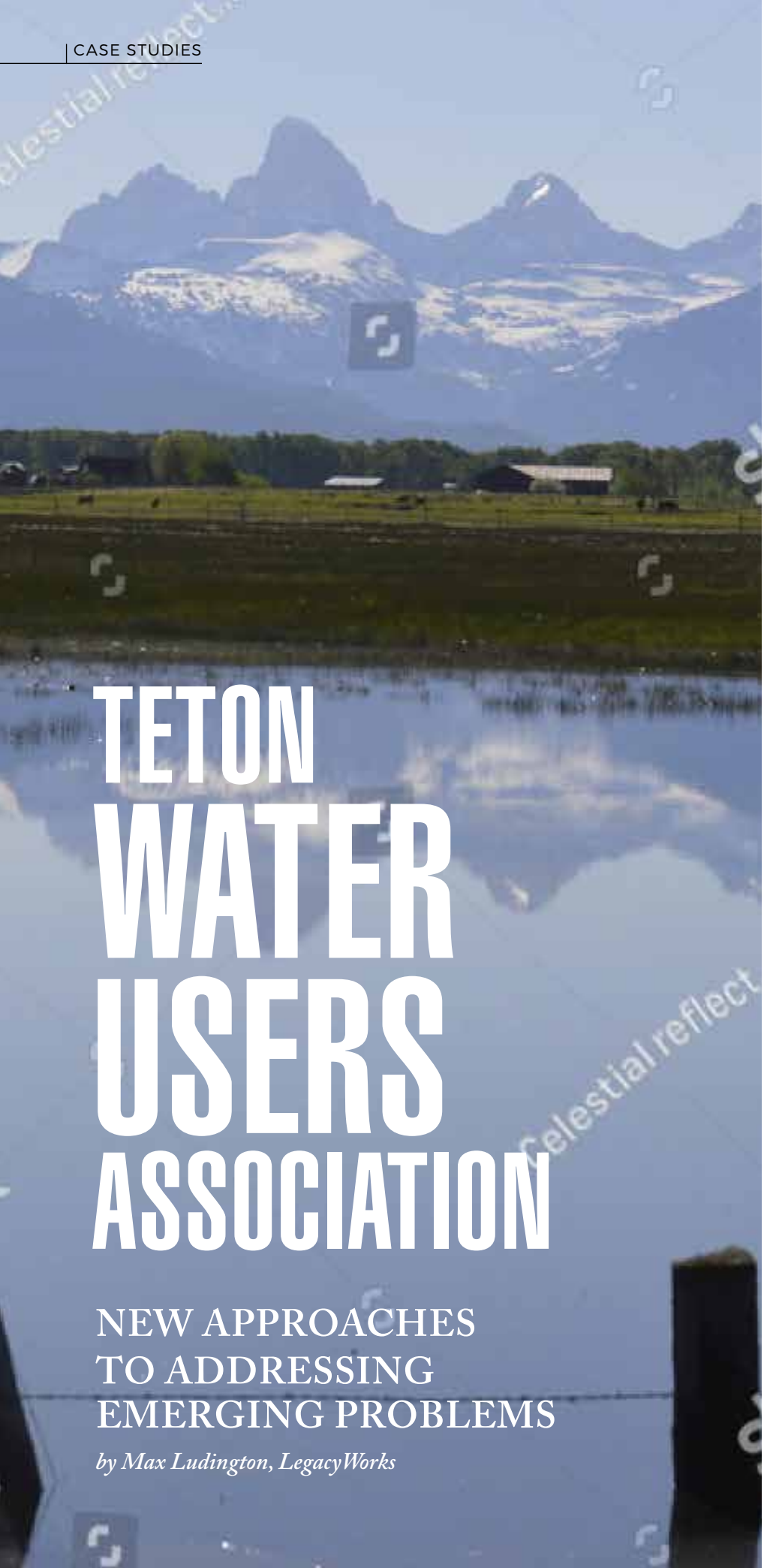

TETON WATER USERS ASSOCIATION

NEW APPROACHES TO ADDRESSING EMERGING PROBLEMS

by Max Ludington, LegacyWorks

"What direction does water flow?"

Anyone who has watched snow melt off the mountains every year knows the obvious answer: "Downhill." Yet those who've made water their life's work often give a different reply: "Water flows towards money."

If you doubt that answer, look at any one of the many infrastructure projects around the United States that pump water uphill, at times over entire mountain ranges, to places where water is needed and people are willing to pay for it. Or for a more local context, look at any of the agricultural pumps that move water out of our waterways to make it available for agricultural use.

Why mention this? Because we can no longer take for granted water availability in the Greater Yellowstone Ecosystem (GYE). As climate change alters our weather patterns and human demand for water increases, water availability throughout the ecosystem is changing, affecting both people and wildlife. Economics drives both the management and availability of water. If we are to devise durable solutions to water availability for the GYE, we must think about both natural ecosystems and the economics of water. One way to do this is by considering a new effort in Idaho's Teton Valley: the Teton Water Users Association (TWUA).

TETON WATER USERS ASSOCIATION

TWUA is a first-of-its-kind partnership attempting to combine science, economics, and the ingenuity of local farmers to address decreasing water availability. Partners include farmers, local irrigators, and variety of local governments, state agencies, and local and regional non-profits. A partial list of those partners includes: Teton Soil and Water Conservation District, Teton County Farm Bureau, Friends of the Teton River, Henry's Fork Foundation, Teton Regional Land Trust, Teton County, ID, the City of Driggs, and LegacyWorks Group.

What makes this group of collaborators distinctive, if not unique, is its mix of agricultural and environmental interests, all working together to address water issues. It's been said about the American West that whiskey is for drinking and water is for fighting over. While that may hold true in general, it's simply not the case with TWUA. In the face of a shared challenge, these groups have decided to work together.

TWUA was created in response to the same types of changes in water availability being seen throughout the GYE. In the case of Teton County, Idaho, in recent decades the valley's aquifer has been declining at precipitous rates: on average by roughly 25 feet, and up to 55 feet in some localized areas.

This decline has affected the entire Teton Valley community. For example, around the county agricultural and residential wells have gone dry. For farmers the problems created by increasingly short water years have been exacerbated by earlier calls for water from the downstream holders of senior water rights. And for outdoor enthusiasts, aquifer-dependent flows into the Teton River are declining late-season, affecting fishing, wetland habitat and overall riparian health.

"Scarce summer water is worth more than abundant spring water… TWUA's goal is to convert spring water into summer water, in so doing creating value."

CHANGES IN WATER AVAILABILITY

The reasons for the change in water availability are varied, but three key factors seem to be driving it.

First is a change in snowpack. Traditionally, snowpack has functioned as a free reservoir, holding water that arrives as snow until farmers and their crops need it in the summer. As Earth's temperatures rise, though, more of the Tetons' spring moisture is coming as rain, leading to earlier runoffs – over time, the date for peak runoff has crept ever-earlier in the season. The end result is that less water is available in the summer, when both agricultural and ecosystem demands for that water are at their highest.

Simply put, as the planet warms, any community dependent on snow run-off is losing one of its key water storage systems. That's certainly the case in the Teton Valley.

The second cause is an increased demand for water. This is being driven by both local residential and downstream agricultural uses. The proliferation of homes in Teton Valley has resulted in more and more residential wells, which draw out groundwater without replacing it. At the same time, many of the senior water rights in the Teton River system lie downstream in the Eastern Snake River Plain around Idaho Falls and Rexburg. As those users deal with increased demand for water, one solution has been to make earlier calls for water in headwater basins like Teton Valley.

The third cause, and also the root of a potential solution, is a change in agricultural water use.

To make their operations more efficient, most of Teton Valley's farmers have switched from flood irrigation to sprinkler systems. These systems offer a variety of benefits, including reduced water use, improved crop production, and decreased labor costs.

From the perspectives of both water conservation and food production, this switch has been a boon: per capita water demand has decreased throughout the valley, and farmers are producing greater yields than were possible through flood irrigation. However, a major unforeseen consequence of the shift is that the extra water used in flood irrigation no longer seeps into the ground. As a result, Teton Valley's aquifers have lost a recharging mechanism, which in turn reduces the amount of water emerging from those aquifers later in the summer, water that eventually works its way into local riparian systems. As a result, stream gauge data from the last century reveals a significant decline in late season flows in the Teton River, a decline directly corresponding to the increased use of sprinkler irrigation.

While some might see this loss of aquifer recharge as a lamentable side effect of modernization, TWUA sees a potential solution. This is because these declines have made crystal clear that

how farmers manage their water affects the functioning of the region's hydrologic regime.

Specifically, the decades of flood irrigation in Teton Valley showed that local farmers have the ability increase aquifer recharge, and in so doing slow the rate at which water leaves the valley. There are good reasons this doesn't happen any longer, but is it possible to bring back some of that recharge?

SUMMER WATER IS MORE VALUABLE THAN SPRING WATER

To address this question, TWUA has proposed a solution based on a simple economic concept: Scarce summer water is worth more than abundant spring water. Building on this idea, TWUA's goal is to convert spring water into summer water, in so doing creating value. Here's how it works.

The seepage into the ground that occurs during irrigation is known as incidental recharge, and it currently accounts for roughly 40% of total aquifer recharge in Teton Valley. While we lack the data to know what this figure was when flood irrigation was the primary means of irrigating crops, modeling suggests it was much higher. Combine flood irrigation with Teton Valley's highly porous soils, and the result is significant incidental recharge, something that also occurs when water runs down unlined, leaky canals or out into rocky soils.

Once in the aquifer, recharge water slows down, delaying its delivery into local streams by an estimated 1-3 months, depending on location. In essence, the aquifer acts like an underground reservoir, holding abundant spring water until summer, when water is scarce.

From an economic standpoint, the aquifer stores cheap spring runoff and turns it into valuable summer water. As this occurs, the additional water availability can give downstream farmers a couple of extra weeks of irrigation water during a time of year when every day of water can make or break a crop season.

In addition, water stored in this underground reservoir has significant ecosystem benefits, including feeding wetlands, putting cold water into streams during summer months when water temperature is a major concern, and boosting the water table.

CONVERTING SPRING WATER INTO SUMMER WATER

So how can Teton Valley farmers manage their water in a way that optimizes both irrigation efficiency and aquifer recharge? For all of its ecosys-

tem benefits and water storage capacity, going back to flood irrigation from sprinkler systems simply doesn't make sense for a modern farmer – it's just not economically feasible to give up the efficient, productive watering of center pivot irrigation systems.

Instead, what TWUA has been working on is not a wholesale change, but rather combining seasonal flood irrigation with sprinkler systems. In essence, the idea is to ask farmers to engage in the old irrigation practices that lead to high rates of aquifer recharge during the spring months when water is abundant, and use pivot irrigation when it's not.

How does it work? For farmers with rocky pastureland that can handle early season flood irrigation, we're encouraging them to flood irrigate it (a practice which, not insignificantly, can also lead to better farming results on marginal ground). Then, as soon as water starts to become scarce, farmers can go right back to sprinkler irrigation. Put simply, what we're encouraging farmers to do is use as much water as they can when it's abundant, and be as efficient as possible with it's scarce.

How does this new water management regime create value? As in most of the western US, in Idaho water rights are based on a system of prior appropriation. That means that those who filed the first water rights get their water first. Since the headwater basins like Teton Valley were typically settled after those on the Snake River Plain, Teton Valley claims on water rights are considered junior, with farmers and residents getting their water allotments only after senior water rights are met. The more water flowing out of Teton Valley late in the season, the higher the likelihood that senior rights will be met, and the more likely it becomes that Teton Valley farmers will be able to continue diverting water. This program is designed to boost late season flows, making more water available for all farmers, while also putting more water into the ecosystem.

In spring 2018, TWUA launched a two-year pilot program, working with a few Teton Valley irrigators to manage their water rights to increase incidental recharge. If the monitoring data indicate the effort is improving both stream and aquifer health, the plan is to expand the program in 2020 and beyond.

TWUA's fundamental goal to change in the timing of water flowing out of Teton Valley. That is no small task, and success will require a coordinated effort from all of TWUA's members. To date, TWUA has succeeded in the critical first steps of developing not only the knowledge needed to pursue the project, but the mutual trust between the many parties necessary to carry it out. Should it succeed, this approach has great potential to be applied in agriculture-heavy headwater basins throughout the GYE, as well as broadly across the West.

As the planet warms, the effects of climate change are only going to become more apparent. If our communities are to cope, and ideally to continue to thrive, we will need to develop new, innovative, cost-effective approaches to our challenges. As the Teton Valley sees its snowpack diminish and in so doing loses its natural water storage system, the challenge is to develop new, cost effective storage replacements. TWUA believes groundwater recharge is just that.

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KEY TAKEAWAYS

Agriculture in Idaho's Teton Valley and areas further downstream depend on snowpack to serve as a natural water storage system.

Climate change is causing snow to melt earlier, making it harder for farmers to obtain water when most needed in late summer. The earlier run-off is also harming the region's riparian health.

Agricultural interests hold and manage the vast majority of water rights in Teton Valley. Farmers have the means and legal right to manage water in ways that lead to more late season water availability.

By incenting Teton Valley's farmers to flood irrigate their fields when water is abundant, the area's aquifers can be turned into an alternative, natural, and cost-effective water storage mechanism.

SUGGESTED NEXT STEPS

Generate statistically significant improvements in Teton River baseflows through pilot program.

Secure funding to grow the program.

Scale the effort to serve other headwater basins in the West.