrational people who think that sewer water can, somehow, never again become pure. Cities everywhere take water from rivers, purify it, use it, partially clean it, then dump it back into the river from which it came. The next city downstream does the same thing with the same water, and the next city, and the next.

When people come to believe that the water is safe and pure, they will use it and drink it. This is a communications problem—not a technology problem.

Water picks up contaminates very easily. That is one of its most useful properties. But, while they are temporarily emulsified, the contaminants do not affect the water molecules. Through modern (existing) technology, contaminants can be removed and the water made pure.

Even within nature, most contaminants settle out (of water) or are filtered out over time and distance. The evaporation of water is one of nature's favorite purification techniques. Standing water loses many contaminates through settling. Soaking through layers of sand or soil removes many contaminates.

Modern technology speeds up the purifying process through the use of traditional sewage treatment methods, plus further purification through microfiltration, reverse osmosis, and ultraviolet disinfection.

Other cities have found that people will accept and use wastewater treated this way. The case must to be laid before the people. They must become educated in an open and forthright manner, but it can be and has been done. The above mentioned cities overcame the Yuck Factor.

The aquifer itself provides natural filtration. It is not just a big hole in the ground that is partially filled with water. The aquifer is composed of many layers of every kind of material imaginable. It has layers and pockets of solid and fragmented rock, gravel, soil and sand that provide both natural structure and water storage. Water fills up the spaces between the structural components of the aquifer as well as underground cavities.

This natural filtration will help remove impurities from the water as it moves through the strata from recharge area to re-pumping points. It can then be extracted and further purified for human consumption and use (exactly as our pumped water is now purified). Before use, it will meet the same rigid health standards that must be met by all of our culinary water whether obtained from pumping or surface sources.

5. Are these the best options for spending our water development and conservation dollars?

In my opinion, they are the best ideas on the table right now.

Of course, there are, and will be, other ideas. Maybe someone will come up with an idea that trumps them all. And that would be great. There are a couple of other ideas that are on the table but which I feel should take a back seat to this proposal.

Trading Sewage Effluent for Quichapa Water Rights

One idea now under discussion would permanently take control of our wastewater plant effluent away from the city and transfer it to farmers. These farmers would sell/trade their water rights in the Quichapa area to the city and move their farming operations to (Cedar City owed) land adjacent to the wastewater treatment plan. They would then use the wastewater plant effluent to irrigate their crops. This would take (pumping) pressure away from the Quichapa area, thereby slowing down the rate of aquifer deterioration. This

idea has been around for a while and has some traction. But, while it may sound good in theory, it has some serious problems. Here are just a few:

- It deals with only about 60 percent of the wastewater (40 percent would be wasted). Farmers farm just seven of the twelve months of the year, so five months of the effluent would still be dumped.
- It does not materially reduce the need to find and bring new water into the valley in the immediate future.
- It ties up an enormous amount of water far into the future and removes the possibility of recycling this vast amount of wastewater.
- It permanently takes control of our wastewater water out of the city's hands.
- It would take many years to fully develop (if it could be made to happen).
- The city would be exposed to extensive risk.
- Farming is a risky business. Farm families often do not perpetuate. Accidents happen. Farmers go broke. For every farmer that has been successful in this valley over the long term, dozens have gone broke.
- The soil around the treatment plant is mediocre, at best. It is not all that fertile as farm land goes.
- It is a bad idea to encourage any new land to come under irrigation in this valley. We clearly do not have enough water to expand our irrigated acreage.
- The targeted farmers may not be willing to take the risks involved.
- This project may stop today's farmers from pumping in the Quichapa area for a few years, but will it keep others from simply transferring their rights in and resuming pumping near Quichapa? (The state engineer is talking about obliterating its imaginary management line that has long separated water rights south of Highway 56 from those to its north.)

There are other problems with this idea. If it continues to be thought to be the best use of our valuable sewer effluent, I'll bring more of them up.

<u>Bringing in West Desert Water</u>

Another idea is to develop wells and pump water many miles from the west desert. A recent op ed. in a local paper stated that we don't have much money to use for water projects. Then, a few paragraphs later, it justified spending $250 million for the west desert project because that was only half of the projected cost of bringing water from Lake Powell would cost. Huh?

Currently Cedar City delivers about 7,500 acre feet of water annually. The west desert project is said to eventually provide 25,000+ acre feet of new water. At the $250 million price tag, that is a development cost of about $10,000 per acre foot of water. We don't need that much new water, particularly if we recycle and carefully manage our existing water. And we certainly don't need to spend that kind of money. (Are there 35,000 people in this valley? $250 million divided by 35,000 people = $7,143 per person.)

The recycling project should be in the $15-$25 million dollar range. That is hundreds—not thousands—of dollars per resident.

At the present Cedar City water consumption rate of 222 gallons per day per person, the city's population would need to reach 100,000 before it reached the 25,000 acre feet the west desert project is (roughly) targeted to provide. If our wastewater is purified and recycled, our population could reach about 200,000 before we would need that much additional water.

6. Is it the best use of our wastewater?

I think it is. It certainly beats the farming idea. We need less irrigation and fewer crops being grown in this valley, not more. Growing twenty acres of people requires less than half the water needed to grow twenty acres of alfalfa. Consider the following:

- Recharging 50+ percent of the water that the city pumps out of the aquifer back into it each year would be an incredible accomplishment. And it would be very helpful. That water would form a solid basis on which to build our future economy. The 50+ percent rate should be sustainable in perpetuity.
- Under present water management practices, Cedar City needs 100 percent new water every year. If we put 55 percent back, only 45 percent would need to be new water. We would still pump the 5,400 acre feet (and more as we grow), but the recharge could be as much as 3,000 acre feet now and more as growth occurs and water use increases. The present net new water needed would be just 2,400 acre feet.
- Of the 5,400 acre feet, there is very little recharge from our wastewater (and none in the areas it is originally pumped from and where it is most needed). This project would recharge directly into the #2 most critical area. (Remember that this is a direct recharge into the aquifer—not flooding of a broad area that is subject to extensive evaporation.)

Cedar City can and should study this wastewater recycling project very carefully.

Local government can retain its ownership of west desert water rights and develop those resources after all local water resources are depleted.

much water is involved at such a low cost not to recycle our wastewater.

<u>There are also additional, highly important benefits from using wastewater effluent to recharge our aquifer in the critical sweet water areas.</u>

- Not all recharge projects are of equal value. A lot of winter creek water goes into the gravel pits located just off Bull Dog Road. This is not a desirable area from which to pump high-quality culinary water. The (east) Enoch and Quichapa sectors have excellent water. That is why, over many decades, Cedar City has drilled wells and pumped water from these less convenient places, rather than closer in where pumping costs would be much lower. Recharging the Enoch sector is a no-brainer.
- Another benefit is the productive effect it has on the state engineer's safe pumping level, arbitrarily set by him at 21,000 acre feet per year. If Cedar City decides to use the aquifer as a storage facility for 3,000 acre feet of water each year—and more as water use grows—the safe pumping level should rise. Perhaps it will not rise gallon for gallon but, even so, this aggressive recharging would raise the safe pumping level somewhat. That said, if we do calculate it gallon for gallon, the safe level should rise to 24,000 acre feet per year—an improvement of about 15 percent, which is sizeable. And as the volume of yearly recharge increases—if all other factors remain the same—the safe pumping level should continue to rise. *(Note: The cited 15 percent increase is an aquifer-wide average. The improvement in the Enoch sector of the aquifer would be far more dramatic since the 2.6 million gallons per day is far in excess of the amount of water that is currently being pumped daily from that sector. It should have a net effect of raising the water table measurably in this sector.)*
- Yet another benefit is the positive effect it could have on the oldest junior water rights. If the safe pumping level rises, the oldest junior rights should become senior rights. If I understand the state folks correctly, 21,000 acre feet of water rights were issued by the state as of the end of the year 1934. If the new safe pumping level was raised to 24,000 acre feet because of recharging, the oldest 3,000 acre feet of junior rights should then be classified as senior rights.

- The state says we need to pump 7,000 fewer acre feet per year. Recharging 3,000 acre feet annually should shrink the discrepancy to about 4,000 acre feet. That covers 43 percent of the problem—far more than Cedar City's logical proportional responsibility (since it pumps less than 25 percent of the water taken from the aquifer).

Closely related, but not a part of this proposal is the current effort to use the five months of Coal Creek winter water to recharge an area on the north side of Highway 56 in the southwest valley. The amount of potential recharge from that water is well over 3,000 acre feet of water during the five winter months. I don't know who owns that water, nor many of the details of the project. However, the idea seems like a good one and, if it works as designed, it—combined with the one proposed herein—could go a very long way toward solving our long term water problems.

Couple these two recharge projects with reasonable conservation on the part of agricultural users, and our (present and future) water problems could be far less severe than previously thought.

Hopefully, these thoughts and proposals will help stimulate an active and productive conversation about our local approach to water and wastewater management and usage. We have a bright future if we can move forward in ways that are innovative, that work and that will provide this valley with a healthy water future in which we make the best use of our scarce—though adequate—water resources.

We need to change the way we think about water in general and specifically about our wastewater.

I hope others will share their ideas about these topics in helpful ways.

Peter Grimshaw