THESIS

THE OPPOSITE OF 'WHOLE':
GROUNDWATER DEPENDENCE
IN A RURAL AGRICULTURAL COMMUNITY IN COLORADO

Submitted by

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ABSTRACT

THE OPPOSITE OF 'WHOLE':

DEPENDENCE ON AN INVISIBLE RESOURCE

IN A RURAL AGRICULTURAL COMMUNITY IN COLORADO

As the American West faces increasing water demands and decreased access and flows due to the effects of climate change, increasing populations, and pollution it is more important than ever to examine governance structures of common pool resources like groundwater. In the San Luis Valley of south-central Colorado, the community's dependence on this resource has been concealed by the hiddenness of groundwater, which also obscured its role in shaping agriculture, expansion in farmland, and social structure in the Valley. This unsustainable use of groundwater—the opposite of 'whole'—made a 'tragedy of the commons' possible. In response, a local water management organization spearheaded a groundwater management plan with a main goal to preserve as many livelihoods as possible. Similar to other natural resource dependent communities, subdistrict #1 provides a case study of how a community is responding to their overuse through collective action. Support and opposition for this plan stems from different perceptions among community members influenced by their legal, geographical and social relationships with water and ability to access it; perceptions of who bears the responsibility for solving the issue of overdraft; perceptions of the state of the local farming based economy and community; and perceptions of the future of agriculture in the Valley. This case study relies on in-depth interviews with 25 people and participant observation. Critiquing Ostrom's (1990) framework for behavioral choice, this study finds that social vulnerability is

unevenly distributed and thus, in order to return the aquifer to a sustainable level, there cannot be just one solution to the problem.

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CHAPTER 1: INTRODUCTION

> "It's not worth anything if you don't have any water; there's really nothing that's worth anything to anybody."
>
> Larry, farmer

During the winter of 2001 and 2002 a significant shortfall in snowpack in the mountains of southern Colorado deepened an already brewing crisis. The effects were felt strongly in the San Luis Valley (the Valley)—a predominantly agricultural area about the size of Connecticut with just over 46,000 residents. The drought of 2002 brought to light long dormant issues in groundwater management. Years of adequate surface flows kept those with surface rights supplied and mostly content. However, drought caused a call on the Rio Grande in order to meet compact deliveries to New Mexico. Even those with the most senior surface rights were curtailed or shut off—causing major economic losses and increased tension between surface water users and those who "push the button," withdrawing hundreds of thousands of gallons of groundwater a day in peak use months, drawing down the aquifer the northern Valley relies upon.

In the arid American West groundwater is vital for agriculture and municipalities as it increasingly is used to supplement surface flows. Relatively cheap access to reliable and plentiful fresh water provides a myriad of benefits and can transform the local landscape and social structure. However, overuse or "mining" of groundwater can threaten the stability and livelihoods of communities that grow dependent on the resource. This is a universal problem in resource dependent communities and is often lamented as another "tragedy of the commons" in which individualistic actors acted in their best interest, destroying a vital resource. Others argue that collective management strategies, such as Ostrom's (1990) institutional arrangements, provide the solution for communities like these. This research is a case study in why collective action in natural resource management is difficult. This is not something people deal with in

times of abundance. Thus, as the American West and the larger world face increasing water demands and decreased access and flows due to the effects of climate change, increasing populations, Green Revolution agriculture, privatization of water, and pollution, these issues must be examined.

The increasing accessibility of relatively cheap pumping technology—referred to as the 'Silent Revolution'—has fundamentally altered human relationships with fresh water located in underground aquifers (Llamas and Martinez-Santos 2005; Molle *et al.* 2003). The advent of on-demand, easy access to this fresh water leads to a metamorphosis in the patterns and distribution of larger scale irrigation projects as well as a significant increase in intensive groundwater use with social and livelihood impacts. Molle *et al.* (2003) describe the silent revolution as occurring in three stages. The submersible turbine pumps that allowed for access to water located deep beneath the ground's surface were first available in the United States, Spain, Mexico, and Italy in the early part of the 20th century enabling the Green Revolution in agriculture. The next stage took place in parts of India, China, North Africa and the Middle East during the 1970s through present day. A third stage of groundwater extraction is emerging in Sri Lanka, Vietnam, and Africa. What many of these places have in common is a deficit of fresh water or arid climate. Thus, cheap access to reliable and plentiful fresh water provides a myriad of benefits and can transform the landscape and social structure. However, overuse of the finite resource can threaten the stability and livelihoods of communities that grow dependent on the cheap and plentiful resource.

Groundwater is water that has been trapped between layers of earth or percolated down and settled around porous soil or rocks in formations called aquifers. Groundwater travels much slower than surface water, taking weeks and sometimes centuries to recharge an aquifer. When

the rate of extraction is greater than the recharge, it is called groundwater "mining." Access to aquifers creates tremendous benefits for people. Groundwater enables farmers to survive prolonged droughts, arid and semi-arid populations to thrive, municipalities a relatively protected resource, and solutions to issues of surface water quality. However, groundwater management is in a state of transition, as unrestrained development has cultivated dependence on a resource that is unable to sustain the current level of use.

Historically, unlike surface water, there was not much concerted action to manage groundwater because it was perceived as limitless, its movements and particular structures were difficult to understand, and with many landowners sitting above an aquifer, management can be contentious (Burke and Moench 2000). With surface water it is easy to determine when the stream, river or lake is running low and thus curtail use. It is also seemingly easier to measure and partition. Plus, in humid climates, a plentiful water cycle can generally be counted on to replenish sources. The invisible nature of an aquifer means that it is difficult to determine a precise measurement of how much water is available for use, understand the forces acting on the water, and equally difficult to connect with social, economic, and environmental impacts above ground. Groundwater hydrology is heterogeneous and complex—no aquifer is the same. Underground water does not follow the same rules and logic as surface water—leading to a general ignorance among non-hydrologists about the operation of a life-sustaining aquifer. Groundwater is also used differently than surface water and thus, Burke *et al.* (1999) argue that the socio-economic distinction between surface water and groundwater is both necessary and deliberate.

Groundwater is also customarily understood as a common pool resource (CPR) because there can be many landowners sitting above a source all of whom believe they have a right to use

it. With multiple parties drawing from an invisible, complex source, negotiating and implementing management plans is costly and contentious. Burke and Moench (2000: 7) insist that although hydrogeology is complex, groundwater management "presents a separate and, arguably, more complex set of issues that relate to the spatial and temporal dimensions of its occurrence and the way societies and their economies organize themselves around its use." The combination of these three things has prolonged the persistent undervaluation of groundwater (Burke and Moench 2000).

In 2010 986 km^3 of groundwater was extracted around the world. 67% was used for irrigation of crops, 22% for domestic use, and the remaining 11% was put to industrial use (van der Gun 2012). Overall, groundwater accounts for an average of 26% of the world's water abstraction and around half of all drinking water (World Water Assessment Program 2009). The United States, one of the original leaders in groundwater extraction, in 1950 withdrew 47 km^3 increasing 155% to a high of 120 km^3 by 1980, and has relatively stabilized between 110-120 km^3 since (Burke and Moench 2000; van der Gun 2012).

Extractive use of groundwater provides numerous benefits. The geologic nature of groundwater means that water is protected by a buffer and thus is able to provide reliable, protected water supply as well as an alternative for polluted surface water supplies. It has provided food security by enabling farmers to produce crops during extended periods of drought as well as a domestic water supply. Groundwater has also contributed to poverty alleviation, equity and rural development. Any person who owns land above an aquifer has the ability to purchase a pump and withdraw whatever amount of water they need. The combination of accessibility and affordability has increased the standard of living and income for millions of farmers around the world. Groundwater also provides *in situ* benefits—this refers to the values

groundwater provides by remaining in the ground. First, it serves a reservoir function during drought, and also supports base surface water flows (Burke and Moench 2000). Groundwater also plays a role in sustaining plant life and ecosystems. Plants with deep taproots who depend on groundwater for sustenance are also known as phreatophytes. Groundwater *in situ* prevents subsidence of the land and seawater intrusion (van der Gun 2012).

Poor or nonexistent management of groundwater has led to the development of two major issues: declining water levels and pollution. The common property nature of groundwater means that it is inherently vulnerable to exploitation (Burke and Moench 2000; Hardin 1968). This vulnerability can manifest in a "race to the pumphouse" where competition to capture benefits has led farmers and countries to extract water as quickly as possible to demonstrate a prior use. It is important to note that though an aquifer may hold plenty of water, "overdraught and water-level declines typically affect the sustainability of uses… long before the resource base itself is threatened with physical exhaustion" (Burke and Moench 2000: 12).

In the United States, it is only recently that Western water law has been used to manage groundwater. Western states have traditionally used the Doctrine of Prior Appropriation to govern surface water. Prior appropriation is based on the axiom, "first in time, first in right," meaning the first person who diverted water from a source and put it to beneficial use has the first right to that water (Ashley and Smith 1999; Cech 2010; Moses 1986; Radosevich *et al.* 1976). A water right is dated from the first diversion of water so that in times of drought, diversions for rights that are junior (have a more recent date) are curtailed or cut off before those with more senior rights. A water right does not mean that water is private property, but rather refers to the right to divert water. Water rights can be traded or sold, but are connected to the land they irrigate, regardless if the land is connected to the surface flow. In order not to lose a

water right, users must put the water to continual, beneficial use, guaranteeing that owners of rights cannot stockpile water. However, a universal, comprehensive definition of 'beneficial' does not exist. Traditionally, 'beneficial' refers to economic or productive benefits, but can also refer to recreational use. Today, many see 'beneficial' use to encompass instream flows, including protection for riparian and fish habitat (Bryner and Purcell 2003).

For states that manage surface water based on prior appropriation the hydrological interconnection with groundwater makes it difficult to govern. The majority of western states have coordinated surface and ground water management, especially where they are evidently connected, this is usually referred to as conjunctive management. Four different legal doctrines have been used to manage groundwater in the west. Common law (formerly Montana, Wyoming, currently Texas), also known as absolute ownership, states that a landowner sitting above an aquifer has the right to pump as much as he or she wishes, regardless of the impact on others. The correlative rights doctrine, in response to absolute ownership, states that all landowners above a groundwater source have equal rights to a reasonable amount of water. The American doctrine (formerly Washington), also known as reasonable use, allows a user to take what they need within a reasonable amount so that it does not negatively impact their neighbors. Most states (Idaho, Montana, New Mexico, Oregon—except in cases of overdraft or unique hydrological features, Utah, Washington, Wyoming, Nevada—in practice) now rely on a variant of prior appropriation to govern their groundwater. The same basic doctrine for surface waters applies for groundwater; the first to access and put the water to beneficial use has a senior right to the water over someone who came along later (Bryner and Purcell 2003). Sometimes, in states with conjunctive management policies groundwater will fall in line with surface water appropriations. California's surface and ground water management policies can generously be

termed complex, as Blomquist *et al.* (2004) put it, as they involve a combination of different rights that can depend on the type of groundwater and ownership.

In the mountain west, Colorado is unique in that its water law recognizes the difference between tributary and non-tributary groundwater (Ashley and Smith 1999; Blomquist *et al.* 2004; Booker *et al.* 2005; Cech 2010). Thus in Colorado, groundwater development is managed based on the relationship of the groundwater with surface water. Aquifers hydraulically interconnected with surface water are considered "tributary" and subject to surface water diversion rights. "Nontributary" water, or groundwater that is not connected with surface flows, may be developed by the landowners above the source (Ashley and Smith 1999; Cech 2010). In 1969, the Water Rights Determination and Administration Act declared that tributary wells were subject to prior appropriation and had to step in line with surface right holders. In some areas it appears this law was not enforced, as precipitation was generally sufficient. In other areas augmentation plans took effect. Colorado is also recognized as the most rigid protector of senior surface users among prior appropriation states in the American West (Blomquist *et al.* 2004; Cech 2010).

Recognized as the largest and highest agricultural alpine valley in the United States the Valley today supports a population of 46,027 over 8,000 square miles (US Census 2010). Agriculture comprises 40% of the Valley's economy; the primary crops are potatoes, barley, alfalfa, and other assorted cold-weather crops (Walton 2012). Categorized as an alpine desert because of its high elevation (between 7,500-8,000 feet above sea level), the Valley has an average precipitation of six to eight inches per year and relies on surface runoff and groundwater to irrigate crops. The Rio Grande winds for 175 miles across the Valley—it cuts southeasterly to the town of Alamosa, where it turns south. To the east stands Mt. Blanca, the fourth highest peak

in Colorado, and Great Sand Dunes National Park and Preserve, with its rolling sand hills, a testament to the powerful forces of wind and water on rock and soil. On the western side of the valley lie the older volcanic San Juan Mountains capable of producing violent and sometimes damaging thunderstorms.

A groundwater computer model of the unconfined aquifer in the closed basin of the SLV covering the last several years, showed over-pumping to be reducing surface flows, affecting senior water rights and curtailments (RGDSS 2006). In order to respond to the overdraft Rio Grande Water Conservation District (RGWCD) President Ray Wright in conjunction with State Senator Lewis Entz, himself a farmer in the Valley, wrote and sponsored SB222-04. Once passed, the bill allowed water conservation districts to subdivide into groundwater management districts to govern the unique groundwater features within their watershed. Previously, farmers and ranchers in the first subdistrict did not provide augmentation water or pay any fees to pump water because the area of the subdistrict, referred to as a closed basin, was considered hydraulically disconnected from the Rio Grande. The RGDSS found that pumping in the subdistrict was causing some depletion to the river, but because of the closed basin designation, the area was not considered tributary under the 1969 Act.

In December 2011, the Colorado Supreme Court approved a two-fold groundwater management plan for the first subdistrict created (Subdistrict #1) put forward by the RGWCD. The plan states that first, based on Colorado law, Subdistrict #1 will purchase augmentation water to replace the depletions to the Rio Grande from pumping occurring within the subdistrict. The augmentation water will compensate any injury to senior surface right holders. Instead of having each well owner create and submit an individual augmentation plan, the subdistrict will represent the pumpers and through pumping fees purchase and supply replacement water.

Second, the plan creates a land-fallowing program in partnership with the federal Conservation Reserve Enhancement Program (CREP). However, payments from CREP funds did not come online until 2013 and during the first year of the plan (2012), fallowing contracts were paid for by groundwater pumping fees. Of the 174,000 acres and 3,300 groundwater wells in production in Subdistrict #1, the RGWCD hope to eventually fallow 40,000 acres. Farmers and ranchers are paid per acre based on their location within the subdistrict (Hildner 2011).

For farmers and ranchers in the Valley, groundwater has provided an answer to seasons of drought, the timing of surface runoff, and increased the reliability and quality of their crop production. The overdrafting of the aquifer in the Valley challenges prevailing groundwater law in that the formation of the subdistrict allows for more local control to remedy the situation, as opposed to the State Engineer stepping in and forcing a shut down of the wells. However, it also modifies 130 years of Colorado Water Law as almost all wells are junior to surface water rights, and yet they are allowed to continue operating. Most farmers operate with a mixture of surface rights and groundwater. However, several operate with significantly junior or no surface rights and are able to pump even when those with surface rights are curtailed or cut off—in spite of the historicity of their right.

At its root, I argue, this is not just an agricultural based community and economy, this is a groundwater based community and economy. Issues of governance must be dealt with in order to protect the water supply for the future but these must be balanced with protecting livelihoods that have built up around it. Similar to other natural resource dependent communities like fisheries and forests, subdistrict #1 provides a case study of how a community is responding to their overuse through collective action, however, the solution is not simple. Through setting a price for pumping and paying farmers to remove land from production, the RGWCD took a market-

based approach hoping to curb use through a behavioral incentive. This is where Ostrom's behavioral theory of individual choice is lacking: individuals are situated in a complex social, historical, political, and economic context and are not just rational actors. The choices people in the community make are based on impacts that are unequal and different depending on a variety of circumstances. Complex issues with multiple factors defy simple technological and financial solutions. Thus, building buy-in from the community will depend on recognition of those divergent factors, different messaging, and promoting diverse incentives.

A reoccurring theme in interviews with stakeholders was the concept of being 'whole.' The term 'whole' refers to extraction of water from the aquifer being equal to the amount returned through recharge of surface flows. To be 'whole' is to have found a balance that will enable future survival. Though the RGWCD is simply hoping to bring groundwater use levels down in order to bring the aquifer back up to a predetermined sustainable level, they are attempting to do much more than refill an aquifer—they are choosing a future for agriculture in an arid region, attempting to become 'whole'. The way the plan is enacted and the meaning it is given by landowners will have repercussions for generations of farmers and ranchers to come, as well as the larger community. With multiple states in the American West and other countries depending heavily on mined groundwater, the RGWCD's subdistrict #1 is an experiment in survival that can provide lessons to other groundwater dependent regions on how—hopefully—to successfully manage and rejuvenate an overdrafted resource with minimal harm to those dependent on it.

Originally, I developed four broad overarching questions from which to start my research: (1) How will the groundwater management plan in subdistrict #1 affect the way of life for farmers and ranchers who rely on groundwater? (2) How will the groundwater management

plan in subdistrict #1 affect the way of life in the local community? (3) What aspects of the groundwater management plan do producers and others with a direct stake in groundwater view as workable and which aspects of the plan are considered problematic? (4) What lessons might be learned from this case that could inform the management of groundwater in the future in the SLV and elsewhere?

Over the course of my research these questions were modified as patterns emerged through in-depth interviews and participant observation and in order to answer my original questions, I explored these two larger themes. The first pattern to emerge involved the agency of the aquifer itself to shape social systems. The invisibility of the resource affected consumption and social patterns of the community, and led to the problems experienced there today. In the process of trying to protect and rejuvenate the resource, the RGWCD has done more than make people aware of groundwater through things like metering and implementing payments for water. These actions create new meaning for groundwater among people dependent upon it; acts of conservation are about more than water, they are about protecting the larger community. The second pattern to emerge revolved around why farmers and ranchers' have different responses to the formation of the subdistrict. It highlights the diversity of geographical and legal relationships with water among users.

In order to address these questions and my findings I will first set up the background of the problem in subdistrict #1 using relevant literature to situate water in the context of the Valley. While the details make this case unique, there are universal implications for water management. Next, I will describe how I conducted my research, including how I came to this topic and the role of the researcher. In chapter four I will examine how the invisible nature of groundwater drove expansion in farming, fundamentally changed family structure in the Valley,

led to the overdraft of the aquifer, and the ways groundwater has been made visible and meaning created by those who rely on it for their livelihoods. Chapter five will examine the different geographical and legal relationships people in the subdistrict have with groundwater and how this affects their support or opposition to the subdistrict plan. Finally, I will discuss what all of this means in the context of the San Luis Valley and the larger implications for groundwater management.

CHAPTER 2: SITUATING WATER IN THE SAN LUIS VALLEY

Colorado water law shapes how farmers and ranchers interact with water as well as one another and provided the context for groundwater development to move forward unimpeded. Understanding the development of groundwater exploitation in Colorado provides a textured background, revealing the cultural values at play and social relationships different groups have with water in the Valley. Mining of groundwater in the Valley is a problem that has been developing over the last century. Miller *et al.* (1993: 731) note that while the case of water in the Valley is not unique, it is nonetheless demonstrative of the "costs that can be incurred in defining and enforcing water rights in a complex, variable and interconnected hydrologic system." As a common-pool resource, groundwater brings to light a tension between rights to a resource and the ability to access a resource among a "bundle of owners" (Geisler and Daneker 2000; Ostrom 1990). This chapter will also cover the European and Mexican settlement of the San Luis Valley, which lead to the historical foundations of over-appropriation of water resources in the Valley, as well as the process by which Colorado water law has attempted and failed to manage the situation, allowing for the creation of a common-pool resource management regime by invested stakeholders and their opponents.

Garrett Hardin (1968), in his infamous essay *The Tragedy of the Commons*, argues that communal resources will inevitably be deteriorated, as people have no incentive to limit their use of a communal resource. He uses the example of communal grazing lands. Each herder, of a rational mind, to increase his or her own profit will add one more animal to the herd. However, the negative impacts of this act are shared by everyone, therefore the negative impact on the herder is only a fraction of the immediate gain—it is in their rational best interest to add more animals to the herd. Those who choose not to do so are seen as losers in the equation and will not

survive. Hardin maintains that people will continue extracting the resource until the costs of extraction are equal to the benefit—leading to the destruction of the resource. His solution is privatization or centralized government control of the resources. Because Hardin views users as unable to change their interaction with the resource, outside authorities must direct the process.

Groundwater is commonly considered a common-pool resource (CPR) because it is difficult to prohibit people from accessing it and use by one person takes away from the overall quantity of the good and thus the ability of another to use that good (Ostrom 2000). Common-pool resources can be seen on a continuum of private to public ownership, and solving a resource depletion issue does not have to be an either/or situation as Hardin (1968) proposed. In fact the world of property is much more complicated (Dietz *et al.* 2002; Feeny *et al.* 1990; Ostom 1990; Ostrom 2000; Schlager and Ostrom 1992). Contra to Hardin, Bromley (1986: 2) observed, "the group as a whole has some abiding interest in survival, in cohesion, in the benefits and costs attendant to a particular use regime, and on economizing on perceived scarcities." Most of the inhabitants of a rural, isolated community like the Valley have a vested interest in the agricultural community thriving.

Ostrom (1990) argues for a third way: cooperative governing institutions organized and maintained by the resource users themselves. Often referred to as "institutional choice" or "Institutional Analysis and Development," Ostrom (1990) argues that local common pool resource regimes can and often are more productive, efficient, and fair than large, top-down management strategies advocated by Hardin (1968). This framework relies heavily on quantitative models which focus on reducing situations to as few variables as possible in order to generate a model. Like Hardin (1968), her framework rests on the assumption that the individual is a rational actor and that joining in the collective action is in the actors best interest. Her

framework is often used to study fisheries, forests, and water (Berkes 1986; Ostrom 1990; Taylor 2000).

In her seminal work, *Governing the Commons*, Ostrom (1990) identifies eight design principles that characterize successful CPRs. The first is that the resource must have clearly defined boundaries. Second, appropriation rules must be equivalent to the sustainable use of the resource and there must be proportional equivalence between benefits and costs for users. Third, collective choice arrangements are made by those affected by resource use. Fourth, in successful cases of CPRs resource users or those closely associated with them monitor use. Fifth, a series of graduated sanctions are enforced to place pressure on violators. Sixth, low-cost and easily available conflict management mechanisms exist to deal effectively with conflict. Seventh, users must have the recognition and authority to operate from outside institutions. Finally, management must be part of a nested enterprise if is within a larger resource system.

However, common property regimes do not always take into account the cultural, political, or economic context of the resource and can be exclusionary in and of themselves (Schorr 2012). In spite of Ostrom's collective action in response to Hardin's isolated individual, Ostrom's framework still rests on the assumption that the individual is a rational actor and that joining in the collective arrangement is not only in the actor's best interest, but is the "right" decision. In some cases it may not be. This perspective still rests on the foundation of the individual as the rational decision maker. Actors are embedded in a larger historical and cultural context of the resource, thus bring in different values and ideas as to what their best interest is. Therefore, in implementing a successful CPR, it is important to examine what, beyond their rational decisions about groundwater, binds people together in order to bring or keep them at the table. Finally, Ostrom's framework is heavily quantitative and relies on reducing complex

situations to a few variables, which eradicates the complexity of real life. Actors in everyday reality face difficult decisions in complex situations with multiple conflicting and often contradictory factors. In addition, not every actor faces similar circumstances. Ostrom herself admitted that her framework is not a universal cure for local management. But it does provide useful and cogent insight in analysis and action for CPR institutions.

This is also a story of contested access to a resource. The idea of "access" is defined by Ribot and Peluso (2003: 153) as "the *ability* to derive benefits from things" which must be differentiated from property, in which an owner possesses a *right* to draw benefits. Based on this understanding, access to a natural resource such as groundwater, involves a wide range of social relationships. In the case of groundwater in the Valley, surface rights-holders possess the legal backing to support their claim to surface waters, however, groundwater users are able to access a common pool resource without ownership and greater ability to benefit from water due to the nature of groundwater and context of their use. The ability to derive a benefit from a resource is important because people and communities survive and potentially thrive on benefits (Ribot and Peluso 2003). Thus, while possessing a right to a resource is important, it is not necessary in order to access and thus benefit from that resource.

Since groundwater extraction in the Valley has historically not been regulated or managed in action and since the nature of groundwater prevents ownership of the water or the right to water, it has been possible for farmers and ranchers to derive benefits that have supported their own families as well as the larger community. Schools have been built, the health care system and local university have grown, shopping centers have risen, and various populations including seasonal workers, chemical and fertilizer suppliers, and machinery dealers have become dependent upon the continued benefit derived from extraction of groundwater.

In understanding that rights and access involve a wide range of social relationships, ownership of property becomes merely one factor among many in the ability to derive a benefit. Surface right holders possess a property right, which Schlager and Ostrom (1992) define as the license to take specified actions in a particular arena. Surface water right-holders in Colorado have law on their side and thus enjoy a certain amount of social power. Tarlock (2000) takes this idea a step further by claiming there is a quasi-religious connection in western irrigators minds that property rights are a sacred contract with the federal government as reward for the hardships endured in settlement.

Ribot and Peluso (2003: 56) however, differentiate access from property and argue that access encompasses

> *all* possible means by which a person is able to benefit from things. Property generally evokes some kind of *socially acknowledged and supported* claims or rights—whether that acknowledgement is by law, custom, or convention…. The rights associated with law, custom, and convention are not always equivalent. Some actions may be illegal under state law, while maintaining a socially sanctioned base in customary or conventional realms of collective legitimacy, or vice versa.

In the case of the Valley, groundwater extraction, though governed by both the 1965 and 1969 Acts in Colorado, went unmanaged due to years of plentiful water. Only in 2002 when water was scarce and senior surface right holders were impacted did controversy finally surface. Thus, the ability to actually derive benefits from a natural resource, regardless of rights, is shaped by cultural, social, political, and economic frames surrounding the resource and property is only one of several factors (Ribot and Peluso 2003).

The nature of groundwater itself prevents direct property ownership of the resource as it is located underground, follows no formalized boundaries, can be part of a complex hydraulic system, and invisible. Most research and writing on the invisible nature of groundwater is in the context of transboundary aquifers in which the aquifer's use is contested by two separate entities

(Jarvis 2006; Puri 2003; Puri *et al.* 2001). Very little research has been done that address the impacts of an invisible or 'hidden' resource on the social structure or cultural context of people reliant on the resource. It is this hiddenness, or 'out of sight, out of mind' nature that can lead to a lack of recognition of its value in supporting surface flows, pollution, misunderstanding and thus, conflict (Daly 2009; Jarvis 2006).

SETTLEMENT OF THE SAN LUIS VALLEY

Three hours from Santa Fe, four hours from Denver, the San Luis Valley is historically and culturally, a unique place (see figure 2.1). Isolated from the rest of Colorado by a split in the Rocky Mountains, settlement in the Valley has been largely influenced by Mexican Land Grants. The Sangre de Cristos were named for a Spanish explorer who cried out the phrase as he died after battles with natives, and the San Luis Valley itself is named for the hometown saint of another Spanish explorer (Simmons 1999). The wide, flat, alpine plain of the valley is the roughly the size of Connecticut and draws together a diverse group of people, as it is part of the collective identity for the Utes, Navajo, Apache, Hispanic Land Grant settlers, Mormons, Amish, Mennonites, Anglos, and migrant farm workers moving through. The Valley is home to a state university, several 14,000+ peaks, and a place where old-world Castilian Spanish, modern Spanish, Q'anjob'al (a native language from Guatemala), and English are spoken.

Figure 2.1. *The San Luis Valley in Colorado*

Until the 1800s, nomadic Ute and other native peoples predominantly occupied the San Luis Valley. In 1598, in spite of never having been there, Don Juan de Oñate claimed the Valley for King Phillip II of Spain. French traders and American explorers including Zebulon Pike visited the Valley as well. However, it remained under Spanish authority until 1821 when Mexico won its independence from Spain. In an effort to encourage permanent settlements and drive out the native populations that moved through the Valley, the fledgling Republic of Mexico issued sizable land grants to potential colonists. With the ending of the Mexican-American War in 1848 and the signing of the treaty of Guadalupe Hidalgo, Mexico was forced to sell much of its northern lands to the United States. Overnight, the treaty changed the citizenship of the Spanish speaking, Mexican residents (Gonzales 2003).

The first permanent settlements in the Valley were built near the flowing waters of the Conejos River and Rio Grande. Land for the first settlement was granted by Mexico in 1833 covering the western side of the Valley up to the La Garita mountains to the north and Rio Grande to the east by families from northern New Mexico, but due to resistance from Navajo peoples in the area, the settlers could only herd sheep there in the summers. Four other land grants were commissioned in Colorado in 1843 and 44. The Sangre de Cristo land grant covered the southeastern part of Valley and included over a million acres—it is the largest privately held piece of land ever in Colorado (Simmons 1999). Through a series of events "Don Carlos" Beaubien, a naturalized French-Canadian and judge in the northern district of New Mexico came to possess both the Sangre grant and the Beaubien-Miranda (also known as Maxwell) land grant on the eastern side of the Sangre de Cristo Mountains. Settlement was not attempted until 1848 when the U.S. government began an intensive campaign to rid the area of the Ute and Navajo peoples since they were now bound to protect their citizens.

In order to scratch out an existence, settlers in the San Luis area along the Culebra Creek dug what has become the longest continually used water ditch in Colorado (Hicks and Pena 2003). The San Luis People's ditch is also the first recorded water right in Colorado, dated April 10, 1852. Beaubien also gave the settlers a communal grazing area called a vega. In this regard settlers had both private and common property, which was typical of New Mexican communities (Simmons 1999). However, land ownership issues for descendants of the settlers continued, with many being dispossessed of their rights (Gonzales 2003; Hicks and Pena 2003; Lindner 2012). For the U.S. government communal land ownership did not fit into the private property mold, and since New Mexico and Colorado had not acquired statehood yet, they had little say in the process of adjudicating the land grants in congress. Coupled with court battles and a system that was conducted in English, land grants heirs lost more and more ownership and rights to communal grazing properties. The narrative of distrust—outright and subversive—remains in the collective memory of the Hispanic communities in the Valley (Counihan 2009; Lindner 2012).

Slowly, settlements began spreading across the Valley. In 1878 the Denver and Rio Grande Railway reached Alamosa and facilitated increased migration. In 1877 the Church of the Latter Day Saints established the town of Manassa and spread out around the area also establishing the town of Sanford. The railroad then moved north, prompting the settlement of towns Mosca, Hooper, and Moffat. Communities of Holderman Mennonite and Amish have been established in more recent times.

Today, the Valley is home to Adams State University—a four year state university drawing around 2,500 students. With just over 46,000 inhabitants total the population is about half ethnic Hispanics and half white with much of the older Hispanic population located in the southern part of the valley (Census 2010). Due to the agricultural economy in the valley, migrant

farmworkers began coming up to work the harvest. Many of these workers come from Mexico and Latin America and live in and around the town of Center, located within the subdistrict—however, a majority of the landowners, farmers and ranchers in this area are white. For some, an indescribable sense—what Cross (2001) refers to as a "spiritual" connection to place—calls to them. This can be seen in the spiritual communities based outside of Crestone at the base of the Sangre de Cristo Mountains. For others, a biographical connection to land based on ancestral occupation and rights attaches them to the Valley. And for others an ideological commitment to the Valley, its inhabitants, or a particular way of life calls them to remain.

The Luis Maria Baca land grant, established by the U.S. government in 1860 for the original heirs of a land grant in Las Vegas, New Mexico, covers the area around the Great Sand Dunes and north along the western edge of the Sangres. In 1978 ownership passed into the hands of the undersecretary of the U.N., Maurice Strong and his wife Hanne. Hanne opened up a parcel of the land for spiritual retreat centers. Today, there are 23 spiritual centers including Tibetan Buddhist, Zen Buddhist, Catholic Carmelite, Hindu, and a spiritualist group called the Shumei Institute.

Strong, who has driven many of the environmental declarations adopted by the U.N., saw business potential in the Valley. With several investors he started American Water Developer's, Incorporated (AWDI). The purpose of this conglomeration was to build a pipeline, market, and sell up to 200,000 acre-feet of water a year to the Denver metro area. Water would be withdrawn from his property, the Baca Land Grant, located within the Closed Basin and next to the current location of the area of study in this paper. Opposition within the Valley community was both swift and generally united (Bingham 1996; Miller *et al.* 1993). After organizing a united front, passing a tax to fund a lawsuit against the plan, and winning a court battle, ADWI was

abandoned. However, the memory of the threat, "that we're going to lose our water to somebody else," still looms in the minds of Valley inhabitants who were around during the fight (Carswell 2013).

WATER IN THE WEST

Water in the American West is a scarce and thus, contested resource. John Wesley Powell, after exploring part of the American west and southwest during the late 1860s and 1870s warned in his "Report on the lands of the Arid Region of the United States," (1879) that agriculture in these areas would not survive without irrigation, unlike the eastern United States. Even then, "within the Arid Region only a small portion of the country is irrigable" (Powell 1879: 6). However, settlement and cultivation by Europeans fueled by the Homestead Act and based on knowledge of humid climates during the late 1800s meant increased reliance on limited supplies and Powell's carefully scripted recommendations for limiting settlement to watersheds went unheeded.

From archeological evidence it appears that the Ancestral Puebloans were perhaps the first group to attempt management of water through diversion and dissemination. However, evidence suggests that a prolonged drought drove the Ancestral Puebloans away from the southwest and their established communities. Furthermore, it appears that drought may have contributed to increased violent conflict. Regardless, water was a precious commodity that created vulnerable conditions for inhabitants of the American West long before Europeans arrived in the area.

Birth of Prior Appropriation

The birth of the doctrine of prior appropriation has taken on mythical significance in the American West. As the story goes, in the mid-1800s European settlers were trickling into

California, embarking on the mythic promise of the West. Many saw an opportunity in entrepreneurial endeavors including John Sutter, who in 1847 hired a crew from a Mormon battalion to stay back and help build a mill on the American River in California. The mill project was sidetracked when gold was discovered in the streambed and hillside in early 1848. Sutter attempted to keep the find quiet, but word spread and in 1849 the area was overrun with squatters and fortune seekers. The California gold rush had begun. It quickly became apparent that water was one of the key ingredients in gold mining. In fact a running supply of water was as important as a land claim. In order to separate the gold from soil, miners would build sluice boxes and pile sediment in them. Water was then run through the boxes carrying away the lighter soils and leaving behind the heavier gold. Miners who were the first on a stream and had diverted water from the stream to operate their sluice boxes were not happy to suddenly find the stream no longer flowing when another miner set up camp above them. But neither miner—the one already settled nor the newcomer—had any legal ground to argue from. (Jones and Cech 2009; Moses 1986; Radosevich *et al.* 1976)

Riparian law governed water use in the more humid eastern U.S. and was first codified by the Romans who declared all water in a stream belonged to the public and individuals were not allowed to control it. However, in times of drought, those who needed water were commanded to "share and share alike" (Jones and Cech 2009). The British adopted the doctrine into the English Common Law and the European settlers of the eastern U.S. and Canada brought the rules of the Riparian Doctrine with them. Riparian rights stipulated that all persons who owned land on a body of water could make use of that water as long as it did not diminish or damage the quality or quantity of water for other users (Radosevich *et al.* 1976). Therefore, all property owners were essentially equals in terms of access (Radosevich *et al.* 1976). What is

unique about prior appropriation is that one did not need to be a property owner in order to access surface water. A settler or farmer needed only to divert water and put it to beneficial use, thus creating a more equalizing effect (Schorr 2012).

Due to the limited amount of water and arid nature of the land it became apparent that the doctrine of riparian rights that governed water use in the Midwest and eastern U.S. would not suffice where seasonal flows varied so considerably. Had the aforementioned miners resorted to riparian law sharing would have provided each miner with a "reasonable" measurement of water, however, it would not have been enough to operate a sluice box. As Jones and Cech (2009: 59) explain, "Common sense suggested that it was better for at least one miner to carry on operations, even if the other had to cease his, than to provide both with inadequate water for their operations."

Over time miners developed an understanding that whoever arrived, diverted water, and used the water for mining purposes first would have a senior claim to the water in times of scarcity. The miners who arrived after formed a priority line, and it was commonly understood that water would not be available until those ahead of them in line were satisfied. This event is generally looked at as the beginnings of the system of Prior Appropriation and while there is broad agreement on the circumstances of the story, there is disagreement on the meaning of the birth of prior appropriation. Those knowledgeable about prior appropriation generally fall into camps for or against camp regarding what they see as the law in terms of property, wealth creation, and environmental impacts (Schorr 2012).

The four universal tenants of the American system of Prior Appropriation include:

1) Prior appropriation recognizes the state as the proprietor of surface water. To establish a right, an individual had to divert water from its source and apply it to a "beneficial" use.

That user holds "usufructory" rights to the water, meaning the water could not be owned, but rather the right to use the water could be developed (Howe 1997; Libecap 2010). The ownership of a water right was dependent upon continued application of water to a beneficial use.

2) During times of shortage, the priority system would be invoked and those "first in time," were also "first in right." As their needs were satisfied, the water became available to those further down the priority line. Those with earlier priorities are known as "seniors" and those with more recent priorities as "juniors."
3) Water was now separated from riparian areas and could be diverted away from a drainage system.
4) A water right can be sold to another party. While the particular laws may vary from state to state, generally the buyer is purchasing the place in the priority line to divert the water from the stream. In California the water right was eventually separated from the mining claim.

Prior Appropriation was firmly established in Colorado in 1882 by *Coffin v. Left Hand Ditch* in which the court declared:

> We conclude, then, that the common law doctrine giving the riparian owner a right to the flow of water in its natural channel upon and over his lands, even though he makes no beneficial use thereof, is inapplicable to Colorado. Imperative necessity, unknown to the countries which gave it birth, compels the recognition of another doctrine in conflict therewith. And we hold that, in the absence of express statutes to the contrary, the first appropriator of water from a natural stream for a beneficial purpose has, with the qualifications contained in the constitution, a prior right thereto, to the extent of such appropriation (1882).

Schorr (2012) challenges the understanding that the logic behind prior appropriation is based on maximizing efficiency in which private property is valued over common ownership. Rather, Schorr (2012) argues that prior appropriation purposely attempts to advance distributive

justice of a resource, which explains "inefficient" conditions such as the requirement for 'beneficial use', and the loss of the right if unused. These requirements prohibit wealthy landowners from hording a resource and allow both rich and poor to extract the same benefit from the resource. He argues that prior appropriation was not born of a winner-take-all mentality, but rather of a share equally until the point of sufficiency is reached. Meaning, that in early mining camps—the birth place of prior appropriation—when a new settler arrived to pan for gold settlers would make room and share water equally among everyone on the stream. When the addition of one more person would make each diversion of water useless, no more appropriations were allowed. Thus, argues Schorr (2012: 140), the aim of prior appropriation is "broadly egalitarian," designed to maximize the number of water-right holders, and therefore results in "distributions of wealth [that tend] toward equality" making it a progressive policy.

Conflict with Downstream Users

At the beginning of the 20th century almost all accessible surface water in Colorado was appropriated[1]—particularly in the Valley. The headwaters of the Rio Grande, one of the most iconic rivers of the American southwest, are located in the San Juan Mountains to the west of the Valley (see Figure 2.2). The Rio Grande is the fifth longest river in North America and travels nearly 175 miles in Colorado before crossing into New Mexico. One

Figure 2.2. *The Upper Rio Grande Basin*

[1] Water that is captured, impounded, or diverted from its natural course or channel and is put to beneficial use by the appropriator, excluding others from its use.

major tributary, the Conejos River, and several smaller tributaries add to the Rio Grande in the Valley.

The rapid increase in population in the Valley driven by the arrival of the railroad and the Homestead Act, also led to a substantial increase in irrigation. Between 1870 and 1890, irrigated acres in the Valley grew from 50,000 to 300,000 (Hundley 1966). Several large canals, some financed by eastern insurance companies like Traveler's Insurance, were built to facilitate diversions between 1880 and 1888: the Rio Grande Canal (1,699 cubic feet per second), the Farmers Union Canal (841 c.f.s.), the San Luis Valley Canal (575 c.f.s.), the Empire Canal (512 c.f.s), the Prairie Ditch (367 c.f.s.), the Monte Vista Canal (340 c.f.c), and the Costilla Ditch (103 c.f.s.) (Paddock 2001). With 1,200 miles of new canals by 1889, irrigation grew another 100,000 acres by 1894 (Hundley 1966). By 1896 priorities and flow rates for existing water rights had been adjudicated in the Valley (Paddock 2001).

Downstream, users in New Mexico, Texas, and Mexico noticed a decreasing flow in the river. Hundley (1966) documents the shortages that began to appear in the El Paso-Juarez section of the river which led to increasing conflict along the border. The International Boundary Commission, an international body created in 1889 by the U.S. and Mexico to administer boundaries and water-rights shared by the two nations, declared that diversions along the northern part of the river, specifically in the Valley "had seriously hurt farmers in New Mexico as well as in Texas and Mexico" (Hundley 1966: 24-5). The outcome of the study and further negotiations was the 1906 Rio Grande Treaty, which covered the headwaters of the Rio Grande down to Fort Quitman, Texas (refer to figure 2.2). The Treaty guaranteed Mexico 60,000 acre-feet of water per year, and to ensure delivery the U.S. funded and built Elephant Butte Dam, 100

miles upstream from El Paso. In compensation for covering the cost of the Dam, Mexico agreed to waive their claim to damages.

In spite of the amicability of the 1906 Treaty, the states of the Upper Rio Grande, Colorado, New Mexico, and Texas, had not developed a plan to allow for the sharing of the Rio Grande's resources (Paddock 2001). In 1929 the states signed a "standstill" agreement to keep the status quo until further studies could be done. With the stock market crash of 1929, the investigation was put off for several years until 1937 when the federal Rio Grande Joint Investigation commenced. The inquiry into the water situation concluded that water was fully appropriated in the upper sections of the Rio Grande, and that reservoir development in Colorado would benefit the entire basin (Colorado Foundation for Water Education 2010).

According to the Compact, the Rio Grande's flow was divided between the three states based on flow records between 1928-1937. The percentage of delivery is based on how much water flows into the system that year. The more water flows in, the higher the percentage owed downstream; thus, the amount of water owed varies from year to year. Colorado's obligation is derived from flow rates at four river gauging stations in the Valley: two separate delivery schedules were created, one for the Rio Grande and another for the tributary Conejos River. New Mexico's measurement takes place at the head of Elephant Butte Reservoir. Both Colorado and New Mexico are allowed to accrue water credits when they over-deliver and any debts Colorado has are forgiven when Elephant Butte Dam spills over. After almost 40 years of negotiations Colorado, Texas, and New Mexico signed the Rio Grande Compact in 1938.

The 1938 Rio Grande Compact is unique amongst compacts for several reasons. First, it divides the Upper Rio Grande into three basins based on physical properties as opposed to political boundaries including the Valley, the Middle Rio Grande (New Mexico north of

Elephant Butte Reservoir), and the Elephant Butte-Fort Quitman, Texas section (Paddock 2001). Second, instead of a specified amount of water delivered annually, a complicated annual schedule of deliveries based on percentages is used to measure compliance (Paddock 2001). And, third, it is the only compact to have a water quality standard (Jones and Cech 2009). This requirement was included because the Valley eventually hoped to utilize water from an area of the valley known as the Closed Basin.

Located north of the Rio Grande, the Closed Basin covers approximately 2,940 square miles and though it is still considered "tributary" to the Rio Grande, it is separated by a hydraulic divide and has no natural outlet (Rio Grande Water Conservation District 2013; Jones and Cech 2009; Miller *et al.* 1993; Paddock 2001). At the time of the compact the water table in this area of the valley was very high, and plans were made to "salvage" shallow ground water from evaporation and transpiration through the development of the Closed Basin Project (Jones and Cech 2009). A series of wells, pipeline, and a canal were planned to move water to the Rio Grande to aid in meeting compact obligations. Though the Closed Basin Project was not authorized until 1972, and not completed until the 1980s the water quality caveat was included in the compact because the water in the Closed Basin has high sodium content and Colorado must meet certain quality requirements in order for the water to meet compact arrangements.

In spite of the 40 years it took to develop and agree on the Rio Grande Compact, its approval did not signify the end of the issues between Colorado, New Mexico, and Texas. Due to consecutive dry years in the mid-1950s as well as an increase in groundwater pumping, Colorado under-delivered on its obligation and went into debt during the 1950s. By the mid-1960s Colorado owed well over 900,000 acre-feet of water and in 1967 New Mexico and Texas sued Colorado. The three states agreed to a stipulation the following year in which Colorado was

required to use all available means to meet the compact requirements, including curtailment of water rights. From this point on, Colorado began a strict administration of surface water rights, as well as passing a prohibition on new well construction[2] (Paddock 2001).

Slowly, Colorado began to reduce its debt and in 1985, with around 500,000 acre feet still left to repay, Elephant Butte Reservoir spilled for the first time since 1942. Colorado's debt was erased and New Mexico and Texas dropped their suit with prejudice (Paddock 2001). To this day, Colorado generally attempts to accrue a small credit on their obligations to downstream users (Colorado Foundation for Water Education 2010). However, curtailments are a regular occurrence for surface rights holders on both the Rio Grande and Conejos and the Closed Basin project has not met delivery expectations of 60,000 acre feet/year and thus has not reduced this burden on surface rights holders (Paddock 2001).

Hydrology of the Valley

The hydrology of the Valley is particularly complex because of the geologic formation of the valley. The Valley is a rift valley generally extending around 20,000-30,000 feet below the valley floor (Emery 1971). Over thousands of years the process of erosion filled the rift with alluvium (see figure 2.3). The topmost layer of the valley floor consists of gravels, sand, and silt. This alluvium is home to an unconfined aquifer that is separated from a lower confined aquifer by a layer of blue, green, and gray clay. The unconfined aquifer ranges from 0-200 feet deep and the confined aquifer from around 4,050 to 14,000 feet deep (Emery 1971; Topper *et al.* 2003). The confining clay layer is as shallow as 40 feet and deep as 100 feet in different parts of the

[2] Ronald Blewitt, former division engineer in Alamosa from 1973-1974, describes how the "unlawful" curtailment of pre-compact rights to satisfy the 1938 compact agreements as well as a potential water exportation threat in the early 1990s compelled him to write a pamphlet on the Valley's unique water situation. His argument is that pre-compact rights should have been protected from curtailment to meet the compact needs by the doctrine of prior appropriation and the 1938 Compact itself. The state's failure to enact groundwater legislation to govern withdrawal from the Rio Grande's tributary aquifers "resulted in years of under-delivery" and to which Colorado responded by "unlawfully taking water from pre-compact surface water rights and users" while ground water continued to be pumped out of post-compact wells (Blewitt 1991: foreward).

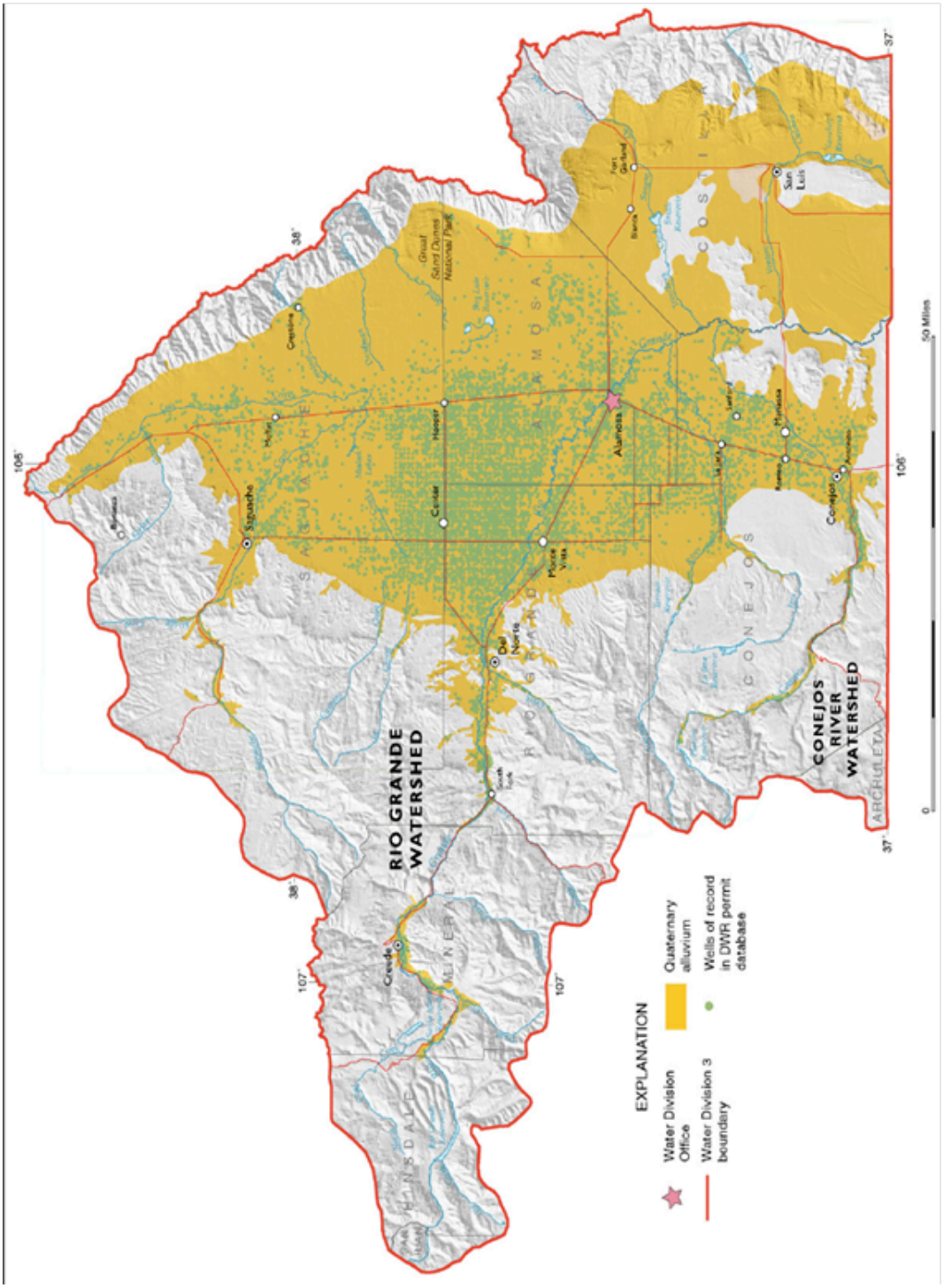

Figure 2.3. *Alluvium deposits in the San Luis Valley (*Topper *et al.* 2003)

valley. Water predominantly enters the valley via snowmelt and precipitation within the valley, and the unconfined aquifer is recharged by application of irrigation water and absorption via leakage from irrigation canals (Emery 1971; Mayo *et al.* 2007).

The *Groundwater Atlas of Colorado* explains that there is some hydraulic connectivity between the two aquifers. It has been estimated that there are over two billion acre-feet in storage beneath the valley floor, however, only about 140 million acre-feet are "recoverable" (Emery 1971; Topper *et al.* 2003). The aquifers in the Valley are considered tributary to the Rio Grande, as the groundwater generally percolates in that direction and serves to support base river flows (see figure 2.4). The Closed Basin area of the Valley, located north of the Rio Grande is considered hydraulically disconnected from the Rio by a hydraulic divide made of alluvium deposits (Rio Grande Water Conservation District; Mayo *et al.* 2007). Water settles in the Basin and has no natural outlet. The San Luis Lakes, on the eastern side of the Closed Basin, are sometimes referred to as "the Sump" as the elevation of the unconfined aquifer is lowest at this location within the Closed Basin and water appears to head in that direction.

Groundwater Development and Law

One of the major issues with integrating wells into prior appropriation is that the nature of groundwater makes it difficult to precisely gauge how one well affects the quantity of water available to surface users (Miller *et al.* 1993). These delayed depletions might not show up for months or years, however, when they do, the effects are in direct proportion with the water that was removed via pumping (Jones and Cech 2009). By 1900, over 2,000 artesian wells were developed in the Valley, there were 6,000 in 1936, and by 1952, that number had increased to 7,500 (Blewitt 1991; Miller *et al.* 1993). According to Tipton (1955), there was only one shallow well in the unconfined aquifer as of 1928, but that number increased to 176 by 1936, and

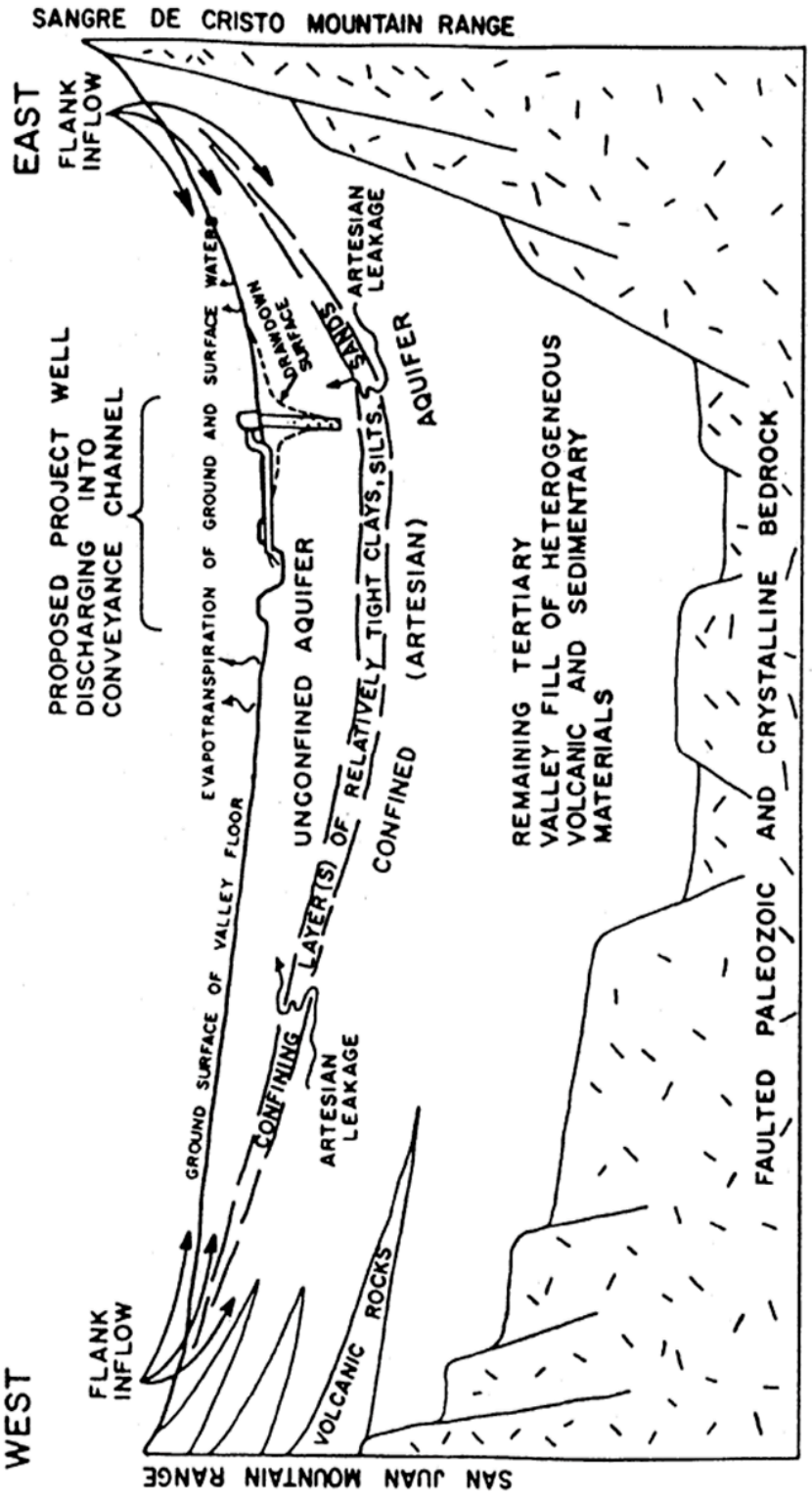

Figure 2.4. *Side view of Valley aquifers and inflow* (Charles 1987)

skyrocketed to around 1,300 in 1952. A major drought in the 1950s drove further groundwater development, utilizing newer technology including high capacity wells for irrigating land (Miller *et al.* 1993). One of the socio-economic benefits of groundwater withdrawal is that it provides a reliable fallback to keep production up and protect the agricultural and economic community in times of drought (Burke and Moench 2000). Initially, groundwater withdrawal just supplemented irrigation in the late summer for junior right holders, when river curtailments were enacted to meet the Rio Grande Compact, but by the second half of the 20th Century most farmers came to rely on groundwater for irrigation due to drought in the 1950s and the invention and ease of center pivot irrigation.

Colorado was behind other western states in regulating groundwater by the mid-1900s and wells did not require permits prior to 1953. With the increase of wells and declining surface flows, particularly in alluvial aquifers along the South Platte and Arkansas Rivers, the state passed the 1953 Underground Water Act, which placed some restrictions on pumpers. However, well permitting was not established until 1957 with the Colorado Ground Water Law. The newly created Colorado Ground Water Commission was tasked with specifying "Tentatively Critical Ground Water Districts" in order to allow for managed withdrawals from aquifers experiencing declines. It quickly became obvious that the 1957 Act did not provide enough of a framework for administration of groundwater as neither the 1953 nor 1957 Acts required groundwater to be managed for the benefit of senior surface right holders.

In 1965 the General Assembly passed the Ground Water Management Act, replacing the 1957 Act. It provided a more comprehensive management strategy in terms of appropriation and administration of groundwater. The State Engineer was given explicit authority to administer wells, with the power to curtail groundwater pumping if it injured senior surface rights. The 1965

Act also classified certain areas as "Designated Groundwater Basins." These designated basins covered groundwater that was tributary, but were located far away from main stem surface flows and which now had vibrant economies flourishing around them. These basins were to be managed differently than all others.

Knowledge about the interconnection between groundwater and surface water flows was limited at the time. The 1965 Act defines groundwater development as dependent on its effect on surface water flows. Aquifers hydraulically interconnected with surface water, such as alluvial aquifers that support the base flow in a river or stream, are considered "tributary" and subject to surface water rights. "Non-tributary" water, or groundwater that is minimally connected with surface flows, may be developed by the landowner above the source and is not subject to prior appropriation doctrine. In the case of non-tributary water the General Assembly concluded that the potential economic benefit created by allowing these wells to operate exceeded the *de minimus*, or "inconsequential" impact on surface flows (Jones and Cech 2009). Closed Basin area waters—though hydraulically "separate" from the Rio Grande—are still considered tributary waters, as dictated by the 1965 and 1969 Acts set by the State of Colorado, however, they have been "duly appropriated for the project by the Rio Grande Water Conservation District" (RGWCD 2013).[3]

Due to relatively unregulated groundwater pumping, Colorado faced another crisis. It had encouraged large-scale pumping to further agricultural and economic gains and now people depended upon the livelihoods created by groundwater (Jones and Cech 2009). Furthermore,

[3] The Closed Basin Project as well as the connectivity between the Basin and Rio Grande are contentious issues. In fact in writing the ruling for a Colorado Supreme Court assessing the legitimacy of subdistricts to manage groundwater and replace injuries to senior right holders, Justice Hobbs states, "Whereas previous court decrees and groundwater studies indicate that such a divide formerly existed, none clearly exists today -- perhaps one reason why Subdistrict well pumping is currently causing depletions to the Rio Grande and its tributaries" (Hobbs Jr 2011: 34). This account does not claim to adequately represent the controversy surround the Basin nor the Project, as that has the potential to be the subject of another thesis or dissertation.

issues in the South Platte and Arkansas had not been adequately resolved. Thus, the General Assembly commissioned the Bittinger/Wright Study of the South Platte Basin and their conclusions helped shape the guiding principles of the 1969 Water Rights Determination and Administration Act, which replaced the 1965 Act in terms of tributary groundwater management. The 1969 Act provides the outline for administration of tributary groundwater, or water that had more than a *de minimus* impact on surface flows.

In the 1969 Act wells in the alluvium were still required to become part of the surface priority system and thus could be curtailed to benefit more senior right holder, the exception being Designated Groundwater basins. The 1969 Act unambiguously espouses the principle of maximizing water use in Colorado, including groundwater. The Act states that, "it is the policy of this state to integrate the appropriation, use, and administration of underground water tributary to a stream with the use of surface water in such a way as to maximize the beneficial use of all of the waters of this state" (MacDonnell 1986: 138). As Jones and Cech (2009) explain, tributary wells "would be curtailed no more than necessary to prevent material injury to senior surface water rights and that no well should be curtailed unless doing so would increase supplies for an affected senior" (249). The solution to maximizing water use was to require all wells to have augmentation plans—a court-approved plan in which the party seeking to withdraw groundwater replaces that well's depletion to surface flows in the same time and place, thus preventing injury. Colorado water law's augmentation plans are unique to water law in the west (MacDonnell 1986). Users on the South Platte and Arkansas joined together to created well user groups, pooling resources to purchase augmentation water. However, in the Valley groundwater management did not develop in the same way.

Groundwater in the Valley

Despite the uniqueness of Colorado water law, the distinctive nature of hydrology in the San Luis Valley and the contributions of previous work, little comprehensive analysis of the social impacts of intensive use of groundwater development has been conducted. The perspective of groundwater as a common property resource (CPR) highlights the vulnerability and imprecise nature of groundwater sources and management (Burke and Moench 2000; Burke *et al.* 1999). Burke *et al.* (1999: 303) examined the broad role of groundwater in society, and observe "groundwater is an important input to economic activity and social well-being through the range of extractive and in situ services it provides by virtue of its circulation in aquifer systems and its general ubiquity." However, few studies, outside of the U.N. report written by Burke and Moench (2000), focus on specific social impacts of groundwater depletion outside of economic impacts on rural communities or policy surrounding sustainable development and management (Booker *et al.* 2005; Bromley *et al.* 2001; Custodio *et al.* 2005). Thus, Burke *et al.* (1999: 306) note, "very few formal attempts have been made to estimate both the immediate use and in situ values of groundwater."

As wells located in the confined aquifer became more and more commonplace in the Valley, the prevalence of subirrigation techniques correspondingly became ubiquitous in the Closed Basin area. Subirrigation is a process by which water is delivered to the roots of a plant either by a high naturally occurring water table, or through artificial means. The Closed Basin already had a high water table and subirrigation was possible for many without additional water—in fact issues of tractors stuck in mud and fields too bogged down with water were common up until the 1970s. The gradual drawdown of the unconfined aquifer led to an increase in using groundwater from the confined aquifer to raise the water table, first documented in the

1940s (Blewitt 1991). These wells were generally powered by artesian pressure coming from the confined water in the aquifer. Blewitt (1991) notes, and several interviews confirmed, that these wells would be left to flow out onto the valley floor in order to raise the water table so that the roots of crops could reach the water. This practice, believes Blewitt (1991: 6) is "highly inefficient water-wise, albeit highly efficient labor-wise… Huge quantities of water were being lost to evaporation from water surfaces, wet lands, and near-useless vegetation."

These forms of "near-useless vegetation" consist of cottonwoods, willows (both planted by farmers and ranchers near homes and pastures), greasewood, rabbitbrush, and salt grass (Charles 1987; Emery 1971; Kray 2010). However, high water tables may also feed some high-value crops like alfalfa. Though not considered "beneficial" and a scourge, "accounting for up to 1/3 of the annual groundwater outflow" (RGDSS 2006), "phreatophytes" or natural vegetation fed by shallow groundwater, do serve at least one important purpose. Phreatophytes predominantly serve to keep soil erosion down, which is particularly important during the spring windy season in the Valley. It has also been documented that some species may supplement or reduce their use of groundwater via summer rains (Kray 2010).

Blewitt (1991) estimates that groundwater withdrawal began exceeding recharge rates in the aquifer in 1949. The gradual drawdown of the aquifer through subirrigation, irrigation, evaporation, and other means contributed to a decrease in the water table and the inability of Colorado to meet its compact obligation. Subirrigation became impractical, and many farmers switched to center pivot irrigation. It appeared that wells were becoming a serious problem, particularly without regulation.

A series of State Engineers passed through the state office starting in 1955 with J. E. Whitten (a Valley native), A. Ralph Owens (1964-69), and C. J. Kuiper (1969-79) who were

unable to retard well use in the Valley due to a lack of a priority list incorporating wells and manpower to enforce well curtailments. Blewitt (1991) argues that the compact effectively divided water rights into two camps: pre-compact and post-compact rights. Thus, once Colorado was out of compliance the only way to meet the Compact was curtailment, and therefore, only post-compact rights, including wells, should be curtailed or shut down. Instead it was more expedient to meet compact obligations by curtailing surface water rights, even those with rights senior to the compact—setting the precedent for succeeding state engineers.

However, to prevent any more loss or injury to senior users, Kuiper in 1972 halted all new permits for wells drilled in the confined aquifer. This was after both the confined and unconfined were assessed to be tributary to surface streams in the Valley. Then, in 1974 Kuiper signed an order that would effectively curtail groundwater withdrawals in the Valley. According to Blewitt (1991: 22), this was wildly unpopular as most farmers relied on groundwater for crop irrigation by this point—he claims that to enforce this order would have required "hundreds of extra personnel, preferably with police authority", but since division engineers no longer had police powers, the only other option was to issue hundreds and hundreds of court injunctions. However, only a few days after issuing the order, Kuiper nullified it and thus groundwater pumping in the Valley was not curtailed, nor incorporated into a priority list.

Throughout the 1980s and 1990s the Valley received record precipitation and maintained high water levels; consequently, no issues with the lack of groundwater management surfaced. There was enough to go around. However, drought struck in 2002 and the water table dropped dramatically: surface users were curtailed to meet Compact obligations, farmers were losing crops and ranchers cutting cattle. Meanwhile, groundwater users were able to go on pumping and producing sizeable crops, relatively unaffected by the drought. Not only were senior right

holders being curtailed or cut off, they were paying for ditch riders and irrigation companies. Within the Closed Basin area most farmers operated under a combination of surface water rights and groundwater pumping. But there were several farmers who existed without any surface rights at all. The unconfined aquifer level was drawn down to its lowest level ever since records were first kept in 1976. Quite suddenly, the aquifer was revealed as the sustenance of the valley, and many felt pumpers were at an unfair advantage, and probably causing injurious harm to surface rights.

Then president of the Rio Grande Water Conservation District (RGWCD), Ray Wright, developed an idea to manage groundwater from within the valley, as opposed to the State Engineer forcing wells to shut-off as was happening along the S. Platte and Arkansas. Agriculture was the predominant income for the Valley—comprising 40% of the economy in one estimate (Walton 2012). Lewis Entz, a senator in the General Assembly from the valley, backed Senate Bill 2004-222. SB04-222 concerned the authority of the state engineer in administering groundwater use, specifically in Division 3. The stated aim of the bill was to:

> provide a water management alternative to state-imposed regulations that limits the use of irrigation wells within the Subdistrict, that is, a system of self-regulation using economic-based incentives that promote responsible irrigation water use and management and insure the protection of senior surface rights (Hobbs Jr 2011: 34)

In total, six subdistricts would be formed, starting with subdistrict #1 as the exemplar. There are two main priorities for subdistrict #1: first, to replace and prevent injurious depletions to senior surface right holders through a collective augmentation plan for well users in the defined boundaries; the second priority is to return the unconfined aquifer to a sustainable level. Sustainable is defined as between 200,000 and 400,000 acre-feet below the measurement taken in 1976, and since 2002, the aquifer has only continued to decline (see figure 2.5). Sustainable

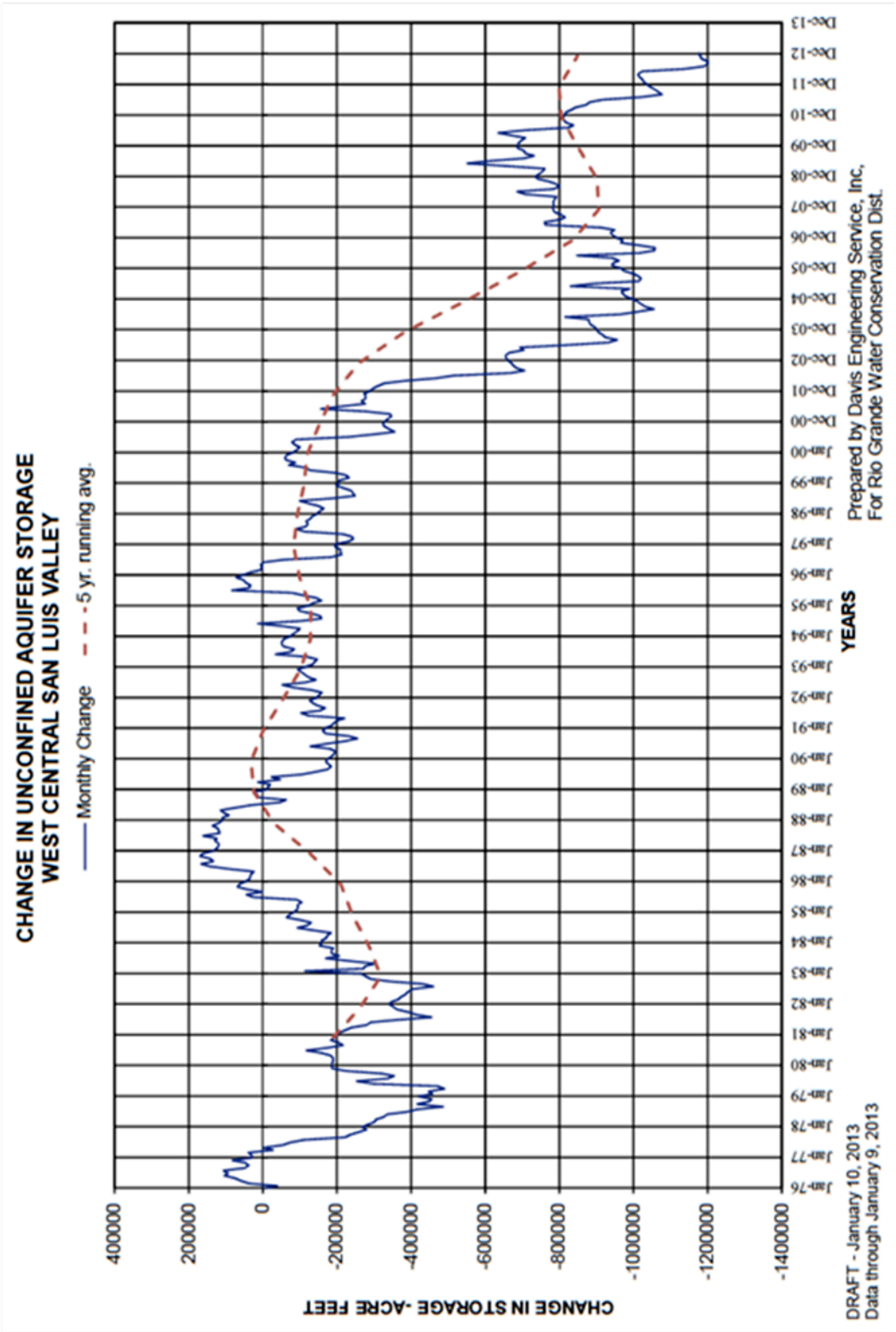

Figure 2.5. *Change in Unconfined Aquifer Storage since January 1976.* (RGWCD 2011)

levels will be accomplished by removing 40,000 acres of the 174,000 acres in production in the area of subdistrict #1 over 10 years through a fallowing program.

Conservation Reserve Enhancement Program (CREP) funds through the Conservation Reserve Program (CRP) under the USDA still have not been approved by congress to support fallowing at the time of this writing. If approved, CREP funds will provide technical and financial assistance to support conservation practices. The program stipulates that farmers sign a 14-15 year contract with the USDA and Farm Services Agency (FSA) and that the land remain out of production during that time period. Irrigation may only be used to establish a cover crop. The hope is that by removing 40,000 acres from production, pumping will be reduced by 60,000 acre feet annually, as well as reducing the amount of energy used with so many pumps out of production and with the hope that the remaining pumps will not have to work as hard as water levels increase.

For 2013 the subdistrict will also be offering a 2-tiered incentive program to encourage farmers to sign fallowing contracts (see table 2.1). The funds for the incentive program come from a fee based on each acre-foot of water pumped. Two types of land divide the incentive

Table 2.1. *Subdistrict #1 Incentives for fallowing* (Krizansky Feb. 8, 2013)

	In the Bonus Zone	**Outside the Bonus Zone**
15 Year Retirement	Annual water retirement payment of $33 an acre a year for 15 years for a total of $495; an annual rental payment bonus of $10 an acre a year for 15 years for a total of $150; a one time bonus payment of $100 per acre; and a one-time cover establishment bonus of up to $100 an acre barring it does not exceed the total cost of establishment. Grand total: $845 per acre.	Annual water retirement payment of $22 an acre a year for 15 years for a total of $330.
Permanent Removal	Annual water retirement payment of $66 an acre a year for 15 years for a total of $990; a one-time bonus payment of $100 an acre; a permanent water retirement bonus of $200 per acre; an annual rental payment bonus of $10 an acre a year for 15 years for a total of $150; and a one time cover establishment bonus of $100 an acre barring it does not exceed the total cost of establishment. Grand total: $1,540 per acre.	Annual water retirement payment of $44 an acre a year for 15 years for a total of $660 and a permanent water retirement bonus of $200 an acre. Grand total: $860 per acre.

program: land within the "Bonus Zone" and land outside of the Bonus Zone, but still in subdistrict #1. The Bonus Zone is located east of Del Norte, over to just north of Monte Vista and is known both positively and critically as "the Holy Land" or "God's Country" due to the high water table levels still, even as the aquifer overall has dropped. As part of the Plan of Water Management (PWM) the subdistrict #1 board of managers approved three different fees for pumpers: an administrative fee of $5/irrigated acre; a CREP fee of $1/irrigated acre to meet required match funds; and a variable fee to be administered per acre-foot pumped, as measured on the well meters. The variable fee scale goes up to $75—and was implemented in 2012.

The first part of the plan—to prevent injuries to senior right holders—will be accomplished via replacement of stream depletions, calculated by the complex modeling of the RGDSS. By the PWM's own admission, current and historic operation of wells has caused and will continue to cause stream depletions to the Rio Grande and its tributaries—reducing, and possible eliminating the hydraulic divide (Hobbs Jr 2011). The PWM mandates the creation of an Annual Replacement Plan (ARP) every year, effective May 1-April 30, based on the RGDSS model to estimate groundwater depletions, based on time, place, and amount so that augmentation can occur in accordance with Colorado statutes. The ARP must also include timelines for and availability to acquire replacement water for the upcoming year. The ARP also includes measurements from hydraulic divide observation wells, a five-year running average of the storage levels in the unconfined aquifer as well as a report on the actual delivery of replacement water and acres fallowed. In the primary ruling, the water court maintained the right of any party to challenge the ARP within 15 days of its approval by the State Engineer.

The concept was and has continued to be controversial. Twice the water district was taken to court within the Division No. 3 Water Court, and the objectors appealed the ruling,

taking the case to the Colorado Supreme Court (all cases go directly to the Supreme Court if appealed). The prosecution, made up predominantly of opponents located outside of the subdistrict, challenged the legitimacy of the subdistrict on several issues: (1) One of the objections was that the plan did not meet the necessary requirements of an augmentation plan and did not go far enough to prevent injury to senior water rights; (2) They also challenged the authority of the State Engineer to approve ARPs, maintaining that it is for the water courts to approve; (3) The trial court had insufficient authority to "decree additional procedural terms and conditions for operation" as well (Hobbs Jr 2011: 56); (4) Objectors argued that by delaying implementation of replacement water for past injuries until 2012, seniors were injured still further; (5) The next objection centered around the argument that recharges plans go violate recharge decrees of a number of valley water associations; (6) Objectors also contested a part of the plan that would allow the subdistrict—at some unspecified time in the future—to contract with well owners outside the district for replacement water or to enlarge the subdistrict; (7) Finally, they also objected to the use of Closed Basin Project water as replacement water and argued that the amount of water lost through evapotranspiration due to phreatophytes in the RGDSS model was too high. The Supreme Court rejected all of their objections and affirmed the trial courts judgment and ruling on December 19, 2011.

In their examination of the attempts of AWDI to export groundwater from the Closed Basin in the early 1990s, Miller *et al.* (1993: 755) declare that "no mechanisms are in place for the local development and enforcement of rules governing groundwater use, the principles that [Elinor] Ostrom identified as characterizing robust self-governance institutions are missing in the San Luis Valley." Similarly, they note the case of water in the Valley is not unique, in fact it is demonstrative of the "costs that can be incurred in defining and enforcing water rights in a

complex, variable and interconnected hydrologic system" (731). As an invisible resource, groundwater brings to light a tension in Colorado water law between property rights and ability to access a resource. Access to a natural resource, such as ground and surface water, involves a wide range of social relationships. The potential social impacts of this plan are unprecedented; as this is the first large-scale, self-governance management plan for groundwater users to compensate those with senior surface rights in the American West (Hildner 2011). Moving forward this thesis will examine the influence of the hidden nature of groundwater on social structure and resource use. It will also examine how perceptions of the subdistrict formation and plan for water management are influenced by social, legal, and geographical relationships with water rights and access.

CHAPTER 3: METHODS

In the previous chapter, I discussed the history and development of surface and ground water issues for the San Luis Valley (the Valley). In this chapter I will provide an overview of my study, including a rationale for choosing qualitative methods, my research design, sampling and population of interest, and my unique position as a researcher to access a population with a reputation for being closed off. I will also provide an overview of my data collection methods including in-depth interviews and participant observation, and coding processes. Finally, I will close by engaging in a brief discussion of the methodological issues and challenges I encountered in my research. By taking the time to discuss my research methodologies and approach, I can illuminate the oftentimes complex and overlapping relationships that develop between a researcher and the researched before approaching my empirical findings in the next two chapters.

QUALITATIVE RATIONALE

In conducting this research, I was interested in people's perceptions of the subdistrict plan and their thoughts and feelings about the future of agriculture in the Valley. These topics are part of larger patterns and themes and in order for me to gain insight I need to understand what these concepts mean to the people themselves (Marshall and Rossman 2011). Qualitative research attempts to "acquire in-depth and intimate information about a smaller group of persons," and "to learn about how and why people behave, think, and make meaning as they do" (Ambert *et al.* 1995: 880). This approach allows me to gain a better grasp of what water, rights, and their communities mean to the people affected and it also enables me to compare what people say, with their actions as they make meaning. Qualitative methodology also facilitates a continuous, flexible, and adaptive project (Rubin and Rubin 2012). By allowing for continuity, I

was able to open up and accept new ideas, concepts, and directions as they came along, meaning my research project evolved as it grew. Being flexible meant that I was able to investigate new avenues of information or take advantage of situations as they arose. Finally, being adaptive meant I could face and respond to the unexpected without losing ground.

As a newcomer to issues of water in Colorado and since the subdistrict had not yet been through a growing season, I chose to take a broad approach to my research. Several news articles on the plan had referenced the possibility of unintended social consequences due to the uncharted nature of the plan and so I chose to focus broadly here. In order to approach the groundwater situation in the San Luis Valley, I developed these four research questions to guide my research: (1) How will the groundwater management plan in subdistrict #1 affect the way of life for farmers and ranchers who rely on groundwater? (2) How will the groundwater management plan in subdistrict #1 affect the way of life in the local community? (3) What aspects of the groundwater management plan do producers and others with a direct stake in groundwater view as workable and which aspects of the plan are considered problematic? (4) What lessons might be learned from this case that could inform the management of groundwater in the future in the SLV and elsewhere?

In order to study the social impacts of the subdistrict formation and the groundwater management plan and allow major themes among stakeholders to emerge on their own, I used a grounded theory methodological framework. According to Suddaby (2006: 633), grounded theory is a pragmatic approach to qualitative social research that involves an "ongoing interpretation of meaning." This approach is best suited in "efforts to understand the process by which actors construct meaning out of intersubjective experience" (Suddaby 2006: 634). Intersubjectivity refers to the importance of collective experiences in how people understand the

world around them. Relying on the cyclical process of grounded theory to build, re-evaluate, and refine theory allows new ideas and experiences to emerge through the process of interviews and participant observation as I was constantly comparing and analyzing data as it was collected. Theory, in this process, is emergent, and it allowed the stakeholders' experiences to guide the direction of my research while I analyzed and identified patterns across relationships and individual cases (Eisenhardt and Graebner 2007: 25).

RESEARCH SITE AND SAMPLING

The location for this study is the north central portion of the Valley (see figure 3.1), designated subdistrict #1. This area covers approximately 700 square miles overlapping three counties: Rio Grande, Alamosa, and Saguache. The town of Center, the largest in the subdistrict, has a population of 2,230 (US Census 2010). Hooper is the only other incorporated town with a population of 103 (US Census 2010). Three school districts fall within the boundaries of subdistrict #1 as well: Sargent Re-33j with 478 students, Sangre de Cristo Re-22j with 312 students, and Center 26 JT with 568 students (GreatSchools 2012). The population is mostly concentrated around the town of Center, with farmers and ranchers spread out over almost all of the land within the district. As evidenced by land use percentages, agriculture and rangeland predominate all three counties (see table 3.1).

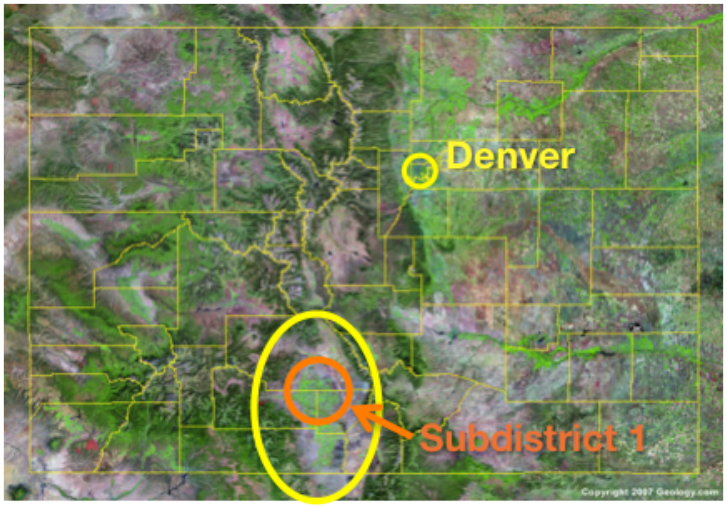

Figure 3.1. *Subdistrict #1 in the San Luis Valley*

Table 3.1. *Demographics of the counties in which subdistrict #1 resides* (US Census 2010).

	Colorado	Alamosa	Rio Grande	Saguache
% of land in Agriculture	---	24	25	7.3
% of land rangeland	---	60	33	45
Population	5.026 mill	15,445	11,982	6,108
% Hispanic	20.7	46	42	40
% speak Spanish	10.5	26	27	35
Median Income	$55,735	$35,960	$37,993	$28,866
% children qualifying for Free or Reduced lunch	38	67	60	76

Approximately 47% of the Valley is of Hispanic origin and 46, 42 and 40 per cent of Alamosa, Rio Grande, and Saguache counties respectively (US Census 2010). Overall 32 percent of the population in the Valley are native Spanish speakers which includes 26 percent of those in Alamosa County, 27 percent in Rio Grande, and 35 percent in Saguache County (US Census 2010). However, most of the Hispanic population is concentrated in the towns of these counties, and the majority of landowners are white. The three counties covering the subdistrict all have considerably lower median incomes than the state of Colorado overall. The percent of children qualifying for free and reduced lunch programs is included to demonstrate the levels of poverty and near poverty present in these counties and are higher than the state levels. In order to be eligible for the free lunch program a family's income must be below 130 percent of the poverty line. To qualify for the reduced lunch program a family's income must be between 130 and 185 percent of the poverty line.

Population

The population of interest for this study is adults who have a direct stake in and/or knowledgeable perspectives on the groundwater management plan, and those who will experience residual impacts in the community. This population engages on a daily basis with both surface and ground water and thus lives out the social impacts of the groundwater

management plan. For this research I interviewed engineers, an agronomist, people in water management positions, farmers, ranchers, board members of relevant organizations, a reporter, people in related organizations, and business owners. Many of these people had intersecting roles, creating the texture of intersubjective experience.

Sampling Strategy and Access

My sampling strategy began with a conceptually driven sample (Curtis *et al.* 2000) because I was interested in focusing on those with experience or significant knowledge about the subdistrict formation. With one month to conduct interviews, my goal was to conduct 25 interviews, the predominant amount being with farmers and ranchers who owned or worked land in the subdistrict. I also focused on sampling farmers and ranchers from different geographical locations within the subdistrict as well as with a variety of relationships with water rights, access, and land.

To gain access to my population I drew on my connections from when I formerly lived south of subdistrict #1. In this way I had several contacts that served as key informants to the populations I interviewed. Through one of my contacts, I was invited to meet with one of the head engineers in the subdistrict process, who wished to understand my motives as I engaged in this research. Through that initial conversation, he became a gatekeeper to the community and promoted my research at meetings as well as connecting me with several other stakeholders in the community. Once given his "blessing" to begin, I was able to build rapport with interviewees through my own contacts as well as my personal experience living in the area. Access to reticent stakeholders proved difficult in one case in particular and I was unable to conduct an interview in spite of numerous attempts through direct contact and my gatekeeper.

My initial sample of gatekeepers and two key informants (they were not interviewed but provided invaluable assistance in contacts and support) (Peek and Fothergill 2009) then allowed me to engage in snowball sampling. At the conclusion of each interview I asked each participant if they would be willing to connect me with others who could share a different perspective or relationship with water (Biernacki and Waldorf 1981; Charmaz 2006). I continued this process until I had to leave. Most interviewees were able to provide at least a few names, and in some cases contacted them on my behalf. Towards the end of my time in the Valley, the same names started coming up when I asked for recommendations, which provided validity to my sample. I also took advantage of "spontaneous recruitment" in which a relative, friend, or community member appeared during the interview and was invited to join in (Peek and Fothergill 2009). Not only did this add to my rapport as a researcher with interviewees, but allowed me the flexibility to conduct interviews spontaneously. Analysis of my data occurred throughout the course of my interviews allowing me to adjust questions and probe in certain areas to follow a particular theme that was emerging from the data. This enabled me to restrict my sample and focus on including stakeholders that brought depth to my sample (Eisenhardt and Graebner 2007:27).

My final sample of participants included 25 total interviewees, in 23 interviews, all but two were white. Three were women and two of these women were farmers, the other worked in a related industry. 17 of those interviewed were farmers or ranchers and 14 of them worked on family farms. I defined a family farm by ownership of the land farmed or ranched for two or more generations. All but two owned or worked land in the subdistrict. Of those who did not engage in farming or ranching, their professions included journalism, engineering, management, fertilizer, and health care.

DATA COLLECTION METHODS

To answer my research questions I used a combination of in-depth interviews and participant observation. Before entering the field, however, I reviewed relevant documents on the subdistrict and recent newspaper articles on the process in order to be familiar with key terms, topics, and issues.

Review of Relevant Documents

Although I did not engage in a formal document analysis, I did access and review documents to provide basic context and familiarity with key terms (Reinharz and Davidman 1992). First, I reviewed recent news articles both in the local paper, the Valley Courier, the regional paper, the Pueblo Chieftain, and online articles. These documents provided me with a general picture of who the key players were, the organizations involved, and the basics of the situation surrounding the formation of the subdistricts.

Next, I reviewed the court documents that covered the two cases covering the formation of the subdistricts, the Annual Replacement Plan, and the Plan for Water Management. These documents provided information on the set up and administration of the subdistricts as well as providing me insight on probing questions during interviews. Basic knowledge of these documents also allowed me to build rapport with interviewees as they perceived that I was familiar with key terms and ideas, but could also provide greater insight into these issues. My minimal interaction with relevant documents facilitated my ability to triangulate with in-depth interviews and participant observation, adding validity to my findings (Neuman 2006).

Participant Observation

I conducted participant observation in June and July of 2012, as well as January of 2013. During this time I attended subdistrict board meetings, conservation district board meetings, and

Roundtable meetings. I also conducted observation along side my interviews, on several occasions participating in the function of the farm or ranching duties, and riding along on errands necessitated by farm work. Attending meetings permitted me to make contacts in the community and provided the opportunity for me to meet people prior to interviewing them, which helped establish rapport and build trust (Rubin and Rubin 2012). A few of my interviewees even told me how they heard about me from someone else who met me at a meeting. Often these informal references piqued their interest enough to consent to an interview.

After these sessions I would either sit down and record or write up field notes detailing my experience and observation (Emerson *et al.* 2011). Conducting interviews in an agricultural area often means lots of driving. During the drive home I would record my field notes and transcribed them later. Writing and recording field notes took anywhere from 30 minutes to several hours. Writing up field notes after meetings was often difficult because of the socialization that would occur after these meetings. Often a group of people would head to the local bar for drinks and food and invite me to join them. This demonstrated both my acceptance into the group and provided another venue to participate. However, it often meant a late arrival at home. In these situations I would begin writing as soon as possible in the morning.

Becker and Geer (1957) contend that participant observation provides a yardstick against which to measure the data gathered in my interviews. Participant observation assisted me in gaining a more thorough understanding of the terminology and local knowledge of my interviewees. Second, participant observation provided the opportunity to understand more than could be revealed in interviews alone as I witnessed things participants may not have thought to talk about in interviews; often prompting questions or conversations that otherwise would not

have arisen. Third, participant observation allowed me to verify information I gathered from documents and interviews. (Becker and Geer 1957)

In-depth Interviews

I conducted in-depth interviews in June and July of 2012, with one follow up interview in October of 2012. These interviews were predominantly one-on-one and in two cases with two interviewees. Interviews usually took place at a location of the stakeholder's choosing—often an office, home, field, restaurant, coffeeshop, and in one case, a golf course. My sample included 22 men and three women; all but two were white. My shortest interview was 30 minutes and the longest almost four hours, with an average of an hour.

Each participant was asked to sign the consent form and fill out a face sheet in order to have the interviewee's contact information for follow up questions and a courtesy thank-you note (see Appendix A & B). The interviews were recorded with a digital voice recorder with an external microphone. Prior to turning on the recorder I explained to each participant that I would like to record the conversation in order to focus on them and not on taking notes during the interview, allowing me the attention to probe certain topics further (Emerson *et al.* 2011: 29). All participants consented to interviews and three used my offer to turn off the recorder when they shared sensitive information.

My interviewing style was based on Rubin and Rubin's (2012) responsive interviewing model, which allows the interviewer to guide the conversation while also being flexible in response to the participants' experiences. My interviews followed a progressive style in which easy topics are broached first to build rapport before moving into what may be more sensitive areas involving water, conflict, and personal impacts (Rubin and Rubin 2012: 107-112). The interview protocol (see Appendix C) follows a non-schedule standardized form in which similar

information is desired from all participants, but must be tailored to their specific circumstances (Denzin 1989: 105). The individual interviews produced data on: 1) the individual and overall situation of water in the Valley; 2) the social impacts on individuals, families, and the community, both positive and negative, of the groundwater management plan; 3) the groups or social organizations that have been involved in the formation of the plan; 4) the process of developing the groundwater management plan; 5) and individual's perceptions of what the future will look like for water and agriculture in the Valley.

Recording and Transcription

Recordings were downloaded onto my computer as soon as I returned from interviews. Each participant was immediately given a code name and their consent form and face sheet stored in a lock box without a reference to their code name. Code names and real names were stored in a password-protected file on my computer. Transcription occurred during the fall of 2012 and winter of 2013 by myself.

DATA ANALYSIS OF INTERVIEWS AND FIELD NOTES

Before beginning the coding process I read through each of my interviews a minimum of twice. By this point I was becoming familiar enough with the material to begin to see larger themes emerging, however, I refrained from highlighting a single code until I read through all of the interviews. This allowed me to keep an open mind and let the data tell its story to me instead of me imposing my vision on it (Corbin and Strauss 2008). At this point I utilized NVivo software to code sections of interviews that showed larger themes, events, examples, ideas, and concepts (Charmaz 2006; Rubin and Rubin 2011). Grounded theory codes will provide me with the "bones of [my] analysis" (Charmaz 2006: 45). Through the process of coding I began to see a picture of what is going on in my data and I also began wrestling with what it means. I went

through several phases of coding. First, I engaged in initial coding, in which I found big-picture themes. Next, I utilized a more focused coding, which is a selective phase where the most significant and/or frequent initial codes are synthesized through sorting, integration, and organization of the data (Charmaz 2006). Finally, I followed with axial coding—this type of coding follows a developing major category. Axial coding assisted me to "sort, synthesize, and organize large amounts of data and reassemble them in new ways after open coding" (Charmaz 2006: 60).

At various points throughout the interviewing, transcription and coding process I engaged in summarizing through memo writing (Charmaz 2006; Rubin and Rubin 2010). Memo writing served as "the pivotal intermediate step between data collection and writing drafts of papers" helping me synthesize and recognize important information (Charmaz 2006: 72). Not only did it prompt me to analyze my data early on in the process, but it also made my work more concrete and manageable.

SITUATING MYSELF IN THE RESEARCH

According to Adler (1987: 87), "we are the research instrument." Therefore, it is important to explore my role in the research setting and how I will both influence and be influenced by it. Because I am a former member of the community with strong ties to some individuals affected by and knowledgeable about the groundwater management plan, I felt confident prior to beginning research that people would be willing to talk with me because we shared a personal connection to the research (Curtis *et al.* 2000). However, it is important to point out that I did not take sides in the issues at hand, rather, my goal was to gather information from as many different perspectives as possible in order to create a rich and nuanced understanding of the social impacts of the plan.

As an Americorps volunteer fresh out of college and then as a community member, I made Alamosa, in the heart of the San Luis Valley, my home for six years. During that time I became well integrated into a number of communities in the area. I was heavily involved in the non-profit sector working at two different non-profits and partnering with several others on joint initiatives. It was through this work as well as an Americorps position at the Food Bank Network of the San Luis Valley that I met and developed relationships with several farmers and ranchers in the area.

The close nature of rural communities meant that I often saw some of the participants in social settings outside of interviews and observations and in some cases was invited to socialize with them. Therefore, based on Adler's (1987: 33) descriptions of different types of role membership I took on a mix between peripheral and active membership roles. The peripheral membership role involves creating a research persona for the time I spend in the field and use of gatekeepers to access other parts of the population. As a peripheral member, I was limited by the outside nature of my involvement—I am no longer a member of the community and am unable to commit long-term to the group (Adler 1987). Nonetheless, based on my experience within and familiarity with the community I fluctuated between a peripheral and active member. Since I am a former community member and have several relationships with participants, some likely viewed me in more of an active membership role since I participate in the core social events and share some commonalities with certain members. Adler (1987) argues that this state of flux is a natural part of the research experience as my involvement in the setting naturally ebbed and flowed.

Warren (2001) contends that issues arise in the field because each fieldworker is a gendered person with a body, and this affects their role in the field and the research that is

available to them as the "research instrument" (203). Since most of my participants were older males, I was very aware of the gendered field issues I could encounter as a female researcher. In support of Warren's (2001) argument, there were very few women in the political and public realm of water management as women are also usually steered away from these areas. However, also in accordance with Warren (2001), I found that being a young, white female offered me an easier time gaining access and building rapport and trust in the field than males. The lone female I met who worked directly with water users in a management capacity corroborated my experience.

CHALLENGES AND LIMITATIONS

The nature of research involving humans fundamentally means there will be some methodological challenges. The main challenge I encountered was limiting the scope of my research. Early into my interviews I was advised by an interviewee to restrict my focus to subdistrict #1. This advice was heeded due to time and feasibility constraints. Not only did it allow me to gather a greater depth of data, but also it reigned in the scope of my research. However, it did limit the perspective of this thesis. There were many people who did not own land in the subdistrict, with informed perspectives who I was not able to interview due to time restraints.

Another limitation of my research is the inability to document or remember exactly what is happening as it is happening. This means recording how people are enacting their lived experience as they enact it. The meaning of these actions can often be misinterpreted or assumed based on my own experiences (Emerson *et al.* 2011). Part of this stems from not being able to complete field notes in an immediate manner, as I prioritized building rapport and trust through invitations to social gatherings.

CHAPTER 4: GROUNDWATER: THE INVISIBLE ACTOR

> It's not worth anything if you don't have any water, there's really nothing that's worth anything to anybody.
>
> Larry, farmer

> Most people understand we have to cut back, but we're trying to unscramble an egg. We made this wonderful scrambled egg plate and then figured out: we put too many "somethings" in there.
>
> Sam, water engineer

INTRODUCTION

Groundwater is invisible. Not in that it can be seen through or is intangible—it is quite tangible—but that we do not possess the ability to directly see it and the ways it interacts with the soil under our feet. It exists under the ground, out of sight. When water is visible, above the ground, we call it a lake, a pond, or a marsh. And yet, groundwater is connected to those visible points—they are supported by groundwater. The height of a river is supported by groundwater. When the water table drops, these bodies of water are also affected. The effect on people who are dependent on this resource works much the same way—in this line of thinking, groundwater is a central actor in shaping human social systems around farming and ranching in the Valley. Farmers and ranchers in Subdistrict #1 have always been dependent on groundwater to uphold the water table, and thus, their livelihoods. If the water table drops and does not recover, it can no longer support the livelihoods of all. In this case, the water table did not decrease naturally. Plentiful groundwater created the perception that growth was ideal and drove expansion in farmland. Over 3,300 high capacity, agricultural wells are licensed in the area. People plant crops, raise cattle, marry, have children, build lives, and get up every morning based on the presumption that the water is there and will continue to be there. Because groundwater is invisible it was overused. People could not see the aquifer dropping and therefore, they were

blind to the way it shaped the development of the community, the impacts of its decrease, and what it would mean for their way and quality of life.

THE VALUE OF WATER

The San Luis Valley (from here on referred to as "the Valley") is considered an agricultural community. By that phrase people generally mean that the economy of the area is based on agriculture, or that the predominant industry is agriculture. When people say that the economy is agriculturally-based in the area, they mean that the area relies on its agricultural production for its economic viability as a community. However, in this chapter and the next, I review findings that indicate that fundamentally this is a surface and ground water based community even before agriculture. Without the surface water, no one would have settled the Valley. Without the groundwater, the area would not have grown to the size it is today and become so dependent on agriculture. At its root, this is a water-based economy in which the health and well-being of the agriculture industry relies on the water flowing out of the mountains and under everyone's feet. Without the water there is no agriculture, period. Nor is there a larger Valley community to add social and cultural diversity that makes a community worth living in.

Reflecting on their dependence on water, farmers and ranchers often mentioned the idea of being "whole." Ranchers or farmers with very senior surface water rights on senior ditches were referred to as "closer to whole," "more whole," or "drought proof." The less surface water you have, the "less whole" your operation is. Larry, a second-generation Valley farmer in his early 60s lives on the eastern side of Subdistrict #1. He describes how the difference between being more or less whole impacts people under the Subdistrict #1 plan,

> Without any surface rights at all, you're paying $75 an acre foot for every bit of water you pump, some of the farm quarters in the valley, specifically in the Sargent area, have two or three ditches that supply surface water, and are closer to being whole than a lot of us are.

Being "whole" also refers to whether or not your water extraction equals your input. When farmers pump groundwater to water their crops they are now part of the augmentation system within the Subdistrict, thus, if they have surface rights, those rights can count against or augment the water they pump. Therefore if Farmer A has 100 shares of surface water, which he places in recharge ponds[4] and the meters on his wells record that he pumped the exact same amount, Farmer A owes nothing. But, if Farmer B pumps more water than she has surface credits, she will be able to subtract the amount she augments with from her total usage and only pay for the amount of water not covered. However, Farmer C—who has no surface credits—must pay for every drop of water he pumps. Thus, the monetary value of water impacts farmers and ranchers who are "less whole" to a greater extent than those who are "more whole."

Jim, who mostly farms spinach and lettuce, is in his late 50s and lives and farms on the western side of Subdistrict 1. When I sat down with him, he pulled out maps of the subdistrict showing the canal system and which canals serve which areas. "The gray ones," he said, pointing to a swath of area in the north and northeastern part of the subdistrict,

> 50% of them will be out of business [with the Subdistrict plan]. The Billings [canal] I think will be whole based on what they divert. So you hate to see—essentially this much [puts his hands around a quarter of the farms in the subdistrict]—go out of business. And a lot of this out here is not suitable for anything but small grains and alfalfa, which is a high water use and they're only going to be able to grow half-circles, if that. So you're looking to take that out of there, it would devastate the agriculture in the valley.

The ability to be "closer to whole" or "whole" is determined by one's surface rights. Better rights mean you pay less for water because you have the ability to offset your pumping. Jim raises the issue of geographic location as an important variable in whether or not a farm or ranch is whole—not whether it is suitable to grow crops. How whole you are determines your

[4] Recharge ponds are used to allow surface water through ditches to soak back into the ground to recharge the aquifer. Farmers usually locate these ponds near their wells, so that ideally, the water increases their pumping efficiency.

dependence on groundwater and within the subdistrict everyone is dependent on groundwater because almost no one in the area flood irrigates, and there are no drought proof ranches located there either. As Jim explains, the health of agriculture in the Valley is dependent on the water available.

Perception of Plenty

In spite of the dependence on water, farmers and ranchers in the area had not previously been concerned about the availability of groundwater. While very few would argue that a resource like groundwater was unlimited and eternal, it was pumped as if this were true. Sam, a water engineer with a big moustache, has been closely involved in all water matters in the Valley for over 30 years. Back in the mid-1900s, he explains, "the science that ties surface to groundwater wasn't anywhere close to being understood and so we just drilled wells." With limited information and very little understanding of how the aquifer functioned, it seemed to be a resource without end. Even today, when more advanced scientific measurements put the total amount of water in the aquifer at around 2 billion acre-feet, Charlene, who moved to the Valley to farm and ranch in the 1970s with her husband, expresses what she perceives as the inability to fully comprehend the complexity of the aquifer. "Anything geological is really mysterious and no one really can understand it." This lack of understanding fed the disconnect between users, the state, and the resource.

Clint, a rancher who wears the quintessential cowboy boots and hat, works in water management in the Valley with one of the irrigation districts. He describes the mindset he saw and sometimes still sees in regard to the groundwater,

> Up until 2002 the aquifer is fairly healthy, [it's a] vibrant economy, it's kind of live and let live. People are over-pumping, applying more water than what the potatoes need… people weren't monitoring their water. Now we had guys… really measuring their water use and trying to be efficient, but I think generally, most operators were "there's a water

> supply. Well it looks kind of dry out, I'm going to pump some water—take a couple more passes around." So that was our starting point.

What Clint describes happened across Subdistrict #1 as the norm did not involve being conscious of how much water you were using because it seemed unnecessary. People operated under the unspoken assumption that the water would be there. This operational assumption doesn't mean that people were trying to be wasteful, but were unaware of the potential impacts of their pumping and watering choices.

Some farmers, like Ted, who together with his son have a second and third generation family farm on the eastern side of the subdistrict, have some surface rights with a ditch company. But they know their rights are pretty low in terms of priority, and cannot be counted on to provide them much recharge.

> All of our water is ---- ditch, which isn't the best of everything, but it is what we have and back 40 years ago nobody knew, nobody knew. We just did what we could….

Forty years ago it didn't seem to matter where your water came from because there was plenty in the ground to use and thus surface water was not viewed as an essential part of the equation. Other farmers, like Bradley, a third generation valley farmer in her mid-30s, inherited wells that were not adjudicated in court and therefore, under the new subdistrict system, were no longer legal. While attempting to rectify the situation she realized that the paperwork had never been filed for the wells.

> I think back then it just wasn't that big of a deal, people didn't worry about it. There was a lot of water—it was a lot more green. It didn't feel like something you had to worry about.

Like Ted discussing the ditches, Bradley expresses a similar lack on concern towards groundwater through her predecessors neglecting to finish the legal process of adjudication of

wells. This nonchalance that Ted and Bradley describe came across in several interviews about past actions of farmers in the subdistrict.

Expansion in Farming

Unconcern surrounding groundwater in the Valley from the time wells first started being drilled became part of the cultural environment in farming and ranching. Finishing the paperwork for a well was not the most important thing to do in daily operations; just as which ditch you were on didn't seem to matter because people acted on the assumption that water would continue to be there. The invisible nature of groundwater enabled this mindset. Surface water would rise and fall each year and that change was immediately perceptible, but changes in groundwater were not. Groundwater was, in practice, treated as an unlimited resource and the physical and geographic properties of it influenced how people built systems based on it, thus, groundwater itself, both as invisible and as actor, fueled an unsustainable expansion in farming.

Many farmers and ranchers identified the state government as part of the problem in the expansion of farming, particularly during the 1960s and 70s. At that point Colorado was creating laws governing the use and management of groundwater around the state. However, wells in the shallow unconfined aquifer were not curtailed. Sam describes the lack of regulation around groundwater and how the state recognized that it needed to respond.

> …we just drilled wells—didn't need a permit, didn't need anything. So hundreds of wells were drilled in the 50s and 60s. Then by the mid-to-late 60s the state started recognizing and more work was done and realized that there was a connection between groundwater and surface water. [The state] started requiring permits and we continued to drill wells….
>
> By 1972 the State Engineer stopped, said "wait a second," the deep aquifer under most of the valley—it was recognized that that aquifer was tied to the surface streams particularly on lower Rio Grande and Conejos—and the more development there was in the confined aquifer, the less water showed up in springs and so for down there on the south end of the valley. The State Engineer says, "no more confined aquifer well permits," which made everybody mad. The State Engineer also stopped well permits for alluvial aquifers, the deep aquifers, and the shallow aquifer south of the Rio Grande. He preserved the Closed Basin, the shallow aquifer in the Closed Basin where all the wells

> are—the real high intensity irrigation on the north between here and Saguache—State Engineer goes, "we'll leave that open because it's not tied to the Rio Grande, it's a closed basin, we don't have to worry about it." The deep aquifer shut off, but he left appropriations of ground water available in the area. That went on until 1981.
>
> Now, even the locals are going "well there's so much well production that my old well isn't working as good as it used to cause the water table had dropped." So, the State Engineer issued another moratorium on the shallow aquifer in the Closed Basin which was the only place left to get a permit. Since 1972 everything but the Closed Basin unconfined aquifer and since 1981 in that closed basin shallow aquifer, there's been a moratorium on new appropriation of groundwater.

However, not everyone views the state as acting responsibly in the matter. Bradley, who was a child in the 1970s, explains how she sees a historical lack of management by the state combine with the more current drought to create the current issues with the aquifer:

> I think there are two main factors: First, we have been in a drought for many of those years; second, the over-adjudication of water rights. From the very beginning the state ended up issuing too many well permits. And now those two factors have put us in a hard spot and I think it's hard for people to get something like that—water is such an essential, especially for our livelihood, when your business is growing crops, you depend on water so much, and groundwater, because it's dry enough here, we don't have enough precipitation.

Like Bradley many farmers and ranchers saw the state as doing too little too late to curb expansion of drilling in the unconfined aquifer.

Some, like Alfred, a sixth generation rancher on the west side of the valley, thinks the short-sightedness was motivated more by greed on all sides than a lack of understanding the aquifer or bureaucratic irresponsibility.

> It's all based off of greed, from every aspect. The state wanted more taxes, obviously the farmer wanted to expand. The counties love it, they get more taxes; the cities love it, they got more sales and taxes. It benefitted everybody, But it's like everything else, you have a limited resource—really shortsighted.

Alfred directs responsibility towards the state but also identifies the role farmers and ranchers had in applying for those permits.

Regardless of the motivations for expansion of farmland and increased number of well permits, the existence of, and accessibility of groundwater seemed to provide the answer to over-appropriated surface water and people wanted a piece of it. It had been easy to tell that surface water was fully appropriated because the Rio Grande could not meet all of its obligations. It was almost impossible to tell when and if the aquifer was fully appropriated. Johnny, a gregarious potato farmer in his 40s located in the Center area, represents many who feel that

> 10-15% of the acreage in the Valley that never should have been farmed. There are even some areas not that far from here that are questionable. They don't have surface rights; it's questionable land to begin with for farming. It's difficult to farm and then we have all these water issues.

Farmers like Johnny, who are located on the western side of the subdistrict, think that unlimited groundwater access fueled an unsustainable expansion in farmland to the east, demonstrating the influence of groundwater on shaping settlement. Larry is one of them.

Larry's medium sized operation consists of 18 quarters[5] predominantly in potatoes and barley for Coors. His father began farming by purchasing two quarters in the 1950s and Larry added to the property starting the 1970s.

> There's a lot of these wells and quarters out here—and I'm probably as guilty as anybody—that probably shouldn't have gone into production. But, the state, in all its wisdom, issued those well permits.

Larry admits culpability in the problem, but also blames the state for giving him permission to do what he requested. Sam, who works for the state in a management capacity, admits that fault rests with the state for not curbing permits for the wells.

> To be really fair about it we issued too many well permits, we the state of Colorado. We were fortunate in the 70s and particularly the 80s we got some tremendous run-off years which kept the aquifers pretty full and the river was running ok. We were limping along.

[5] "Quarters" refer to a square section of land that is one-half mile, by one-half mile. There are 160 acres in a quarter section of land. Within that area center pivot irrigation systems generally cover 120 acres without end guns leaving 40 acres un-farmed in the corners of the field. Here the term "circles" is used as a synonym for quarters.

In spite of his identification of responsibility in participating in expansion, very few farmers like Larry saw ending their operations as a way to change the situation. Instead, blaming the state for the ultimate responsibility meant they should be able to continue operating because ultimately it was the state's fault and responsibility. Years of good water meant the issues between predominantly surface users and those who relied mainly on groundwater stayed relatively dormant.[6]

Increasing the number of wells in the aquifer not only provided a way to expand production and increase revenue for the state, but it also provided an answer to a problem that had plagued farmers in the valley since they first settled there: the question of timing. In the past snow melt peaked in the late spring, several weeks, if not months before the dry season hit and crops needed water. Water storage was difficult, if not impossible, so even farmers with good surface rights needed access to water during July and August—the hot months. Digging wells answered that problem.

Bill, a potato and barley farmer who accesses his surface water via the San Luis Valley Irrigation District, echoes the difficulties other farmers expressed in accessing water at critical times:

> Even with senior rights there's no way we could raise a good crop even in a good year without wells to enhance river runoff. Because the timing is just… like our district, we'll only have on average three weeks a year where we have water. You can't raise a crop in three weeks. So the wells are a necessity for valley agriculture.

Wells pumping groundwater are a solution to the age-old problem of timing and drought. Bill identifies the connection between Valley agriculture and wells—without groundwater Valley agriculture would cease to exist in its current form. Since most farmers and many ranchers use

[6] Issues surrounding the compact agreement on the Rio Grande, Closed Basin Project and surface/groundwater interchange leading to the 60/40 agreement in the 1970s are extremely important in order to understand the disagreements in the Valley over how to manage groundwater. However, as that relates only cursorily to the increase and expansion of pumping because groundwater is invisible I don't dive into the implications of the issue here.

wells in some capacity to grow or finish crops, a depleted aquifer would be devastating to the entire community. Bill also touches on the positive impact of aquifer use in the valley. As Valley agriculture expanded, so did the population; with increased population came many changes to the area, both in farming and family structure.

Impacts of Advances in Pumping Technology

Pumping technology advances meant many things for the Valley, primarily it caused a revolution in the way of life and farming. Farming practices are always changing as new methods are discovered, new equipment invented, and many times these changes have an interesting connection with societal change. The over-appropriation of surface waters drove technological advances in pumping technology out of necessity. Pumping technology further pushed social changes within family structure. Mark, an agronomist with a local firm, explains what a typical family farm looked like prior to center pivot technology.

> … sheep would rotate through the pastures and the stubble. When that was the case, basically in the 1920s – 1975 roundabout, before the advent of the sprinklers on the landscape, we had more diverse rotations of crops grown and a little bit of livestock… We've got a situation where we've got a limited number of crops in our rotation and that number's become more limited because more farmers have gone away from raising livestock in their production systems. So it went from being sweet clover, wheat, austrian peas… alfalfa, barley, potatoes, some variation of those in sequence. We went from that to being potatoes and barley and once in a while canola maybe. But potatoes and malt barley, potatoes and malt barley, potatoes and malt barley. So it became a shorter rotation with a higher frequency of both of those crops and then it became just those crops.

Mark's description of the transition from a diverse family farm situation to the current set of predominantly potatoes and malt barley was facilitated by the invention of center pivot irrigation. Instead of planting 40 acre plots because of the limitations of surface irrigation, farmers could now plant 120 acres with center pivots, but this made planting a diversity of crops more difficult due to the differing needs of each and the limitations of efficiency.

As the third generation on his family's ranch, founded around 1900, Gary took over the family operation along with his brother in the early 1970s. For him, the transition away from flood irrigation to center pivot was among the first issues that he faced as he took control of the operation. His family possesses relatively senior surface water rights and their land is located north of the subdistrict, with some land within the western boundaries of it as well.

> All the way up through the [19]50s and 60s as long as all of our neighbors were flood irrigating those pumps would run one-thousand gallons a minute, but we didn't pump them very much—we used the canal. We irrigated for three-quarters of the summer with canal water and on a bad year, on a drought year, we would use the pump and we didn't really rely on that pump as our main source, it was an auxiliary or sort of a back up. In the late 1960s and 70s, center pivot irrigation started to come in. Our neighbors all put in center irrigation…. We had two quarters and we would irrigate maybe half of that farm on any given year using flood irrigation. We had sheep and so we would rotate our annual crops of grain, peas, and things around on the farm and we would irrigate those with ditch water and move it around. The rest of the farm was basically pasture. We rotated that pasture in with our small crops that were annual crops that we took off for sale from the farm. So when center pivot irrigation all of a sudden… we were able to farm the whole 120 acres instead of 80 or 60 every year. We were able to irrigate that. So that expanded our use by double.

Gary's experience with his neighbors changing over to center pivot, influenced and in some ways forced him to change over as well. The ability to farm double the amount of land was appealing for a number of reasons, but the trade-offs meant reduced variety, the drawdown of the aquifer, and the loss of the integrated animal/crop rotation.

While wells enabled more land to be flood irrigated, the invention of center pivot irrigation altered the landscape. The old method of surface irrigation was more labor intensive. At the time potatoes were a high value cash crop and many families planted potatoes to pay the bills. Mark discusses what this did to the rotation and diversity of crops and the farm family structure.

> … we intensify the potato rotation and more frequency of potatoes because that's what paid the bills when other things didn't. Or that's what you could most effectively grow under center pivot irrigation system… Previous to [center pivot irrigation systems,

> farmers] had flood irrigated which was more labor intensive, so more people on the landscape, more kids involved in farming. When families went from flood irrigating to center pivot irrigation, there wasn't as much demand for cheap labor or kids on the farm—a factor which really turns into cheap labor cause you pay them in food. That's when people started going away to college—kids—and parents said, "we've got the option of paying someone to irrigate or put up the sprinkler." And many said we're going to put up the sprinkler and do it ourselves. So that facilitated the expansion of potatoes, because it became much easier to manage the irrigation of potatoes and most other crops too. But the potatoes were the highest value crop even in that diverse rotation for most years.

Potatoes were a high value crop at the time and most farms planted some in order to have cash on hand. This enabled them to invest in center pivot technology, children to go off to college, and removed the family from being based in a subsistence lifestyle. Thus, access to the aquifer, combined with technology brought modern prosperity to many farms in the SLV.

Today, Clark's land is usually in a potato/barley rotation. His family arrived in the valley in the 1950s and he returned after college to continue the family farm. He, like many others, sees the prosperity brought by center pivots as a positive thing for the area, and not just for its financial benefits:

> The advent of sprinklers is what made this general area prosper, if you will. They started coming in about '60, about one of the first one was in about '64 or '65, within a mile of here. After that it was just about the only way to go, you know. Especially here where the ground is sandy and doesn't hold much water, so it's a way to be more efficient with your application with the sprinkler. So we put our first one up in '78 I think and before that we couldn't do much with the wells we had. You just couldn't. You know once sprinklers came and they dropped the water table down to eight or nine feet—that was a good thing because the salts went with it.

The eastern portion of Subdistrict 1 is considered a closed basin—meaning there is no natural outlet. Water moves across this part of the valley from the west and settles in, traditionally keeping the water table high. Clark identifies another benefit of the increasing number of wells in the shallow aquifer and center pivot irrigation; besides increasing prosperity for farmers and reducing the work load, using and running sprinklers drew down the water table making muddy

fields more accessible to farm machinery, and drawing away the salts, making the soil healthier for growing plants.

However, output continued to exceed input and the aquifer continued to drop. For 10-20 years, the impact of the receding aquifer was a benefit to farmers. David, a farmer in his mid-30s in the Center area describes the mixed benefit of the receding aquifer.

> When my grandpa bought this he said his neighbors always said he'd never be able to grow it because it had too much water underneath it. He had to put drains in to get rid of water—that was in the 40s, before pumps. The water table must have been just at the surface. It's crazy. Once the pumps came in, it was actually a benefit because when they were irrigating they had all these salt issues with the crop coming up and the sub-irrigation.

Several farmers besides David described how their equipment would get stuck in the mud from the high water table, preventing them from cultivating their fields. The salts would rise to the surface when the water table was high, causing excessively salinized soil, unfit for crop production. But, as the aquifer dropped, the issues with salinity disappeared as well. However, the prosperity brought on by the aquifer was bought at a price.

Gary is passionate about ranching—it's the only life he's known. He spends his summer migrating his cattle from pasture to pasture around the Valley and parts of New Mexico every few days because his ranch alone cannot support his herd. He's recognized around the valley as a progressive rancher and views his animals and his operation as part of a holistic cycle, improving land and soil quality. Gary was in the process of transitioning from sheep to cattle around the time center pivot irrigation came to the valley. When center pivot irrigation gained a foothold on the aquifer Gary noticed changes almost immediately. At first they seemed positive, but he says he quickly saw negative impacts.

> The efficiency of the sprinkler system caused a problem because we evapotranspirated all of 85% of that water into our crops and we created an economy based on that increased evapotranspiration and that capturing of the water that used to be lost to the aquifer.

> Within 5 years we had to put on a sprinkler because we couldn't run [surface] water to the end of the field, I mean, it just went in the ground and disappeared because the aquifer started to drop.

Even though his family was suddenly able to irrigate all 120 acres, the water—now being sprayed above ground and not spread across the ground—was not sinking back into the aquifer and replenishing it. Thus, when they did use their surface water it would not travel as far across the field because the aquifer was not high enough to support it. Instead, the water sank into the ground to replenish the aquifer that was dropping due to center pivot irrigation. Surface water was, at least for Gary and others like him, disappearing. By this point, even if he had wanted to turn back, he couldn't. The water table was too low to flood irrigate his land.

Like using credit, unable to see the money they were spending, the agriculturalists were spending more than they were making. At some point they crossed an invisible line in the soil under their feet in which the groundwater they depended on and had benefitted from started taking things with it as it retreated. David was a child in the 1970s and remembers what the water table was like when he would help out on the farm and how the water level has dramatically changed since then:

> I can remember as a kid that we could dig a five foot hole for laying a line or something and we'd have water in it. Now it's 30 feet lower than that and it's 30-35 years later. I can remember when I was five or six it was like that. We had really good water in the 80s… Since the 2002 [drought], we were around 20 [feet], so we've dropped it 15 foot in the last 10 years in this area.

For several people I interviewed the significance of the water level dropping dramatically impacted them, perhaps because it dropped so quickly. Bradley, also has strong memories of the water levels changing rapidly during her lifetime on the family farm.

> We used to have a ditch running right along here (points outside house). All these ditches used to be full clear into mid-summer, even later. My brother and I used to just dig down, probably a few feet, I don't know exactly, and find water. I was telling you in 1999, that summer, --- and I dug a pit to roast a pig and we dug down, about five feet and we started

> to see water at that time. That was shortly after I took over the farm. By then everything's got center pivots and less water, but we still had it. I guess about five years ago we had a smaller yard well that was about 30 feet—it went dry. That was one of the times it really hit me hard that what a huge change we've seen in a really short amount of time.

The 1980s were relatively high water years, and the 1990s were, if anything, not extreme in either direction, but the drawdown trend in the aquifer continued. However, livelihoods were cultivated based on an invisible and relatively unknowable resource, and they had reached their tipping point. The farmers and ranchers of the area north of the Rio Grande found out how unstable their foundation was with the significant drought of 2002, which caused such an increase in pumping that the aquifer experienced a level of drawdown previously unseen since recordings started.

THE DROUGHT OF 2002

The aquifer provided clues that it was dropping—things like the increased dust and dying off of phreatophytes—this was nature's way of making this invisible resource, visible. But these changes took place slowly over 30 years, making them hard to perceive through the decisions of daily life on the farm or ranch. It was much easier to focus more on the very visible rain or snow: Will she or won't she? Will Mother Nature provide us with the water we think we need to survive? Or will she withhold? It is not hard to see how ancient civilizations turned to worship and attempts at pleasing the deities in a dry summer in the Valley.

Without a priority system to determine who, when, and how much, farmers can legally "punch the button" whenever they want. In other words, turn on the pump and water their fields without more than a permit and a flick of the switch. In this way, the thirst of farms who rely on the aquifer remains quenched, while those relying on surface water often deal with curtailment in short years. However, in 2002, even wells started to see the affects of the drought. Sam, the water engineer, describes what he saw,

> 2002 comes, boom! 2003 comes, and boom! It just eliminated huge portions of that aquifer. Many people around the edges weren't able to get the water they needed—big problem with people wanting supplemental wells or alternate points. It got to where we legally continued to withdraw more water, but the whole problem was we had too many wells. Well, we devastated the aquifer.

For many people on the margins of the aquifer on the eastern side of the Valley, pumps were surging[7]. The drought of 2002 and 2003 caused the largest drop in the level of groundwater stored in the aquifer since recordings began in 1976. This drop was one of the first official and quite visible recognitions that the community was having a significant impact on the aquifer and that their future may be threatened by their continued and unchanged use of the resource.

The focus here is not on the process of community organization around the depletion of a natural resource, but rather how collective action is an attempt to make the invisible—groundwater—visible, so that patterns of use can be changed to become more sustainable. The subdistrict plan, covered in Chapter 2, is an effort, whether intentional or not, to make the connection between the health of the aquifer and the health of the community visible. The Plan for Groundwater Management developed by the board of the Rio Grande Water Conservation District, affirmed by a Colorado Water Court ruling in December of 2011, and enacted by the board of Subdistrict #1, seeks to make the invisible agent—groundwater—visible. However, people are all situated in a social and historical context, and for some the subdistrict plan did not seem to be in their best interest. Thus, the various responses to the subdistrict are reflections of these situated experiences.

What is Sustainability?

When Alfred returned to the family ranch about 10 years ago, he split the ranching and farming aspects of his family's operation with his brother and took over ranching. Alfred's

[7] Surging occurs when there is not enough water to keep pressure in the pump up and it begins to pump air. This causes a spike in energy use and can also damage the pumping mechanism.

perspective comes from his experience as a "Valley-native" who spent a good chunk of his life living and working outside the Valley. For Alfred, an advocate of lifelong learning, history is one of the greatest teachers.

> We want to forget reality and the reality is we are using a limited resource… Mining is a perfect example. Creede has what, 200? 300 people up there? But during the heydays thousands lived up there, but the limited resource was gone, so things changed. Our community is based on natural resources.

In looking to Creede, less than 50 miles from his home, Alfred sees a place built, shaped, subdued, and ultimately changed by its dependence on natural resources. Without mining Creede would not exist, but when the mines were no longer profitable people moved on and the town shrunk from a heyday of 10,000 people. New industries, such as a theater company and artist community developed. Today, Creede's population is a fraction of what it used to be because the natural resource could no longer support such a large population.

To some, the loss of population in the farming community must be avoided. In fact, this is one of the main ideas that drive the development of the subdistrict plan. In mining minerals once the resource has been fully exploited or is no longer economically viable, the population shrinks in accordance. However, explains Clint, the story of water in the Valley diverges from the story of mining.

> This system has the ability to recover. That's what makes us unique from any other area in the state and probably the country. This aquifer has the ability to respond if we will restrain pumping and we can have some water to put back. It shows that responsiveness.

This aquifer is resilient—it can be refilled. Minerals cannot be put back in the earth, but in this case, water can. And if the aquifer can be used as a storage device, then withdrawals can be structured in a sustainable manner, so that with proper management, the same amount of people can maintain their livelihoods. The underlying idea is that it is preferable to spread the losses thinly around the community rather than have a sizable chunk of the population lose their

operation entirely while the rest of the operations remain unaffected. But before that plan can be worked out, the area needed a working definition of sustainability, a goal to work towards.

Sam sits behind his desk piled high with charts, notebooks, and stacks of paper. He points to a chart showing the level of the aquifer from 1976 to present (see Figure 4.1).

> Not only do we have to offset our impacts to the river, we have to operate this aquifer in a sustainable manner. We can't be down here in the basement. We have to operate in this range right here: 200,000-400,000 below where we were in 1976. Why? Because that's why. [He points to various points in time to show when the aquifer was high and within the range. He then points to the difference between that and where we are now]. We've got to figure out how to get back 800,000 [prior to 2012 farming season] feet of water minimum just to get back to where the State Engineer requires us to be. If there is no runoff, you can't gain, and you go the wrong way.

The functional definition of sustainable in this context is a specific number range, now post-court order, enshrined as a mandate by the State Engineer. Return the aquifer to 200,000 – 400,000 acre feet below the 1976 measurement and augment depletions to the Rio Grande and it will be called, "sustainable."

Gary disagrees with this definition. As a rancher who tries to embrace a holistic view of both his and his cattle's role in the world, this understanding of sustainability misses the bigger picture.

> None of [the plan] is based on sustainability, it's based on just an accounting system—it's helpful, and I think we'll use less water, just because of the economics of using that water. But, beyond that it's a little shortsighted, I think…

Returning the aquifer to the "sustainable" level described in the Plan is dependent on a reduction in water use and snowpack levels coming back up. Gary's point is that considerations like snowpack not returning to previous levels, snowpack melting too early, or even who can afford to keep pumping if commodity prices for certain crops stay high were not taken into account in the definition of sustainability. For Gary, both in his approach to the use of groundwater and the way he manages his ranch, sustainability is about integrating the bigger picture.

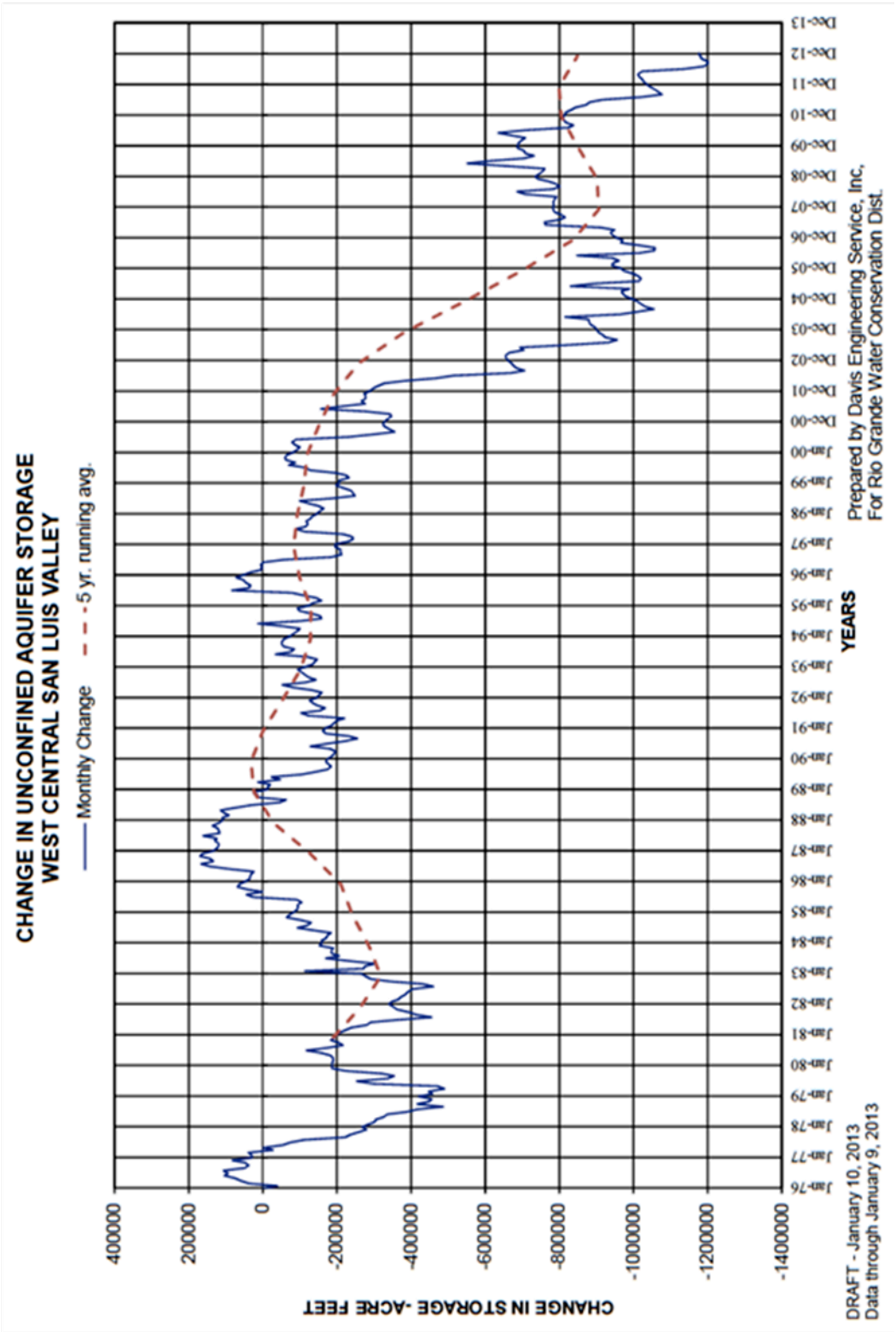

Figure 4.1. *Change in Unconfined Aquifer Storage since January 1976.* (RGWCD 2013)

As Sam and Gary point out from different perspectives, without runoff, the aquifer cannot rejuvenate. Many farmers and ranchers spoke of the need for Mother Nature to cooperate, particularly Larry who sees her as an essential part of his ability to create a livelihood.

> I have Mother Nature for a business partner. I can guarantee you something is changing and it may be cyclical, but the weather has changed in the last 30 years. And, to some people it's cyclical, but it's all depending upon snow in the mountains. If this thing keeps going in the drought direction that we've seen the last couple years, we're done. Period. So that's the other x factor in the equation is it has got to snow, that's the only thing to it. But, that being said, it always has and its come back.

Not only does Larry point a noncommittal finger towards climate change, he also quite adroitly identifies the crux of the subdistrict plan: it is dependent upon there being adequate recharge to the aquifer. But that is only one part of returning groundwater levels to the sustainable level desired. Withdrawal and recharge must come back in balance. In order for that to happen people must make the connection between their actions and the health of the aquifer.

Becoming Visible: Groundwater's Role in Ecosystem Health

Financial difficulties and difficult decisions about the future of their land would come later, first, would be the impact on the landscape. Measurement wells had been informing people that the water table was dropping for almost two decades, but this was interpreted as a blessing for those with water logged fields. Bergkamp and Cross (2006) note that groundwater supports ecosystem services and often that connection goes unrecognized. In this case, the high water table had supported a level of plant life called phreatophytes. These are plants with deep tap roots that could survive extended droughts because their roots could reach groundwater. Examples include alfalfa, cottonwoods, and some native grasses to the area. Phreatophytes not only provide vegetation on an otherwise barren landscape, they also stabilize soils, preventing erosion, purify water, and can be used as fodder for cattle.

For Bradley, these changes have had a deep impact on how she views the land, her quality of life, and her future as a farmer in the Valley. Here she discusses how something as simple as the presence of phreatophytes affects her outlook for her future in farming.

> … This used to be all trees and grass and now it's not… it's so dry that every time the wind whispers this dry powdery stuff whips up and we're even changing our practices too…. Weeds are a bigger problem overall and the way we must deal with them. Most of our quarters that we don't have an irrigated crop in we had alfalfa and they'd compete with the weeds and we'd give them a little bit of water like once a season, it would live for years. Six feet down they could get enough water to survive. It's the same with grasses; we had grasses planted in the corners to help compete with weeds, keep dirt down and they would survive because they could get a little bit of water from down deep and precipitation and now that's all changed. All that's stuff died off. How do you keep it alive when you don't have extra to water it? So it's really a quality of life—it's gone down simply because of that.
>
> And the dust. It's bare, dusty, dirty farms. To dust we will return. It's hard on everything. Tractors: we have to change filters more often, it gets just filthy cause it's just that much more dust. Trucks: we take a leaf blower and open up the trucks and blow them out. And they're old trucks, but just from sitting they get so dusty. Just one more thing to do before harvest season comes around; blow out all the dirt from the trucks.
>
> It's really been wearing on us, especially in more recent years. Just living here feels a lot harder because every spring we get a lot of wind, but it just feels like it's been getting worse and worse because there is more dry ground. There's a lot more dust and having to live in that is difficult… quality of life. I think about it a lot. Do I want to stay here in this spot for the rest of my life? I don't think I can. Especially remembering it so much better or greener or humid, even though it's never been humid here, but it was still a lot better.

For Bradley, the drawdown of the aquifer, the invisibility of groundwater, which led to its use as though it had no end, may perhaps mean an end to her tenure on the family farm. The water level dropped and with nothing holding the soil down, the winds take it to the air. Her quality of life has been significantly affected to the point where she questions whether she will remain in the area—especially if the aquifer continues to recede. "To dust we will return," she said, emphasizing the bareness she now feels in her outlook.

MAKING THE INVISIBLE, VISIBLE

The affect of the dropping aquifer on the ecosystem was visible to some who were aware of what it foreshadowed. However, not everyone noticed these changes or if they did notice they didn't consider them harbingers of ruination. Then pumps began surging and the monitoring wells showed that the aquifer had dropped an unprecedented amount to a new unprecedented low. A picture began to emerge of what lay beneath the Valley and how it fundamentally upheld and shaped the livelihoods of the people who depended upon it on the surface. The drought of 2002 brought the issue to the forefront—it was now unavoidable.

Though there was a graph showing a decline in the amount of water in the aquifer, forecasting that livelihoods could potentially be at stake, it wasn't enough to cause everyone to use less water on their own. Some farmers and ranchers engaged in conservation practices out of their own volition, either because it was part of their value set, practical, or out of necessity if they were on the margins. Ten years after the drought the Plan for Groundwater Management was finally put into action in addition to other state mandated ways of making groundwater visible: first, the Rio Grande Decision Support System (RGDSS), a computerized model that created a simulation of groundwater flow to predict the impacts of pumping; second, meters on all high capacity agricultural wells. Part of the subdistrict plan includes charging people who pump, regardless of whether they have surface rights as well, for the water they pump. This action effectively put a price on water. Prior to this as long as you had the financial resources to afford a pump you could get the water for free. Blowback for these efforts came in the form of a "race to the pumphouse" where farmers increased their pumping to make a future case for need or to demonstrate reduction and in high commodity prices for water consumptive crops like alfalfa and hay. Finally, the threat of the State Engineer's office stepping in and shutting down

wells until they each individually have court approved augmentation plans has encourage well users to support the subdistrict.

The Rio Grande Decision Support System

One of the first ways to make the groundwater issue visible is through a computational groundwater modeling system. These modeling systems are based on mathematical groundwater flow equations and are based on the physical properties of groundwater flow. Today, projections are based on a model called the Rio Grande Decision Support System (RGDSS), which takes its codes from MODFLOW, a U.S. Geological Survey code that solves the groundwater flow equations. Sam, who was involved in the process, explains the model:

> In 1998 a [state] representative from the Valley appropriated $5 million for a model of the groundwater system down in the Valley. It has five layers representing different parts of aquifer. It's on a half-mile by half-mile grid up to the mountains. It has thousands of cells and there are parameters for each cell within the five layers. Inflow, outflow from all six sides. There's evaporative loses, pumping stresses, annual flow, precipitation, on all six sides. We've been trying to—over the past 14 years—create a mathematic computer model that represents the Valley's hydrology. They calibrate it against known measurements: pressure in the confined aquifer, water table levels. The State Engineer passed measurement rules that people now have to have meters on their wells.

This is a complex model based on years of research and work. Basically, as Mark the agronomist puts it, the model's purpose is "to figure out where things are flowing." As pointed out in Sam's comment, this is part of a state initiative to understand groundwater flow in a highly complex aquifer. In order to gain more information about input and output, the state legislature passed a requirement for people to put meters on their wells, the relevance of which will be addressed in the next section.

The reason groundwater models are important, particularly in the case of the aquifer in the Valley, is because even engineers do not fully understand groundwater flow and how withdrawing water impacts other parts of the aquifer, the future sustainability of the aquifer, and

surface flows. Jim, who farms on the west side of the subdistrict, was involved early on in the formation of the subdistrict. He explains how the model assists in understanding depletions:

> When you start a pump out here—for 20 years it affects the river and it's kind of a bell curve. If I were to turn it on right now, well it's obviously not going to lower the Rio Grande that much but it's going to create a hole right here. The river is going to eventually make its way. The engineers through the RGDSS have this figured out… it's fascinating and I don't understand a thing about it.

Jim's point is that withdrawing water via a well at a specific point creates a vacuum. That space, based on the physical properties of water, will be filled with water coming from somewhere. It's like sticking a straw in a glass; water moves to fill the space where water has been sucked out of the glass. One of the main issues the subdistrict plan is trying to prevent is damage to senior surface right owners. According to the Doctrine of Prior Appropriation, all other water use comes after them in terms of priority. Thus, if pumping is reducing surface flows, the depletion must be replaced in time and place. With 3,300 agricultural wells sucking water out of the aquifer in subdistrict #1, water is being drawn to fill the void from anywhere it is available. Jim also says that he does not understand how the model really works, but he trusts that it does.

But, computational models are not perfect, nor can scientists be absolutely certain they have all the inputs and outputs understood. There is a level of variance and educated guessing that goes on in models like these. Clint, the manager of an irrigation district, has been involved in many discussions about the validity of the RGDSS.

> You can argue 'til the cows come home what the depletions are. Depletions from a well three miles north of Center; what impact does that have on the river at Del Norte, 15 miles from there? Pretty hard to calculate. So that's where the modeling comes in, and as you know, all models are wrong. But it gives you a starting place. I refer to it as: that's the girl that we brought to the dance and that's the one we have to dance with even if she's not the prettiest girl at the dance. So we have this—a lot of the discussion about the modeling—it's a fancy spreadsheet. There's inputs, impacts, has outside influences. We know what we're bringing in from the river, we know what we brought in this year through the canals, we can measure that. We're monitoring how much was put for actual recharge. Now that the well metering program is running we know what's being pumped

> out. What's hard to measure is the natural recharge that's going on around the Valley. The melt that comes in and we know that's happening because when you look at inflow-outflow, we've got more water.

In a 2004 court case argued before the District Court, the Court concluded that the RGDSS model was "has much room for improvement" but "meets the professional standards of modeling protocol" (2004 CW 24: X.E.375). Clint's point that the RGDSS is not perfect and is an imprecise science at best must be remembered. Models provide fuzzy pictures of what is going on outside of our vision, and enable us to make decisions based on the best knowledge available. When a fuzzy picture of something we cannot see is available, it's far better than nothing, but it still obfuscates the whole, clear picture and must not be treated as such.

In spite of the court's ruling, there are several groups of people who still take issue with the State Engineer and RGWCD's reliance on the RGDSS to determine depletions and impacts. Todd is in his early 40s and writes for a publication that has an interest in water issues that affect the area. He has interviewed many people involved in the subdistrict, supporters and opposition, and attended community meetings continually since 2007. Todd feels like he has a solid picture of where some of the objectors to the subdistrict are coming from:

> I think they would also say that the RGDSS—which is the computer model that is supposed to tell people how much injury is happening and where it is happening—they feel that how that model is run and what kind of inputs are put in there isn't as transparent as it should be. So there's distrust about—overall, there's distrust about what the subdistrict is.

In the Valley, the proponents of AWDI in the early 1990s used models to demonstrate that their pumping would not affect surface flow in the Valley. The AWDI models were determined by the court to be inadequate. Since then, wariness of models and those who run them seems to be standard in the Valley—even after several presentations and meetings that focus solely on how the RGDSS works. Something a supporter, like Jim, claimed he still did not understand. But

Todd touches on something bigger than that, his perception after five years of covering the formation of the subdistrict is that there is a fundamental distrust of the subdistrict itself.

Not only is there distrust, but some people feel like the RGDSS and those who rely solely on it, miss the bigger picture. Even though Gary does not consider himself an objector to the Subdistrict, and in fact, has been involved in its formation and has held positions of authority for the board of the RGWCD, he still takes issue with the way some things have been handled, especially when it comes to the modeling.

> The so-called phreatophytes that Subdistrict #1 uses in part of the model claims that drying up of those phreatophytes is part of that equation—that's our ranch, that's our grass, our brush plants that we live on [pause while crop-duster flies over]. I knew we were in trouble when they started calling them "phreatophytes", you know, it was a shift to "phreatophytes." It's sort of like calling someone in an army a "terrorist", you have to demonize something before you—to give yourself the moral courage to destroy it… I'm very disappointed in the way the thing has kind of turned out and the way that the accounting, when the model has been put together using salvaged evapotranspiration from phreatophytes as part of that equation. I didn't understand that when they did it and I didn't have sense enough to argue against it when I probably had the chance.

Gary's frustration is that he understood too little too late. The brush plants that grow on his ranch feed his herd. As the water table has dropped, the plants no longer can reach the water, however the model counts that as a good thing—extra water remains in the aquifer because the phreatophytes are not taking it up with their deep taproots and thus, removing water. While this does not amount to a large chunk of groundwater in the model, to Gary, it not only feels personal, it misses the big picture. He feels that by calling the ground cover something foreign sounding, it has been demonized and is no longer viewed as relevant or necessary to the health and viability of the area. When, to Gary, it's his livelihood.

Metering

Part of the state requirement to create the RGDSS in the late '90s and early 2000s included mandating that every agricultural well have a meter to record the exact amount of water

pumped via that well. The meters provide data on output to the model, but also serve another function: they inform the farmer how much water they are pumping out of that particular well. David's family is obsessed with measuring their water. It all started with a "crazy" uncle who brought some new ideas about water use to the Valley in the '70s. Since then, David's family prides themselves on their water efficiency and soil health—regularly using half of what most other farmers do to grow a similar crop. No other family is quite like David's, however, most farmers are beginning to see the meters as another tool providing information to the farmer. David processes this mindset:

> The meters are actually, in my opinion, a good thing. Makes us better managers. A lot of people are like, "oh, meters, we don't want meters, we don't like being told how much to pump." But if you don't know how much you're pumping how can you be sustainable with it too?

David identifies the role that meters play in the effort to reduce pumping. You need to know your baseline before you make changes. Farmers are able to utilize the exact information of how much they pump to make decisions about soil health and varieties of crops to plant.

Knowing the exact amount of water used allows for increased efficiency in water use and many farmers like David and Bradley have embraced them. For Bradley, it has meant even adapting what they grow.

> Now with the meters we are a lot more aware. So, we've done a lot of things to try to become as efficient as we can with our water usage and even the varieties of the crops we're growing. We try to find varieties that take the least amount of water to grow. That's been a good thing, it made everyone become a lot more efficient.

As Bradley says it, simply being more aware of how much water she's using drives her to increase efficiency. Bradley also mentioned that the meters do not always work perfectly and they've had to deal with meters breaking down or continuing to count water use even when the

pump was turned off. These issues have been annoyances and frustrations, but overall she focuses on the benefits.

Another benefit of the meters is that they can demonstrate how the same crop, grown in two different places can take very different amounts of water. This can be because of the soil health, different types of soil, or even the level of the aquifer. Alfalfa has been soundly denigrated as one of the most water consumptive crops grown in the Valley, but because of high commodity prices and its relevance for ranchers many continue to grow it. Alfred has used meters to take issue with the blame being placed on alfalfa itself. Instead he sees it as an issue of soil health.

> You know how you always hear about those damn alfalfa people? "They're using too much water!" I tell you what, I grow a lot of alfalfa at this end of the Valley where our soil is still good. We leased some property over by Center last year cause we grew potatoes too. I used substantially more water growing those stupid potatoes out in that depleted sand than I do growing alfalfa here. Substantially. About 27 acre-feet more water to grow a circle of potatoes out there than a circle of alfalfa here. I found that fascinating because when they came out with metering records, people knew what was going to happen.

Alfred goes on to argue that the information about water use in different parts of the subdistrict has not been made as visible as it should because it would expose high water users and their poor soil health. Clearly there are merits and drawbacks to publicly touting conservative and efficient users of water and vilifying excessive users, this could create even further divisions in the community.

Even the meters themselves were controversial at first. Clark describes the transition:

> One of [the ballot initiatives back in the 1990s] was that we needed to meter our wells. Well, we didn't think that was an issue at the time. Well, we do now, we just do it. And so what we thought was a huge, huge deal at that time, is commonplace now.

Meters have now become the norm; the change happened and farmers and ranchers adjusted. That does not mean that everyone likes having a meter-reader from the state come onto his or her

property and monitor their water use. But nonetheless, everyone has a meter and there is increased awareness of how much water he or she is pumping from the aquifer, making the invisible groundwater more visible.

Paying for Water

The meter readings are also used to calculate how much each farmer owes the subdistrict based on how much water they pumped. Prior to this change, instituted by the PWM, farmers and ranchers did not pay for water they pumped from the aquifer; therefore, there was no incentive to be conservative with water other than personal values and ethics. Just the simple act of charging for the public resource they use "has definitely made us and everyone around us a lot more aware of how much water we're using," says Bradley.

Most of the farmers I interviewed did not necessarily *like* to pay for their water, but they still recognized the need to start paying for their use. When the Subdistrict #1 board set the pumping fees they created a scale of $45-75/acre foot, to be set at the beginning of each pumping season. Jim explains what happened next:

> They've raised [the pumping fee] because they didn't get any cooperation from Mother Nature, so our inflows are down. So they raised it to $75 for the 2012 growing season. That's the maximum you can go under the subdistrict unless we go back to court and back through our public input process to raise that.

Now that the fee scale is inscribed into law it requires another trip to court to change it in order to create a greater incentive to reduce pumping or to make pumping truly cost-prohibitive.

Richard, who is based out of a major city in the Midwest works for a large corporation that grows crops in the Valley as part of a vertical integration business model. With a plethora of fields all located in subdistrict #1, Richard has been monitoring the water situation closely. In the summer Richard and a company agronomist visit the fields every other week along with the local farmers they hire to grow the crop. Here, Richard describes the role of the subdistrict fees.

> It probably, as long as we have the water available… so as long as we have the water to grow the potatoes, the fees probably won't impact us, though they are substantial. Because potatoes, they say hope's not a strategy, but you hope the prices will be enough to cover your costs—we will grow the potatoes as long as we think we have the water.

Richard tells me they have cut back commodity planting to half a field on almost all of their fields and are not growing any wheat this year because they simply would not be able to pump enough water. However, because the corporation has a larger backing than most family farms, they have the potential to weather the subdistrict fees. The cost of water will not be an impediment to a large corporation; however, it is a huge road block to some of the smaller operations.

Some, like Jeff, strongly oppose the subdistrict; he takes great pride in what he considers a "drought-proof ranch" on the western side of the Valley. Jeff sees the fee structure as a major fault of the price that was set for water.

> That price is ridiculous. The market sets it—they can't set the price. $45 an acrefoot? This guy's making a half million in a circle of potatoes—it's meaningless. But if they're going to be plowing under potatoes this year, it's meaningful. If you socialize that water, you don't have to think about it. And, I don't know how to say it—those guys haven't had to think about it—they're second and third generation—they haven't had to think about that water, all's they've ever done is push the button.

As Jeff sees it, unless the price makes a farmer think twice about how much to plant, the fee is useless. The purpose of the fee is a way to reduce pumping in the subdistrict. If farmers cannot afford to grow their crop, they will not plant it, and more water is left in the ground. From Jeff's perspective as a surface only user, the subdistrict is taking away the risk that the market creates and putting the water "in one big pile," regardless of whether a user is pumping only or mixes both surface and ground water. Jeff also identifies those who "push the button" as people who have always had free water—it's part of a tradition and ritual. In Jeff's eyes, to be someone who just "pushes the button" is to call someone ignorant of the interconnections of groundwater to

surface water, and to other people. Those who "push the button" have not paid into a ditch or irrigation system and invested in shared infrastructure. It's like waiting in turn to get on the freeway and Jeff is next in line, but then five cars come flying down the shoulder; to Jeff it means to steal from people like him, who have first legal claim to enough water to satisfy their needs.

Regardless of the price of water, times are changing for the farmers and ranchers of subdistrict #1. Groundwater is no longer free to anyone with the money to install a pump. Todd, the reporter, describes this fundamental change to the landscape of farming in the Valley:

> We are coming into a time where people are going to have to pay the true cost of water. It's no longer unregulated. For most of this Valley's history anything that got pulled out of the ground has not been regulated and anything coming down the stream has always been regulated. So, it's definitely going to be a new era… And it's probably going to be a better era for surface water users.

In Todd's estimation, the changes being made to water management in the Valley will benefit surface water users because people pumping from the aquifer will now have to pay into a management system and take on fiscal responsibility for their use. They are also now responsible for replacing their depletions to the river, which also directly benefits surface users. It will even benefit the majority who are mixed use, because under the subdistrict plan they can count their surface credits against their pumping bill.

Fear of Management and the "Race to the Pumphouse"

By working to implement a plan to stop the unsustainable use of the aquifer, the knowledge that it could be regulated triggered a "race to the pumphouse." This "race" meant that farmers increased their pumping so that later on down the line they could "reserve" more water or could prove that they reduced their use. Bradley explains what she saw happening:

> The way our laws are, it's kind of a use it or lose it thing. If you stay here you pretty much have to continue using water and farming and that feels frustrating too because I

> think, “well, it's almost a contradiction, we need to conserve but yet if you don't..." So, some people have actually increased their use because when they look at your usage they look at period of time, especially around the time they started metering. Even around me, some made an effort to make an increase in their usage because then they can show a history of using more and the way the law works it seems to support 'if you use more you get to keep more.'

This “race to the pumphouse” is a direct reaction to the rumors that a day would come when water would be more regulated. It also seems ironic, particularly in light of the revelations that the aquifer was being mined unsustainably, that farmers would increase their use of the resource because they feared the government telling them what they could and could not use.

Johnny, who has some surface rights but relies mainly on pumping, was one of those who engaged in the race to the pumphouse.

> It seems like we've been in a race to see who can get rich before the wells run dry. And it absolutely kills me; I hate it. I hate to say it, I’ve been a part of it. It’s something I’m really not that proud of it. But you get the ball rolling and you get an economy that’s been created on a resource that’s dwindling.

Johnny identifies the shortsighted nature of the race—getting rich now, regardless of the future impacts. He also offers the excuse that this is what they’ve created for themselves, their livelihoods have been made on not paying for a resource they were mining. So when the canary dies instead of getting out of the mine, they push their luck a little further, to see if they can get just a little bit more to be ahead.

Not everyone in subdistrict #1 raced to the pumphouse. There were some who saw the canary for what it was, a warning, and backed off. Others were already engaging in conservation practices or not using wells they had permits for. David, Charlene, and Gary fall into this category and when the opportunity came up for them to fallow their land through the subdistrict in exchange for a payment they wanted to sign up. Gary spells out what happened:

> You know there's the CREP program that pays for people not to farm, but if you already can't farm, you aren't going to get anything from them cause you haven't got a basis. Or if

> you've chosen not to pump. I chose not to pump my well at --- from 2003 'til last year was the first time I used any groundwater. When I went around to see about my credits, I don't have any. And the subdistrict wouldn't pay me anything because I'm not a problem. Why would they pay me?

The subdistrict board, in trying to cut or take out high volume pumpers, inadvertently penalized those who already were engaging in more sustainable or healthy practices. As Gary says, they are not the problem, and therefore, they do not get a share of payments because when they had the opportunity to advance their own interest, they chose not to. To Gary, Charlene, and David it seems as though those who raced to the pumphouse were being rewarded for their selfishness at the expense of others.

High Commodity Prices and Resistance to Cutting Back

Another issue that obfuscates the situation with groundwater is commodity prices. Dairies have an insatiable thirst for alfalfa and hay and are willing to pay good prices. Alfalfa has continually been recognized as one of the most consumptive crops in the Valley. Potatoes, the predominant crop in the Valley had been at an all time high prior to the summer of 2012. Sam finds that high commodity prices just create another factor for the Subdistrict to fight against.

> In the last three or four years commodity prices have gone through the roof. Well guess what? Everybody goes, "I'm not cutting back anything, just tell me what I owe you, I'll write you a check, it's just another business expense, and I've got money still running out of my ears." So, here we are in the middle of a drought, and we have probably a 50% runoff, we're going to have maximized pumping again because of commodity prices, which has been going on for the last two or three years. Most people are very reluctant to cut back anything. So you've got the perfect storm. You've got no recharge, no runoff; you've got higher than kite commodities prices, and maximized profit. And you can't make it any worse. And we're trying to operate a subdistrict.

Essentially, during the summer of 2012, with the subdistrict in full swing for the first time, commodity prices were fighting against cutting back water use. For a farmer it can be as simple as a smart business decision: this is the year they make enough to cover the next several. But, if

you are in the business of trying to encourage people to curtail their pumping in order to protect the aquifer for future use, it's damning.

The Role of the State Engineer's Office

Now that subdistrict #1 has gone to court, been tried, and the PWM approved, the subdistrict has 20 years to replace depletions to the surface water users. The way many people in the subdistrict see it, either they get those depletions replaced or the State Engineer steps in a makes it happen. For Larry, it seems like a clear choice.

> If we keep doing what we're doing we're done. Either we do it or the state does it or Mother Nature does it and we'll suck her dry. This is a step in the right direction. If this doesn't work then you can have the State Engineer Office come in a do it like they did in Weld County. That scares me, that's not a good story at all. That would be a game changer and that's what we're trying to stay away from. There's a lot of uncertainty in what could develop but I think we're taking a step in the right direction. I do, I really do…

Part of what is making the invisible groundwater visible is the pressing need for action. Almost all farmers and ranchers related their fears that the State Engineer would step in and force the shutdown of wells in the Valley. The precedent for this action took place on May 5, 2006, after farmers along the South Platte River in Weld County had already planted their crops for the season. When it was shown that the alluvial wells were reducing the surface flow of the river and the group, for a variety of reasons, was unable to fulfill an augmentation plan to offset their pumping, the State Engineer stepped in and shutoff 440 wells that pumped on 200 farms along the South Platte. This action, though protecting senior surface rights, devastated many of those farmers and ranchers.

For Sam, this is the race that matters, getting the subdistrict off and running, replacing depletions and taking land out of production.

> So we're kind of in this race about whether we get our stuff in place before the State Engineer gets his rules done and through court and we end up having the State Engineer

> come in here and say, “ok boys, the deals all up. You tried, but you didn't get ‘er done. Shut your wells off until you have a decreed augmentation plan.” Then we are back to square one again. And he's right, he has all the legal authority to do it, he has the moral and ethical authority, and necessity to do it—to protect the senior rights and preserve our priority system that he's got to do something. Should have been done 30 years ago, but we kept putting band-aids on this thing until we got ourselves in so much trouble we don't have a choice now.

Not everyone agrees with Sam’s assessment of the State Engineer. Todd, who has studied water issues in Colorado since college thinks some people see it differently:

> A lot of people would probably say it isn't a race; the State Engineer is waiting for the subdistrict to settle. But, officially [the State Engineer’s office] will say they are working on the model (new groundwater regulations). They're trying to figure out different iterations of the model. But the jaded people will probably say that the State Engineer isn't going to do anything before the subdistrict stuff is worked out.

In spite of Sam’s biggest fear, that all of his and many other people’s hard work and countless hours will be for naught, some people see that the state itself has too much invested in the subdistrict plan to let it fail unless it does so on its own.

Regardless of whether the State Engineer’s office is likely to step in and start shutting down the wells in subdistrict #1, the threat of it happening is enough to motivate people to support the subdistrict and engage in some cutbacks. But not enough. In 2012 just under 10,000 acres was signed up with the fallowing program. Several more thousand acres were signed up under preventive planning insurance, but still not enough to cover the 40,000 acres needed to start the path towards rejuvenating the aquifer and maintaining a sustainable balance.

CONCLUSION

The drought of 2002 was the precipitating factor in facing a problem with roots that stretched back 50 years in the Valley. The drought triggered a series of events that caused an increase in awareness of the health of the aquifer, and in how the community dealt with and responded to the aquifer. The previously unchallenged assumption about their reliance on an

invisible resource—groundwater—is now, in Larry's words, constantly "in the back of our minds and on the tips of our tongues."

By acting as though the groundwater would always be there, the Valley grew in acres in production, in population dependent on farming and ranching, and in prosperity. As an "agriculturally-based economy," the health of the community and agriculture in the Valley is dependent upon the surface and ground water available. The lack of awareness about water issues stemmed from the perception that water was plentiful, which came from years of good runoff and kept the aquifer high. It also stemmed from people's lack of awareness of the agency of groundwater in shaping their settlement, expansion, and farming practices. People did not desire to burn through the water in the aquifer, but rather were unaware of its level because of the perceived mysterious nature of the aquifer and their blindness to the early signs of drawdown as well as their dependency upon it. Fundamental changes to the landscape occurred as the technology to access groundwater improved and the drawdown of the aquifer brought considerable benefits as well, driving further expansion in acreage. Once one person started using center pivot technology it forced others to as well when the water table could no longer support surface flood irrigation, and altered the way family life was structured as well as the kinds of crops and animals on the farm. Due to the unfeasibility of flood irrigation, no one in the subdistrict flood irrigates any longer, making groundwater vitally important to all agricultural interests.

Feelings of resentment towards the state for not providing stronger regulations against pumping belie the driving role played by increased prosperity felt by many farmers and the fact that there was incredible resistance that prevented regulation in the 1970s amongst farmers in the Valley. Since the drought of 2002, which brought to light the depletion of the aquifer, the

attempts of the RGWCD to make the groundwater problem a visible problem has increased awareness of groundwater through making meaning. Using less groundwater means more than conservation; it is an act that preserves the larger community. Meaning and value are given to groundwater through modeling, metering of wells, and a fee structure, even though the subdistrict system was developed to create accountability and responsibility for pumpers—and to protect senior surface right owners from depletions. The aquifer, as an influential actor, exerted agency in the shaping of different structures of dependency. People previously did not see how dependent on groundwater they were and thus were not always aware how valuable surface rights and wells might become. Farmers who are more "whole" have less to worry about in terms of cost, thus the aquifer creates division in the community in terms of wealth and access. Geographical and ideological relationships within the community also shape how people enact their experience with this invisible resource in the subdistrict.

CHAPTER 5: 100% OR 70%: PERCEPTIONS OF THE FUTURE OF THE VALLEY

> A guy I know over by Center—he's in his 80s now—long time ago somebody asked him about the seasons, he says, 'well, in the spring we plant, in the summer we grow the crop, in the fall we harvest the crop, in the winter we fight over water.' That's kind of the truth...
>
> Clark, farmer

INTRODUCTION

Clint and Alfred's families have been in the Valley for generations. Both men are in their 40s, they ranch on the western side of the Valley, and both speak with a wry sense of humor about water in the west. And still, both men are involved in water and agricultural boards in the Valley and state. Yet in spite of their similarities, philosophically they diverge. Their views encapsulate the larger debate surrounding the subdistrict: is this the best way to manage the depletion of the aquifer? Clint supports the subdistrict because he sees it as a way for almost everyone to survive; if everyone gives a little, sacrifices can be minimized and uncertainty abated.

> What happens if people don't pay their taxes? And they just pack up and go somewhere? What happens to the local economy, what happens to the school district, and the road and bridges, social services? That's what this effort is about. It's to provide a—some guys don't like this—I call it a soft landing, rather than a crash. Rather than just coming in and saying: you can't pump this year, you're out, 50% [of you] and somebody draws a line in the sand. What does that do economically? Socially? It's devastating.

However, Alfred sees it differently:

> The… problem I have with this plan of water management is that… I would rather see 70% of the farmers farming at 100% than 100% of the farmers farming at 70%. Economically that makes sense. Then everyone is under stress and that's not good for the community. I mean it's not good for the community to have 30% of the farmers disappear. But if that's what the resource is, then that's what should happen.

In Alfred's estimation stress on the community—via smaller parcels of land in production and lower revenues—makes for a more unhealthy community, a place he doesn't think will sustain itself. In Clint's eyes a "soft landing" will enable a larger portion of the community to survive as

only a few livelihoods based on farming will shrivel up, preserving more goods and services dependent on the farming community and creating a greater sense of stability in the larger community.

As the subdistrict plan moves forward, however, more and more land will be pulled out of production for several reasons: because it is marginal farmland, the water is no longer there to sustain crops, increased costs of production, or through the fallowing program. Creating conditions of uncertainty causes people to do things they wouldn't normally do, such as go against their ideological values or political beliefs. Even Alfred admits that loosing such a large percentage of the community creates instability, but farmers know too many plants in too small an area do not thrive.

In spite of the efforts of many to make groundwater visible and valuable in the daily lives of those dependent on it, not everyone supports the subdistrict plan. The invisible may become more visible, but with new vision comes uncertainty and one solution is not going to satisfy everyone because people have different geographical and legal relationships with ground and surface water. For some that does not mean they are on board with the subdistrict or want to see prodigious changes in the way things have been done. For others, change must be massive and swift in order to salvage any hope of a future for their operation. And still, for others, the best way to manage the situation is for the state engineer to shut down all the wells in the subdistrict, as they argue the wells are not in accordance with the Doctrine of Prior Appropriation.

Through interviews and participant observation I found four factors that affected how stakeholders perceive the subdistrict. Overarching all of these questions is the larger issue of uncertainty and agency in the face of change. Awareness of control or lack of control as water resources are depleted flows through all of these factors. The first factor is relationships to water

rights and access. This includes whether people have senior, junior, or no surface rights as well as whether they are entirely surface water or ground water dependent or use both. Water access is also dependent upon geographical location of the farm ground and ranches—one area in particular, locally referred to as "God's Country," has plentiful and reliable water compared to the farm ground located in "the margins." Second, contestation over who should be responsible for the management of the aquifer—the state or the local population—plays an important role, as the answer is dependent on their relationship with and access to water as well as how they view the importance of the third factor.

The third factor, people's impressions of the impacts of the subdistrict plan on the state of the local economy and farming community, plays a large role in whether they see the plan as in their own interest or not. For some, without a larger community and local access to equipment, fertilizer, and schools, there is little incentive to remain. Finally, the way farmers and ranchers perceive the future of farming and ranching in the San Luis Valley, as well as their own sense of agency in the face of change, has a tremendous impact on whether or not they support the plan. This chapter demonstrates the arduousness of collective action in the context of common pool resources. The different relationships people have with the problem affects how they see their interests being affected. Thus, exploring the disparate factors that shape the contexts in which actors are embedded is essential to understanding how they respond to the proposed solution and it suggests other solutions that may generate more buy-in.

RELATIONSHIPS WITH WATER RIGHTS

Water is vital to farmers and ranchers in their livelihoods and survival, thus their relationship with water rights and access weighs heavily on their perception of the subdistrict plan. Whether one has surface rights or not matters, as it influences how much they will pay

pumping water under the subdistrict plan. If one has surface rights, the seniority, or place in line in terms of priority, affects how "whole" their operation is. Regardless, almost everyone I interviewed had a few agricultural wells on their property, even senior surface right holders. Therefore, how dependent one's operation is on wells factors into their feelings about the subdistrict. In spite of possessing rights to divert water a few farmers and ranchers lack access to that water, because of their geographical location. Within the Subdistrict there is an area referred to locally as, "God's Country," or the "Holy Land." This area continues to have a high water table, and copious access to water, while those outside this area are considered to be "in the margins" in terms of water access. There are already a few cases of wells surging or drying up while farmers still have crops in the ground. Access to water and owning (or not owning) water rights is a fundamental part of how farmers and ranchers manage their operations and thus play a considerable role in their perception of and interaction with the subdistrict plan.

One of the most important facets in understanding water in Colorado is the priority system. The Doctrine of Prior Appropriation details who "owns" the right to surface water in every system. As previously discussed, the Rio Grande was over-appropriated by the early 1900s, which fueled the expansion into pumping. In the Valley there are three different kinds of relationships with surface water rights: 'Senior' rights, 'junior' rights, and people without any rights to surface water. Senior rights are older and thus more prior rights to others. 'Senior' is a relative term and since almost all of the surface rights in Subdistrict #1 are through mutual ditch companies, many farmers share similar dates if they are on the same ditch. Thus, in actuality, it can be the ditch that is considered to be more junior or senior. Junior rights are comparatively newer compared to senior, and thus farther down the list in terms of priority.

Another part of the relationship to water is whether the farmer or rancher relies on surface or ground water predominantly. Most people with good senior rights are also ranchers and rely mainly on their surface water to fulfill their water needs for irrigation of pastureland and watering their cattle. Generally, in Subdistrict #1, farmers possess junior rights and rely predominantly on groundwater to supplement their water needs and meet the needs of their crops late in the season. As mentioned in the last chapter, timing issues caused by early spring runoff, which is when most surface water is available, cause farmers to turn to groundwater to finish their crops. Stakeholders who rely on both surface and groundwater are referred to as conjunctive users.

The Number One Priority

There is, however, one right that trumps all other water rights in the Valley and that is meeting the terms of the Rio Grande Compact. The Compact, which was more fully laid out in Chapter 2, commits the Rio Grande, and her main tributary, the Conejos, to delivering a certain amount of water across the state line into New Mexico every year. Harry is very familiar with the Compact because he works in water management, and for those who govern water in the Valley, it is never far from their minds.

> On the Rio Grande, because of the compact with the downstream states, the State has made the decision that we will never fall short on our delivery to those states. That is managed by surface water right holders being curtailed by how much water they can take out of the river to meet that demand we have to the downstream states. So when water is plentiful, it's not a big deal, everyone's got all the water they need and are happy. First of all, during drought conditions there isn't the same quantity of water to divvy up between people.

After the lawsuit in the 1960s, Colorado prioritized meeting the compact so that it would never have to pay back such a heavy debt to its downstream neighbors. What Harry pinpoints is the fact that this prioritization trumps even the most senior surface rights, even though some of those

rights were established 80 years prior to the signing of the Compact in 1938. This means that in times of drought, surface users are curtailed in order to meet the needs of the Compact.

For some, this is a serious point of contention. Ted, a farmer in the northern part of the subdistrict recounts a water meeting he attended in which a senior right holder challenged the authority of the Compact:

> One guy said, “this Rio Grande compact? Why do we need to abide by that?” Really? You'll lose if you challenge that. The Division of Water Resources—their job is to make sure that the river delivers its water at the state line, that's the number one water right, no matter what anyone else has, like it or not, that's what it is. They're going to do what they have to to keep Colorado out of debt because Colorado is not going to pay that 36 million to Kansas on the Arkansas, they're not going to do that again… I know [a Div. of Water Resources employee] was there and he said, "it's not going to work that way, we will deliver water by law to the line.”

For Ted, as a farmer who relies mainly on groundwater and who has been in the Valley for three generations, meeting the Compact has been a reality for most of his adult life. Plus, because he pumps almost all of his water, meeting the Compact affects him less than it does those who rely mainly on surface water.

The fact that Ted can still turn out a whole season of crops even in times of drought more than irks some senior surface users. Harry describes the rationale as he has had it described to him by some of the senior surface users:

> During drought conditions those people who have been curtailed more get upset because there are people in the Valley, agricultural producers in the valley, who have wells and they have been allowed to continue pumping their wells. So, I look over my fence and see that you're pumping your wells and have raised two crops of alfalfa, and I've only had enough water to raise one crop of alfalfa and my water right is more senior to when you put in your well. So I'm not a happy person.

Harry has identified one of the main issues that surface users take with the groundwater users. Even though their water right technically trumps the date of a well being put it, because ground and surface waters were not traditionally managed conjunctively in Colorado, wells were not fit

into Prior Appropriation. Thus, there is nothing stopping a well user from pumping as much water as they see necessary in a time of drought. However, surface users have the restriction of the Compact weighing down on them. Their right, as some of them understand it, means their access to water should eclipse all other water use in the Valley.

Ditch Companies & Canals Systems

Water rights are managed through a series of canals and ditches in the subdistrict (see figure 5.1). Most of these ditches are cooperatively managed and have a board to oversee them, managers to manage, and ditch riders to keep them clear. Gary, who is a senior water user and lives outside the district but has land in it, describes the cooperative mindset:

> Subdistrict #1 and the canal systems were able to form because people on the canal system actually have—that's a system where they have to communicate and have to work together. They all own a share in one water right. So they have a reason to want to work together. Whereas if you have individual ranches along a small stream… based on the priority system—they can work together, but it's much more difficult. And you know the law sort of prohibits that in some ways. Priority #1 gets all of its water before priority #2. There's no sharing, it's not like the acequia system where it's much more a communal ownership of the resource.

The canal systems in subdistrict #1, for the most part, share in one water right. Plus, if you are further down the canal, you have a vested interest in taking an active role within the irrigation district to make sure your water reaches you. Gary also critiques Prior Appropriation in that an unintended outcome is that stakeholders who aren't on a ditch (or even between ditch companies) have no incentive to share with their neighbors. It's a system that does not discourage the prior user from acting in their own best interest, without considering their neighbors. However, Gary identifies one of the main advantages of an irrigation district is the communal aspect of the ditch. It forces its users to work together and communicate to make the ditch—and their crops—successful.

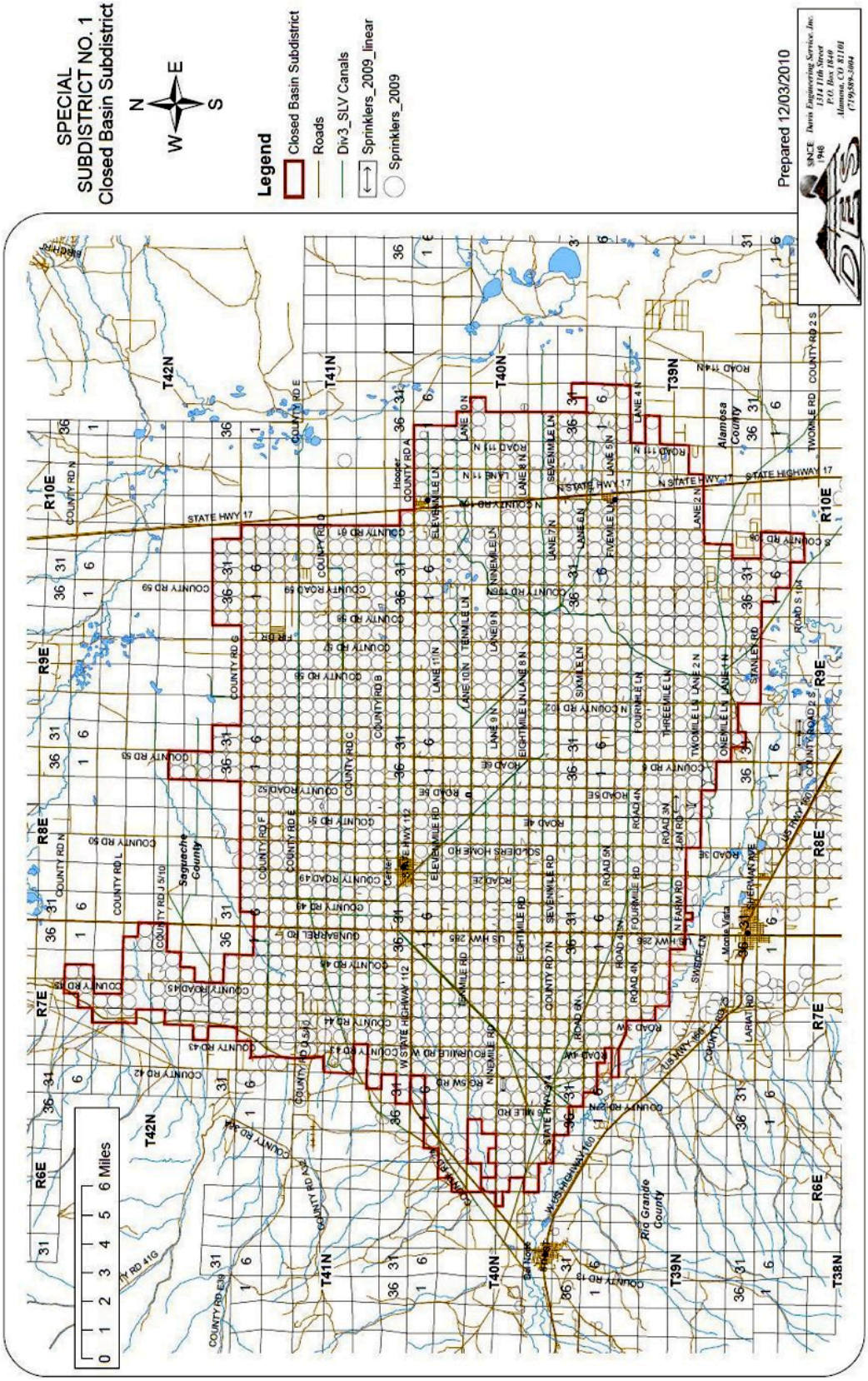

Figure 5.1. *Special Subdistrict No. 1 with canals and ditches*

Since the canals usually share one water right, there is a priority for different canals. Jim, a spinach and lettuce farmer on the Rio Grande Canal in the Western part of the subdistrict describes the set up within the subdistrict:

> Different canal companies have different amounts of water based on their decrees. The Rio Grande is the fullest, if you will. They don't quite, but almost bring in all the water that they pumped. The next closest would be... another one [laughing] I can't remember. But, these people out here don't have any surface rights. [Points to a northern section of a map of the subdistrict]

The Rio Grande Canal has the best rights in the subdistrict and when Jim comments that they are the "fullest," he could also have used the term "whole." As discussed in Chapter 4, they both imply that the water available and water used are generally equal, meaning the farmer or rancher who relies on the surface water either would not need to pump, or can offset their pumping by their surface water credits under the subdistrict.

When farmers in the subdistrict receive their surface water, they generally pipe it into recharge pits. Mark, an agronomist in the Valley, explains the journey the water takes to get there:

> When the ditches run, based on how much snow melts or snow is in the mountains, those ditches run for a certain amount of time, which means everybody on that ditch, who has this much water or that much water, may get something. If you're at the tail end of the ditch and you have the lowest priority… then you might not get much at all. What comes in though, many people will channel into recharge pits. So often those recharge pits will be located somewhere in proximity to their wells in the hope that the water placed into the ground and those recharge pits will get to where the aquifer's being drawn from—or the well they're using to produce a crop.

It's been several decades now since surface irrigation was impractical for farmers in the subdistrict #1 area and recharge pits, which used to be illegal, are one way to return water to the ground. This is how the subdistrict is able to offer credits to those with any surface rights to offset their pumping—by returning the water to the aquifer through recharge pits. In this way a farmer who is a conjunctive user can still be whole since the subdistrict now documents that they

are returning their entire surface share to the ground and pumping meters calculate how much farmers pump.

Senior Surface Users

Jeff has visited the Valley during the summer since he was a boy; his father bought a ranch in the 1960s. Around 2000 Jeff bought a ranch and the accompanying surface rights near where the subdistrict now exists. Here Jeff describes the way he views water is prioritized in practice, in the Valley:

> The basics are: what are the three best water rights in the SLV? 1) The Rio Grande Compact; 2) I can go out and push my button any time I want; 3) The regulated guy on the river. We're regulated, I know. I looked on my computer this morning and the measurement sluice at Del Norte said 315 feet. I know who has water rights and who doesn't. And, there's anarchy out there with them pushing the buttons without any payback.

What Jeff has identified is the contradiction between Colorado water law as it is written and how it is practiced. The Rio Grande Compact takes precedence, in spite of its late onset, to surface rights. Next, because groundwater and surface water were not originally legislated conjunctively, well users are able to pump throughout the season while surface users face a decline. Plus, there is the issue of well users drawing down the water table and reducing runoff from the river, thus affecting surface flows. Finally, from Jeff's viewpoint, come the surface users—somewhat forgotten in spite of the fact that their right should come first.

Sam, a water engineer involved with the formation of the subdistricts, recognizes some of the issues that surface users have to deal with. One of the main problems is that "the guys on the river totally depend on this real steep hydrograph," explains Sam, "you get water a little bit in April, a bunch in May, a bunch in June, and little bit in July and then it's gone." People who rely on surface water must deal with a decline in water as the season progresses. Even those with excellent rights still face the facts of nature—water flow decreases naturally throughout the

summer as snow melt decreases. Those with wells are able to bypass the uncomfortable part of the season where surface users begin to question whether their have enough water. Surface users see this as fundamentally unfair as they believe they have a prior claim to any water use.

Jeff is one of those surface users who relies on surface water predominantly. Here he explicates his situation:

> I'll tell you something; I have the best water right and the best drought proof ranch in the SLV. I do… and I am purely a surface guy. I've got five or six wells for [unintelligible] water. I shouldn't need them. The river reads 315 feet this morning. At 258 I go off and I know I go off. Would it go off if they weren't pumping? You know they're out there 1,000 sprinklers a day, a 2,000 foot river. Those things eat up 2 cubic feet a day.

In Jeff's estimation he should never have to rely on his wells for water. Since he has very good rights to surface water and because he utilizes technology to monitor the river available online, he knows where he's at and who gets water when. However, when he looks at the river he also is thinking about the wells pumping groundwater from an aquifer he believes supports the river. As a "drought proof" ranch, Jeff argues that his rights to water are so good that theoretically, he should never be in a situation where water should be shut off. However, he was back in 2002, and he feels has been coming too close since and senior rights wouldn't be threatened if the 3,300 agricultural wells weren't running.

In understanding how seniors view their relationship with their water rights we return to the concept of "wholeness." To be whole means that your surface water rights and your use are equal. Clint, who works for one of the irrigation districts in the Valley and owns and operates his own ranch, thinks some of the objectors to the subdistrict, like Jeff, are missing the point when they talk about being whole or having a drought proof ranch.

> But the objectors right here, they have bought into the idea that they are somehow whole. Meaning that they have enough surface water to offset their pumping year in and year out. And somehow that they are immune from the rules that are being implemented. So,

> and I know these people, I think they have gotten bad legal counsel and then there is just some general contrariness that they don't receive being told what to do. That's my view.

From Clint's point of view, the objectors are not actually whole. Most of them have wells on their property and rely on them during the later part of the summer when runoff decreases. However, if they believe they are whole, and their surface water rights are equal to or greater than their withdrawals then they share no common ground with groundwater users and view themselves as distinct and separate from the rest of the community.

One particular senior surface user, Mike, whose family has been in the Valley since they emigrated from Germany just after the Civil war, sees it differently from most of the objectors and agrees with Clint. What is surprising about Mike is that he is one of the only ranchers and farmers in the area who has no agricultural wells at all and relies entirely on his surface rights.

> I'm the only one at all these meetings that's just a surface guy. Most everybody… has a well. They did that to survive. We live too close to the river and in 1981 they wouldn't let us do it and I'm not going to do it now. I'm too far out to be drilling a well and pumping water. It'd be nice though.

What Mike highlights is that there really are very few surface users who don't rely on their wells at some point during the season, and very few people are actually "whole." In spite of the fact that Mike would like a well, he still is able to get by with his surface rights—though barely in more recent years, even with some of the better rights in the area.

One of the issues raised by Jeff and Mike as senior surface right holders, is the notion that water is being stolen from them and other senior surface users. Harry explains how this works:

> The water table is high, just 3 feet below the surface, and if I put on my surface irrigation water it's going to be pretty effective. But if the water table is 10 feet below that surface water is not going to be as effective. So I'm getting less out of the water that I have because the water table is lower. So people, in my view, in different parts of the Valley see that these wells have drawn down the groundwater level and are therefore impacting their ability to produce agricultural products.

From a senior surface users perspective their water is being sucked out from underneath them. With water being pumped out of the ground, pulling down the water table there is not as much water on the surface, the water that seniors get to use does not go as far, and it is being done by people, who objectors feel, don't have a right to do it.

Gary, who ranches outside the district, but owns some land on the western side, struggles with the way the state has legislated the water table. As a senior surface right owner, he discovered that those rights don't protect him from the lack of a high water table.

> But I don't have a right to a water table. There's a Supreme Court case, Bender v. Colorado Springs that says that I basically don't have a right to a water table to support those phreatophytes that are my crop. And so, we have these laws that I personally don't agree with. So, It's hard for me to support that, especially now that I'm starting to turn around and look at my place and I have no place to live, and no place to ranch and so here we are out renting pasture. This is not cheap; we don't get this for free. That's the impact to us personally.

Rights lose a significant portion of their value if they don't benefit you, even more so when there is no right to the water table that supports the viability of surface rights and your operation. Gary's ranch can no longer sustain his herd because something that he inadvertently benefited from, a high water table is no longer accessible to him and he has nothing to challenge in court. Thus, the impact of the aquifer drawdown to him and his family operation is significant.

Mike agrees with the unfairness of this, yet his operation is located close to the river and still has access to a relatively high water table. Instead of joining a lawsuit, he sees hope in the subdistrict plan.

> You know it's a process, it takes a long time, that's my problem is it's taking longer than I thought. You know I just need to learn patience with water. But you know, me personally, I'm used to these guys stealing my water for 50 years and now I'm to a point where they're not stealing anymore and it's a good feeling to me. It's the best I can do; you know, it's what there is. I still have faith that it'll work; there are a lot of people working at it.

Mike recognizes that plans of water management take time to enact and systems take time to respond to changes. While the objectors to the subdistrict for the most part are senior surface users outside of the subdistrict, the objectors who are within and located near it are also senior surface users. Mike fits right into this category and yet, does not object to the subdistrict and instead is hopeful that it will work, and water is no longer being stolen from him. For this and other reasons, which will be addressed later on, he actively supports the subdistrict.

Conjunctive Users

According to Todd, a reporter who has followed the development of the subdistricts for six years, a majority of the farmers in the subdistrict #1 area are conjunctive users, meaning they have surface rights through a ditch company and use groundwater. Depending on what ditch farmers are on and their farming practices and crops, the implementation of water fees can mean relatively little change in cost or an astronomical increase. Thus, the surface rights a farmer has means so much more than it did before. "All of our water is Farmer's Union," explains Ted, "which isn't the—that's not the best of everything, but it is what we have and back 40 years ago nobody knew, nobody knew." Before the drought of 2002, no one could have discerned that surface rights could come to mean the difference between breaking even or an incredible monetary input increase.

The subdistrict plan allows for those with surface rights through canal companies to use the surface water for recharge, as previously explained. However, the plan also allows the conjunctive users to take a five-year average of the amount of water they have received through their canal and use that number to offset the water they pump from the aquifer. Sam, a water engineer involved in the development of the plan explains how it works:

> If you have surface water that you brought into the subdistrict you could offset pumping with that surface water. If I have a ditch right and it goes out into the Closed Basin [the

> area generally covered by the Subdistrict] and I bring in 200 acre feet a year—that's the average—and I pump 300 acre feet, I only have to pay for the 100 difference. I've pumped 300, I brought 200 to offset my pumping, and I pay out 100. Then, [the Subdistrict #1 board] set fees for each acre-foot pumped. If the charge is $45 an acre foot and you pump 200, you owe $9000 right off the top.

In this way, those who pump the most with the least or no surface rights, pay the most. In Sam's understanding, those who have the biggest impact on the aquifer, pay for it.

Therefore, because the rights that a farmer has through a ditch determine how much water he or she can use to offset their groundwater pumping, surface rights have come to affect how farmers perceive the subdistrict plan. Clint manages one of the canal districts in the subdistrict and explains how he and his board developed their mindset towards the subdistrict:

> The philosophy that this district has always been—since it was a water short district—very open to the subdistrict concept… Now we have a few, it's not a 100%, and one of the main objectors now is one of my landowners. But he owns water in several different companies and the names don't make any difference. But, generally, this district has been very supportive and saw the need for the subdistrict concept because it's a water short district. It's pumping more than what it's putting in on average… And so, you have a different view than maybe some of the other companies, who early on didn't realize their need for the subdistrict concept because their mindset was a little bit different. They felt, well their surface water was more than what their pumping needs were.

Clint and his board were able to recognize that even in total, their district pumps more water than they are able to offset and conclude that they would actively support the formation of the subdistrict as an alternative to the State Engineer shutting down the wells in the area and demanding an augmentation plan from each. In this way, even though they would be paying for the water they pump, the subdistrict would cover their augmentation as a group. Clint also points out that some of the more senior ditch companies believed their surface rights were whole, and thus the subdistrict would not impact them as much and therefore were either ambivalent or straight up resistant to the idea. Thus, one's rights strongly affect the mindset towards the subdistrict.

For Tom, the outlook is good. As the manager of a conjunctive use farm he is pleased with what the subdistrict will allow him to do: continue to operate.

> It all has surface rights. I guess actually, I think 23 of the 25 fields have Rio Grande Canal water… Rio Grande is real good water. Then we have Prairie Ditch water on one and Billings Ditch on another. Basically this farm, with the Rio Grande water, and what the average has been… we can basically augment the farm for what we pump, we can offset with credit water.

When I asked Tom whether he had received a sizable bill the year before, he responded, "Naw. I think it was $2000 last year." The rights on the farm that Tom manages will allow the farm to maintain the status quo in terms of water use, without a significant increase in cost.

Others, however, have and will continue to experience a significant increase in operating costs. Larry, who owns eight circles in the central-eastern part of the subdistrict will be paying for about half of his water.

> All of our ground that we farm has surface water rights to the San Luis Valley Irrigation District, which is pretty junior on the river. They are not a very high priority… Some of the farm quarters in the valley, specifically in the Sargent area, have two or three ditches that supply surface water, and are closer to being whole than a lot of us are. Or even people out west on the Rio Grande Canal—they have excess water. You get out here in this area with the SLV Irrigation District—we probably augment less than half of the water we pump, so we're buying the other half.

Larry's farm is not whole and therefore, his costs with the arrival of the subdistrict have gone up. In spite of that, Larry is supportive of the subdistrict for the same reasons that Clint discussed. The subdistrict will allow Larry to continue to operate, even though he is paying more. "[The Subdistrict plan] is better than sucking it dry," Larry contemplates, "or shutting off all the wells, because then everything goes away." The increased cost, for Larry, is a better alternative for a continued future in farming.

Some farmers have made adjustments depending on what their water situation is like. David, who farms north of Center, doesn't have the "best water rights" but because of practices

his family started several decades prior, and due the type of crop he grows, his farm is able to make their rights work for their situation.

> We have three circles that are under the SLV Irrigation District and Farmer's Union Canal and we just have one that has Santa Maria and Rio Grande Canal... So we don't have the best water rights… But the first year [of the subdistrict], last year, we actually had a credit; we put more in than we pumped out. For guys in this area, I don't think there's many that can do that unless they are in a rotation like this. If they're growing grain there's no way they can be in balance—they're going to be over the limit and have to pay for their water, so it's like we've done everything but everybody else is still dong their normal pumping and rotation.

David recognizes the unique circumstances his family farm operates under, however, he also is very aware that with some major changes in the way industrial farming is done, people can bring their operations closer to whole under the subdistrict, and now they have an incentive to do that.

There are some conjunctive use farmers for whom the outlook seems bleak. Bradley's family farm has mediocre surface rights. However, her pumping use far exceeds their ability to offset.

> Our water is a combination of surface and ground. We're in a situation where we do not have senior water rights, we're somewhere in the middle. When my grandfather started buying land—which is how we acquired the water rights along with the land in the early 70s and late 60s… We have okay water rights… For me, I don't feel like my situation is sustainable. I'm seriously considering going ahead and selling my land and getting out of it because I don't feel like my water rights are senior enough to make them extremely valuable. They're still valuable… if you lose a water right on a piece of land, is the land worth anything? I think here, it's not worth much. That's the other thing I worry about now… I don't want to end up owning land that's worthless.

Bradley's situation highlights the position that many farmers are in because of the subdistrict. Nevertheless, Bradley openly supports the subdistrict plan because she sees it as the only hope for maintaining the family acreage, however, it is complicated. Bradley also speaks to the idea that land without surface water rights could become worth less as the plan moves forward. Overall, conjunctive users typically support the subdistricts operation because they see it as their only hope for survival; still, the degree of impact to each operation varies tremendously.

Groundwater Only Users

The situation is quite different for farmers and ranchers who rely solely on groundwater for their operations. While they also face the potential of the State Engineer stepping in and effectively ending their operation with a well shut down, they have had a good thing going for decades, free water. Sam, the water engineer, describes how he sees the big picture of the subdistrict:

> So if you want to be able to boil the subdistrict down to this, it's that the people that cause more impact have to pay more. That's all this is about… That's the one-liner for how this works. And of course the other line is that we use that money to try to reduce pumping. That's the two sentences you can use to describe this subdistrict with. It seems simple, but it's not.

The overall idea is that the narrative for the farmers who do not have any surface rights is changing. They will no longer be getting water for the minimal price of a water permit.

For those without any surface rights, the implementation of the subdistrict is a game changer. Larry, who is conjunctive user but has friends who have no surface rights, describes what the situation looks like for some of his friends.

> Without any surface rights at all, you're paying $75 an acre foot for every bit of water you pump… there are farmers out here in this area who have farmed for a long, long time, I mean they're pioneer farmers. Never had the foresight or saw the need to go to the expense of joining the irrigation district so they have no surface rights. There's a point back here when you could've petitioned into the District for a nominal fee. What they were wanting was you to pay your assessments every year so they could fix the dam. They needed to raise the money, so they were taking more people in. They had the opportunity to get in, but not only were they farming out there for 30, 35 years, and didn't feel like they probably needed to do that, water was there and they were pumping it. And so those people, it's a game changer for them.

The viewpoint of Larry's friends echoes Ted's earlier comment and one of the main themes of groundwater as an invisible resource: farmers did not see the need to get surface water while they had practically free and seemingly unlimited groundwater. While it is contestable whether people

who have been farming for 30-35 years are “pioneer farmers,” Larry’s overall point is well taken, for these farmers, everything looks different from here on out.

There’s another view of the plight of the groundwater only user. Clint, the manager of an irrigation district, and Bill discuss how they view the change for groundwater only users.

> Clint: It'll cost the well pumpers who don't have any surface water, they'll pay for every drop and I don't view that as hurting. But here's the other approach, Bill and the others in this district have been paying assessments for over 100 years.
> Bill: Not only this district, every irrigation company in the valley, any big system needs assessments to pay for their ditches and putting water back in the aquifer, and there's a few out there that don't have any surface rights and been pumping for free and going to have to start paying closer to their share than what the rest of us have been paying all along.

To those who have belonged to a ditch company, been paying fees, assessments, and volunteering on boards, this is a reckoning. Groundwater only users are now forced into a system where they are paying for the benefits they received from an expanding and unaccountable system.

Jeff, though he opposes the subdistrict, feels similarly.

> They've socialized the water and it's a capitalistic system making us stabilize subdistrict. They've pulled in the “John Smiths,” they've pulled in the people that don't have surface rights. What about the people like the ---‘s out there? They've spent 100 years—a family potato farm—putting money into the Rio Grande [Canal], maintaining the Rio Grande, paying ditch riders. Bet you they've spent a million dollars. And somebody with a 1975 well or something goes out there and digs a hole in the ground and they've never paid a due in their life.

Though Jeff arrives at a similar sentiment, he sees Clint and Bill, and all the others who pump as part of the problem too, not just those who have no surface rights. The subdistrict, in his view, lets the pumpers off easy, and they have made a considerable amount of money since they pay no fees and have constant water while those who rely on surface rights predominantly struggle. From Jeff’s perspective the only water that someone has a right to is surface water, and the subdistrict is merely enabling people to continue making money.

Counter to Jeff's perspective is the notion that in fact, a well permit is a form of a water right. Clark, who farms in the margins of the district, but has some very, very junior water rights describes the situation of most of his neighbors, who possess no surface rights at all:

> So a lot of this ground, well, right in here, from where we farm… basically there's no water rights… it's not exactly 100%, basically from near to the river to as far north as you farm, that whole area has no water rights, or very few, but they have wells. Well they have a piece of paper that says you are entitled to that water… a viable well permit. I can't argue that. They bought the property or developed the property and the state said: "this is your right." But the state, if they had been on top of their game in those days, they would have only needed to fight one fight, early on, and then people would have only been out the $45 or $60 for a well permit, cause they'd have just denied you and you'd have gone on.

To Clark, the situation is not as cut and dry as Jeff argues it is. People did not just start developing farm ground and wells on their own, they were permitted and encouraged to do so by the state. Though the expansion of groundwater extraction was based on a fundamentally insufficient understanding of the conjunctive nature of surface and groundwaters, people were still given permission to tap that resource and now are going to start paying for it.

Some groundwater only users are attempting to head off the big changes they are facing. Clint's role representing the area on a state level board means he tries to be aware of what everyone is dealing with. Here, Clint discusses the role the owner of one of the large operation in the northern part of the district has taken in response to the subdistrict.

> ---, he's out there, big operation, all groundwater. He'll have a different perspective, but he's been a part of the solution… he's willing to pay. But he knows there's a big change coming. Of course he's involved with the potential solar outfit out there to be able to convert the ag ground into solar, which is another subject. Everybody's got an opinion about that.

Groundwater only users are faced with a major change in they way they have traditionally operated and some of them are quite open to it and as Clint says, "willing to pay" the cost for the

water they pump. However, this farmer in particular, is branching out and finding other avenues to continue supporting his livelihood, in this case converting some of his farmland to solar.

Some groundwater only users challenge whether they're having an impact on anything other than the aquifer and take issue with the charge that their pumping is connected to surface waters. Sam, who works with the board of managers for the subdistrict describes a conversation he had with a member of the board:

> We have a person on our board that represents the people who don't have any surface water. And you know what their answer is? 'I'm using the water that's coming out underground from the mountains, so I'm not using any of the water that comes from the ditches.' Oh really? ...and you're all, well, ok. But they don't pay any ditch assessments; they don't pay any of the things that surface guys have to put up with. They don't have to have any infrastructure, they don't have to have any ditches, they don't have to have recharge ponds, they don't have anything. All they have to do is pay their pump bill. Now what's equitable about that? That's not equitable. So, they get to pay more.

It benefits groundwater only users to be skeptical of the connection between groundwater and surface water in the area. Admittedly, the hydrology of the Valley is incredibly complex and trying to understand the interconnection has stymied scientists and the State Engineer's office for decades. However, to Sam, the situation is at its root, inequitable. Regardless of how the waters are interconnected, groundwater only users have benefited from a system in which they have had few costs for a few decades.

Perceptions of how the subdistrict #1 will affect operations are mediated by several factors, but one of the main issues is water rights. People with senior surface rights, junior surface rights and no surface rights each experience the subdistrict differently and respond differently based on how they perceive it will affect their operation. Senior surface users are not united in opposition to the subdistrict, and groundwater users who will experience significantly increased costs are on the board of managers for the subdistrict. So, though rights play an important part in how one perceives the subdistrict, they do not tell the whole story on their own.

Ability to access water, whether it be through surface rights or pumping, can also have an impact on how people perceive the plan.

RELATIONSHIPS TO WATER ACCESS

When Senate Bill 222 passed the Colorado legislature in 2004, it allowed for the creation of groundwater subdistricts within the overall conservation district of the Rio Grande Watershed. The hydrology of the Valley is unique and complex, thus subdistricts were apportioned around hydraulically connected groundwater basins. Subdistrict #1 has the most agricultural wells in the Valley and has the largest impact on aquifer levels. In spite of the relative wealth of the aquifer farmers and ranchers are sitting on, geographical relationships to water access are not equal across the subdistrict. Water access in the subdistrict is predominantly dependent upon where a farm or ranch is located in the subdistrict. It is this demarcation, between the Holy Land—more reliable aquifer access—and the margins, that defines division within the community and affects how farmers and ranchers view the subdistrict and their investment in its success.

For farmers and ranchers, the ability to access the water they have a surface right to or the ground water they pump up is tantamount to most everything else. Bradley and Johnny are cousins and farm in the Center area. Together, they discuss a farming friend who is experiencing pumping issues,

> Johnny: Farmers this year are abandoning crops. Josh[8], out by Hooper, had to abandon some potatoes. He ran into not-enough-volume-of-water issue.
> Bradley: So he's not able to pump enough water into his sprinkler for the crop, not enough pressure?
> J: Yeah, he thought he was going to or he never would have planted it.
> B: Can you imagine the cost just to plant a crop and give it up? It's a huge dollar amount.
> J: Thousands of dollars an acre just to establish it.
> B: That's pretty phenomenally, and he's physically not able to pump water. Even if you have a water right, if you don't have access to the water—

[8] Name changed.

> J: What good is it? The old saying, 'we all know the worth of water when the well runs dry.' It's sad because that's what it takes sometimes for people to realize—all the warning signs are there. A falsified economy helps you deny that.

Farmers and ranchers in the subdistrict experience a variety of things when it comes to accessing the water they need for their livelihoods. Those who rely on pumping water up from the aquifer can experience surging as the water available to their well decreases. This can lead to things like what Josh faces: the inability to finish a crop already in the ground. This loss not only means Josh will have nothing to sell, but also that all the input—as Johnny says, thousands of dollars—will be lost as well. However, Johnny also points out, that the warning signs were there, farmers knew they were heading into a tough year and Josh's decision to plant was a huge risk, that perhaps at the time did not seem so great based on the hidden quality of groundwater.

One's ability to access continuous groundwater is very dependent on your location in the subdistrict. Not all locations are able to access water to the same degree. Overall the area breaks down into two segments: the Holy Land, also referred to as "God's Country," and "in the puddle"; or, the margins, which is everywhere else that is not in the puddle. This area is difficult to demarcate on a map, but Mark, an agronomist, describes its effects:

> We have Sangre's [Mountains] in the east and San Juan's in the west and they come together in the basin of the valley. There are deep troughs in the valley where that [ground] water is deeper, so there is more of it. So you go into Sargent region, the "Holy Land,"—it's because their water runs well. And part of the reason their water comes out of their well easily is because the overlying material above the aquifer is very porous and gravelly—so they have rocks in their soil. Their soil between the rocks is a bit heavier than the stuff out in Mosca so it holds a little bit more water and more nutrients. So the "Holy Land"… that region has traditionally been one of the more steady water producing water regions.

Basically, there is a large area in the middle-western part of the subdistrict that because it sits above deeper troughs and has more porous and rocky soil is able to access groundwater more easily and readily than other areas. This also means that as water is pulled in through recharge

(both naturally and human-caused) this area will recharge faster. Those not located in "God's Country" live in the margins; "in the rocks" out to the west or "in the sand" out to the east.

The difference in the geographical relationship to water between the Holy Land and the margins creates a division within the subdistrict because ease of access to water now has bigger implications about livelihoods, survival, and the future. Todd, the reporter who has interviewed a number of people within the subdistrict, paints the division:

> The way I've had people describe it to me, the most successful parts of the aquifer is heading up the County Line road between the Rio Grande and Center. Farm ground is more expensive over there in part because of access to the aquifer. I wouldn't describe it as the rich getting richer, but the wealthier farmers will survive better because they can pay the cost of water. Whether they'll make the same amount of profit, I don't know.

The picture Todd illustrates is one where because of their location, certain farmers have profited more than others, and now with the subdistrict pumping fees in effect, these farmers will produce a larger profit and will be able to afford to continue farming. Farmers on the margin—with unreliable and reduced access to water—may not be able to continue operating to the same extent, or in some cases at all.

Charlene and her husband farm in the margins, or what she refers to as, "in pockets." They have experienced declining output from their pumps for almost 20 years. Charlene is fairly certain their operation will no longer be viable.

> The problem with our farm is we are in a pocket where we just can't get at the water. We've got 30 wells and we've got the water rights but the water is just not there. So, [my husband] calls them 'longstraws,' the royalty. In his mind the aquifer is like a punch bowl and if you're in there with a short straw you just can't get [water]. But people like Sarah[9], who are in—some people call it 'God's Country'—you know you can easily get water. I mean there are people who are pumping a lot of water now, even in this situation… Our lives as farmers and ranchers are by definition uncertain. It's just the way you live. But in my opinion, dealing with the water has just really brought out the differences between the longstraws and the shortstraws and the extent to which, it's just really inequitable. I feel like, when I first heard about those guys not paying their taxes, is this going to be war?

9 Name changed.

> That's how I feel. And it's unfathomable to me how they can do that. To me, the greatest thing about life is collaboration and community cooperation. That's as important as anything else. But the extent to which these guys don't consider that…

The experience of Charlene and her husband exemplifies what other farmers in the margins know—they no longer have reliable groundwater. This brings on a crisis, which some view in terms of a conflict with an other. Charlene's husband's description of the "longstraws" verses the "shortstraws" highlights a class distinction within the farming community. The perception is that because of continued access to good, reliable water, certain farming outfits have been able to bring in large profits that allow them to continue operating, while others, like Charlene, have not. Conflict stemming from this perception led to the circulation of rumors about certain farmers in the Holy Land refusing to pay pumping taxes to the subdistrict. Support for the subdistrict is essential for people like Charlene as it provides a cushion as people like her transition away from their operations. Collaboration and cooperation make sense to Charlene because of the situation she faces.

Farmers in the Holy Land do not feel that they need the subdistrict to survive. Their geographical relationship with water provides them the ability to pay pumping fees. This will mean the difference between continued operation and being forced out of farming or ranching. Gary, who is facing an inability to access his surface rights because of decreased water table support for surface flows, agrees with Charlene's assessment.

> I think what will happen in the interim, the people who can afford to and are actually in the puddle, are going to have such a huge advantage over people who aren't. If you're not in the puddle you immediately can't afford it—the puddle being where the last of the aquifer is. And as that shrinks, everybody on the outside of that is just sitting there wondering what happened. Processing. So, they get left out.

Those who are able to access the aquifer reliably, and afford the pumping fees are the ones who will continue on. From Gary's perspective they may also end up being the ones who set the rules

in how the aquifer is managed. With the ability to survive, those on the margins lose access to power because they are no longer big players in farming.

Tom, who farms in the puddle, describes what it is like working in a location that, because of its more reliable access to water, is discussed derisively:

> This area we are in has been referred to as the Holy Land. Some in a derogatory manner… we got good water through here, our wells haven't fluctuated too bad here, they've gone down in pressure, the pivots have got down. But overall, not too bad… I know guys out east that are having problems with their wells and having water issues, looking at the people over in the Sargent area and they hate them. There's always been people in the Holy Land, who have been referred to as those rich potato farmers, or those spoiled Sargent people. So there's always been some animosity and I think it's growing with frustration with one guy out here… You see the crops and things look pretty good in the Sargent area and it just irritates the guys who don't have the water. A lot of the water quality has deteriorated as the aquifer has gone down—they're pumping salt water out there in the east country, so they can't grow the quality crops. Anyway, they're only able to farm a half circle, whereas guys in Sargent are farming full circles, just pumping the heck out of it. So, there's definitely some tension out there. I'm sure you've heard of it, people have probably discussed that very thing. Jealously, hatred are a few of the words that might come to mind, envy, they just didn't like those people over there anyway. So, here we are.

Tom's access to good, reliable water means he is not worried about going out of business or facing the loss of wells. He sees access as breeding animosity between people who have and have not; but specifically, between certain people in the Holy Land who are resistant to the subdistrict. Tom supports the subdistrict and has fallowed several half circles through the fallowing program. However, he identified several of his neighbors who have resisted the subdistrict by not fallowing their land and continuing to plant full fields and use end guns. Actions like this, in Tom's opinion, only increase the frustration felt by farmers and ranchers in the margins.

Mike, who ranches outside the district and sits on one of the local water governing boards, sees this as a big problem:

> The problem [in the Holy Land] is guys are thinking about money, not water. They're thinking about how they can make money off the situation instead of actually putting water back in the river and recovering their aquifer. That's why they call it the Holy Land north of the river, those people are all, they just think they are better than you. They're big farmers, big potato farmers, they make millions. You know so they act a little different than the rest of the valley actually.

Mike's perception of some of the farmers in the Holy Land is that they are unwilling to see how their actions affect the rest of the community and that greed is driving some of their actions. The subdistrict was designed to incentivize the fallowing program, particularly amongst the biggest users of water; because water has not been an issue for some of them that would mean voluntarily choosing to bring in a smaller profit. Mike's feeling is that the incentives should not be the entire package, people should choose to fallow because it is best for the community.

As a surface user, Gary has had his own frustrations with an operation that moved in to the west of his land. He described to me how from the moment they turned on their wells his surface flows have never been the same, in fact they have not made it to his land in years. However, as a former and current president of certain water boards in the area, he sees that the people in the sweet spot are pushing the division in the community.

> Most of these farms have never seen a drought, they don't know what drought is. At some point they are going to have to share in that. That's been sort of pushed off on the everything outside the lowest part of the aquifer, which is you know, everything north of the river in the Sargent, Center area, which is geographically the lowest part of the water table and so those guys haven't seen a drought yet. You know, they have to pay for some water that they didn't used to have to pay for, but that's not the same as not having the water in the first place. This year, there are new wells going dry on the edge of that around Hooper, Mosca. And every time those wells go dry the people in the middle lose the support of the people on the edge and so socially and politically they are starting to lose support for their idea because they can't bring themselves to actually cut back.

Farmers in the Holy Land, in Gary's opinion, need to cut back their use in order to bridge the divide in the community and to make the subdistrict successful for more than themselves.

Without a plan to provide a soft landing for the rest of the community, the Valley will fundamentally change as more and more farmers are forced out with the receding aquifer.

Water access has created different geographical relationships with water and different responses to the subdistrict. Having good water can mean people are resistant to reducing their pumping simply because they still have the water available to pump. Johnny, who lives on the edges of the Holy Land describes what the decision was like for him to plant a field of barley instead of fallow it:

> This will be the last year I grow barley. We knew we were going to have enough water on this farm here to do it and prices were good and it was solely a business decision and it wasn't the right decision. The right thing to do would have been to say, "enough."

Johnny has access to enough water to produce and finish a crop. Prices for various crops throughout the Valley were high and thus, the decision for farmers, especially for those in the Holy Land, seemed straightforward. There is money in growing certain crops, especially alfalfa. Many farmers who had access to water did not reduce their acreage. The subdistrict's goal of fallowing 40,000 acres was shy by about 30,000. However, there was a significant percentage of land removed through preventative planning insurance, which pays out earlier in the season than the subdistrict does—but still not enough, plus the insurance is for only one season. The subdistrict hopes to remove the land from production permanently. Johnny's perception of the "right thing to do" centers on what he perceives now as what is best for the whole community. Reducing his water usage and actively engaging in the subdistrict plan is a reversal in where he was months before we spoke. His impression now is that he needs a healthy, whole community and aquifer more than he needs his field of barley.

Clark explains a further division in the community that separates the people west of God's Country, "in the rocks," and those east of the sweet spot, "in the sand." People in the sand

felt the impacts of the declining aquifer first and some began using surface water for recharge immediately. Out in the rocks, where surface rights tend to be more senior, people did not see the need to recharge. Clark highlights the connection between water rights and access in terms of supporting the subdistrict. Now, Westies and Easties, all support the subdistrict because they are all facing issues with access when compared to those in God's Country.

> We've been recharging full tilt at least since '80. Every single place we can we recharge. And there was a point in time where some of the people further west—they weren't too into recharging—didn't see the real benefit or need to. And now that's kind of changed. There's been greater strides to put in recharge pits and they're utilizing that water a lot better and for the—rightly for them—for the right reasons, there's no doubt. But there's still kind of that divide between all those guys out further west in the big rocks, and out east in the big sand, and God's Country, as some people like to call it—you know that sweet spot down in the middle. But you know this is where my granddad decided to buy land and so this is where we're at.

Clark highlights the difference between the way he manages his operation and what he sees in the rest of the subdistrict. For those in the margins, recognizing the signs of a withdrawing aquifer has meant they have been engaging in recharge and other water saving actions for years, and some decades.

One of the ways those in margins have reduced their production has been through the removal of end guns from sprinklers. End guns are an attachment that fits on the end of the center pivot line. As the irrigation unit moves around the pivot the end gun sprays water further out (see figure 5.2). Ted describes his experience with the effects of end guns:

> By 1980 I had no sprinklers with end guns. Then when we purchased a new sprinkler in 1994, they put an end gun on it and it didn't take me long to disable that. When you have a system like here that pumps 700 gallons of water and then you have an end gun that requires 150 gallons to water and that end gun is going to get maybe 7% of the field but it's going to take more of its water to get it done, it just didn't make sense. And the reason why we started taking them off earlier is… you come across what [the] end gun got and see this isn't worth it, it's not there. They never did water like they were supposed to, never did get it done… You see it today, look under the end guns on the county line you see an end gun running, look at what's under. Look at where it fails. Is it worth putting 20% of your water into 7% of your land? No.

Figure 5.2: *End gun on a center pivot sprinkler system in the San Luis Valley.* Credit: Author

As I attended meetings and interviews it seemed end guns had become a symbol of squandering a resource within the subdistrict and several farmers, ranchers, and water management people spoke about others who were using them still with disdain. As Charlene describes a farmer in particular, she talks about what it feels like to see end guns still in operation and full crop circles without cover crops:

> I think [he's] still using end guns… We ran out of water to use end guns about 18 years ago or 19. But there were people who still used them… For one thing they're real wasteful, you'll have to drive down wet roads—that sort of thing, it's stupid. So, I think some of these guys are still using them… They're pumping full circles, which is just as much a slap in the face. Full circles means you have enough water…

All farmers, like Ted and Charlene, had used end guns and watered full crop circles at one point. But now, with the aquifer no longer supporting their needs, farmers in the margins view the use of end guns as a wasteful example of irresponsibility in water management, especially when they are in use in the Holy Land. The use of end guns has become a symbol of resistance or subtle opposition to the subdistrict and a "slap in the face" to those in the margins, who have been facing shortages for years.

Some farmers are looking for ways to make their location work for them. Several farmers and ranchers called attention to the fact that there are some places without good water rights that have excellent soil and some places with excellent senior water rights but not as productive soil. Location means more than just access to water, it also determines the type of soil you have to start with. Some farmers and ranchers with excellent water rights are considering renting their rights or leasing them to other farmers under the subdistrict. That way they can make money, but will not be planting their fields. Johnny sees the potential in this,

> We are dealing with less inflow and we've got to look at the soil that we have and we've got to keep that soil productive. Guys that have senior water rights that farm in not such good soil are going to have to come up with a program for guys like me who farm in excellent soil that don't have as many water rights. So I could rent his water rights and this land can continue to be productive. It's been talked about for years. There will be ways for the most productive land to continue to be farmed.

Other farmers, like Jim, see ideas like this as a way to assist young farmers just starting out who lack access to good rights or finances to purchase land in God's Country.

Geographical location and relationship with water is an incredibly important factor in understanding how people view the subdistrict. Location can determine a farmer or rancher's ability to access the water they need to support their crops. When combined with water rights, location helps explain the ways that people see the subdistrict as helping their cause, whether that is the survival of a healthy community, providing a soft landing as they leave farming, or making money through renting their water rights. Those who unofficially oppose the subdistrict, or formerly opposed it, do not experience the same declines and access difficulties as those in the margins. Often their actions are perceived as a "slap in the face" to those who are facing declining livelihoods. Inequality between the farmers who have access and those who do not, creates an artificial class structure in which conflict arises. This conflict has manifested itself in the belief that those with money—the farmers with greater access to water—have more power in

the planning and implementation of the subdistrict. This has the potential to sideline the subdistrict if it those in the puddle do not cut back their pumping and reduce their use to help more of their neighbors in the margins weather the storm.

THE INFLUENCE OF "WHOLENESS" IN GOVERNANCE

It's not a popular thing to claim to like government or desire its presence more in daily life. This is especially true among the farming and ranching community in the Valley. Almost everyone was resistant to the government being involved in anything, either from the state level or locally. However, two things happened that began changing people's attitudes towards subdistrict formation. First, people began to realize there was a problem with the aquifer and how fragile their situation actually was if they were not whole. Second, people saw the situation on the South Platte and Arkansas—where the State Engineer shut down a number of wells that were depleting river flows—as a harbinger of what would happen if they didn't create their own process. People in less whole situations faced uncertainty about their water future—would they be able to continue pumping? Whereas people who perceived their operations as whole, faced a more certain water future and therefore could welcome the State Engineer in to shut down wells. As Todd the reporter explains it, the subdistrict is a way for people to avoid facing harsher rules and regulations—it's not just about saving a community or less government, it's about perceptions of survival and livelihoods. Amongst the supporters, the narrative is framed as a fight against the government mucking around in private business and a community coming together around a solution. However, it's led to the creation of what some see as a way around the law that is rooted in a desire for certainty amongst those who are not whole.

Warning Signs from Eastern Colorado

On May 5, 2006, the State Engineer at the time, Hal Simpson, forced the shut down of over 400 wells along the South Platte River. The shut down was due to a failure of the tributary subdistrict representing the wells to meet the augmentation plan requirements set out in the 1969 Water Rights and Administration act. This act incorporated tributary groundwater into the prior appropriation system. In the past, the Act had allowed the State Engineer to approve temporary augmentation plans in which pumpers could provide replacement water and continue pumping whenever there was a call on the river by more senior users. A change in the law forcing well users to have their temporary augmentation plans approved by a water court in combination with the drought years of the early 2000s meant that finding and purchasing enough replacement water and getting the plans approved through court, became impossible. In the San Luis Valley, the groundwater of subdistrict #1 has not been considered tributary to the Rio Grande, however, the fact that the State Engineer enforced the shutdown was noteworthy as 30,000 acres of productive farmland went dry and communities devastated. As Todd the reporter described it, "I know a lot of the subdistrict people saw [the shutdown] as, 'oh shit.'"

At the end of our interview Jim, myself, and a friend of his sit around a dusty table in a warehouse while Jim describes the RV he and his wife recently bought. They are planning on traveling in it extensively once he retires from farming. Jim's location on the western side of the subdistrict means he has not had much trouble accessing water and implies that he has pretty decent surface rights. He also grows lettuce and spinach, which are a lower consumptive use crop than alfalfa and some varieties of potato. Regardless, without the subdistrict Jim's operation is not whole in times of drought. When he looks at his future, Jim recognizes he is indebted to the foresight of others.

> Ray Wright and Lewis Entz had the foresight to look at the Arkansas and South Platte and said we do not want to go into an augmentation plan… if the subdistrict fails we will be in an augmentation situation like the South Platte and we will get to pump what we bring in through our surface right.

Many consider former President of the Rio Grande Water Conservation District and farmer, Ray Wright to be the mastermind behind the subdistrict plan. Lewis Entz represented the Valley in the state Legislature for 20 years, first in the House and then in the Senate. Entz sponsored Senate Bill 222—which allowed for the creation of the subdistricts in the Valley. To many in the area, Wright is a hero, to others, they subverted the system of prior appropriation. Without the subdistrict, farmers and ranchers would need to file and augmentation plan for each well they owned, creating a backlog in the court system and finding sources of supplemental water on their own.

Jim's involvement with the subdistrict formation and his recognition of the role that Wright and Entz played in it stems from his position in the Valley as a respected community member and also his relationship with water.

> I mean we don't like it. I was an objector to it. I was one of the "out Westies." I funded an attorney out of Vail to fight this, then we lost and it's like, ok, if I can't beat them that way, I'll join them and beat them from the inside. Then I started to learn about it, as we all did, most of the out Westies and we were like, "whoa this is going to save not only the valley, but us too!" And most of us, with the exception of a few, have jumped on board... All those nasty things I said about people I had to take back!

Jim formally opposed the subdistrict concept at its inception. As he said, when he became more familiar with the plan, combined with how he perceived the example being set on the South Platte and Arkansas rivers, he changed his mind as he saw what could potentially happen in the San Luis Valley. His involvement originally stemmed from a desire to "beat" the plan from the inside, but his recognition that he stood to benefit from the plan changed his mind. Under the subdistrict plan Jim is able to rent his 300 feet of excess surface water he had this year to his

neighbors who then pay him for water rights to offset their pumping as opposed to the subdistrict. Not only has he made money, his neighbor has saved money, and as Jim says, with just an augmentation plan he would be just donating that extra water to the system.

For some others who were less involved with the on the ground operations, talking to their growers or neighbors and their trust in them influenced their feelings about the subdistrict. Richard, who owns a potato packing operation and over 50 fields in the Valley, most dedicated to potato, barley, and wheat production. Richard does not live in the Valley, the headquarters of his operation are out of state. Thus, Richard relies on the people who grow for him to provide him with input on decisions like the subdistrict.

> For me it was pretty simple. I talked to several of the other growers there with whom we worked and lived in the Valley for all their lives or for a long period of time that were more posted on the water situation than I was. And I asked them what they thought about it. And they told me they thought it was the best solution for us to avoid having our wells turned off by the State Engineer after we had already planted. And I'm aware of the fact that happened to some growers in Eastern Colorado…

The advice Richard received was that if he wanted to avoid having his company's groundwater wells turned off, the corporation needed to support the subdistrict. What Richard also demonstrates is the role the shut off on the South Platte and Arkansas played in making him aware that the shut off was not an idle threat, but a possible reality.

The legal opposition to the subdistrict feels differently about the example set in Eastern Colorado. To them, it's a victory for surface rights that needs to be repeated in the San Luis Valley. When I asked Jeff, one of the main objectors, what kind of impact will there be if the wells are shut down like on the South Platte, he responded by saying:

> The subdistrict is interested in another way of stalling. The inevitable is what happened on the South Platte. And I hope it happens sooner rather than later. Sure, there will be some potato warehouses that will shut down. It will probably devalue my property. It will make it more economically stressed. But, change is all right. Something else will come

> up, I don't know. All I know is that economically it impacts me now because they're stealing my water and they've devalued water and socialized the water.

Jeff acknowledges that in calling for the state to shut off all the wells in subdistrict #1 he is also asking for impacts to his own operation. But, instead of looking to the South Platte and seeing a potential threat and insecurity, Jeff sees hope and promise for his own operation and it drives him in continuing his fight against the subdistricts.

It's Going to Save Us Too

Larry echoes the sentiments Jim had, but farms out in the eastern part of the subdistrict. While Jim has rights to surface water that surpass his needs, Larry is less whole.

> At first, I didn't like the idea, but probably most of us were against it, but as we saw what the alternatives were we were won over. I think most generally everybody in the business—there were a few dissenters out there—most generally everybody came around and realized if we don't do something we will suck it dry. If we suck it dry the state is in here big time as it unfolds. It's better to do it ourselves if we could.

Larry adds to the conversation by acknowledging the role the farmers are playing in reducing the aquifer. While he too initially felt opposition to the subdistrict to regulate his use, the combination with reduced ability to pump water along with the example that the State Engineer would indeed shut down wells, brought him around. What grabbed Larry's attention was the comparison between the State Engineer stepping in versus a plan that was developed locally. From his situation, the local solution provided the better answer as he would be able to remain in business.

Mike's fifth generation ranching operation is run entirely off of surface credits. Though he is not located in the subdistrict, his land is sandwiched between it and the Rio Grande. Mike's perspective, as someone who believes his water has been stolen by the pumpers, is informed by how he views the future of the San Luis Valley and what he believes should be the role of government.

> I didn't want the state to come in and tell us what to do, that's not a good thing, I've watched it happen in other parts of the state, and didn't like what happens so we dreamed up this idea, trying the subdistricts to keep people here basically. Because when the state comes in they just shut off wells, and it don't matter. They shut off city wells; they shut off school wells, that's just the route they take. And then you have to back in to get your permits to pump, and we thought, well you know that will devastate this valley. So we figured out we'd do an economic based system with the subdistrict…

From Mike's perspective, the future of the Valley and the survival of other farmers and ranchers impacts him directly in the form of periphery services and businesses that rely on the agricultural community. Even though his operation is whole, and he has certainty that he will have water, he sees it as being of little use if he can't access the things he needs in close proximity. Therefore, his perception of the subdistrict plan is that local generation of solutions is better than the state stepping in. Couched in terms of an anti-government stance, Mike believes he stands to lose quite a bit if the government does step in, and less with the local governance plan. Therefore, while framed around issues of the proper role of government in people's lives, Mike's interest is based more in his perception of the plans impact on his future, than the proper role of government.

Two Narratives

Resistance to government is often a major part of rural life, and the San Luis Valley is no exception. Mike's comment reveals both of the narratives at work amongst supporters of the subdistrict. One is that people do not want the government stepping in and telling them what to do. The other narrative is a "we take care of our own" sentiment. The first sentiment is generally associated with the western, individual mindset that any government is bad government and the less there is the better. The second narrative is an offshoot of that, which implies that the governance structure of Colorado does not understand the needs and values of this part of

southern Colorado. In a vigilante-like justice system, the people of the Valley are better off taking care of problems and each other as opposed to an outsider stepping into their territory.

Here, Mike further explains his resistance to government involvement in the process:

> That's the main goal, that we could do it by ourselves instead of having somebody tell us how to do it. You know, you don't like people telling you how to run your business; it's the same way. We figured as a community we could get it done, but it's hard to get the community to respond all the same… I just don't like government in here telling us what to do. I mean I understand you've got to have it, but the least amount of it you can get the better off you are.

This is a powerful narrative, particularly outside of the centers of state level governance—the urban outsider other for the rural Valley. In the San Luis Valley, which is culturally and physically isolated from the rest of the state, "government" can be a bad word. This isolation tends to draw people who wish to be outside of governmental restrictions and "intrusion" into their daily lives. Due to the highly-regulated nature of farming in today's political climate, farmers use their anti-government stance as a source of vetting others—if you don't hate government intervention, you are clearly not a farmer. The Valley is also a place where residents have experienced outsiders coming in and buying up water rights to ship water to the Front Range of Colorado—to the growing suburban residences, drying up farmland. Thus, resistance for agriculturalists in the Valley to outsiders is a form of protection.

The other narrative at work amongst supporters of the subdistrict #1 plan is that, in Jim's words, "I think we need to take care of our own." This idea works as the opposition to state intervention, if we take care of our own, we don't need the state. David feels this sense of community very strongly as is evidenced by his role on the subdistrict board, shaping its forward momentum and working towards its success.

> But I feel like just completely turning wells off isn't the answer either. There's got to be some that have to be turned off. They aren't being used or the land isn't productive. Those need to be shut off and that's hard, but I just hope, it's not about individual operations any

> more—we've got to take care of ourselves—but, I guess we can have half the Valley in production and not have all the communities, it'd be different… I think it's about the whole community and trying to get it fixed.

David's operation is one of the few in the Center area that is almost whole—his operation is incredibly water efficient and thus, he is able to make due with junior surface rights. However, if the State Engineer were to step in a shut down wells, David feels that his situation is not certain or secure. Thus, for him, the larger narrative of fixing the problem for everyone takes precedence over the state engineer. He also touches on the idea Mike raised earlier—that the community would not be the same if they lost half the operations.

Not everyone supports the subdistrict. It is in comparison with the views of those who don't that it becomes clear that the narratives are a product of what people perceive as their best interest, and how that is shaped by their access to water and water rights. In his years of covering the development of the subdistricts, Todd sees the subdistrict as "groundwater users' response to keeping from facing harsher rules and regulations." Most of the supporters of the subdistrict are not whole in their water rights. If the State Engineer were to act as he did in Eastern Colorado, many of their careers would be over. However, amongst the opposition to the subdistrict, in spite of an anti-government stance, the opposition thinks the state should step in and enforce laws they see as clearly in their favor.

Jeff's water rights are among some of the best and he considers his ranch to be whole. Therefore, even in times of drought, Jeff feels certain that his operation should be fine—if all the wells weren't pumping. Jeff recounted a conversation he had with Ray Wright, before Wright's early death.

> I really think that maybe if everybody did their own individual plan, we would know who [used] what. Put it in one big pile, tragedy happens. It is a private property right and you can say 'beneficial use' and everything else, but it's a private property right. And you put it all in one big pile and say there, this is ours—that's socializing there… I told that to

> Ray Wright one day and he laughed at me, he says, "what do you do? You want the state to run your water or do you want us local guys to? Do you want the subdistrict to?" I say, I think the state is such damn—you know I looked at my date and thought about my property… and people know what they bought and if they can steal something from you, they will. You just fight for ownership, you've got to fight for it. That's why not everybody's an owner.

To Jeff, the state's role is to guarantee his property right of surface water rights. When he and Wright discussed the matter it became apparent that they were coming from two very different angles, not necessarily about the role of government—Jeff considers himself a staunch conservative—but about private property. Since Jeff is able to support his ranch with his surface water credits he is not threatened by what happened on the South Platte River, he is emboldened by it. Therefore, even though he is not a fan of government intervention, he needs the state to step in and shut down the wells, because that is, in his mind, his best interest.

The two narratives at work amongst the supporters—the no government in our business and we take care of our own—confirms their own feelings and creates group cohesion amongst a group of people who are water insecure. Through the process of watching wells get shut off by the State Engineer in Eastern Colorado, many in the area who were initially resistant to more regulation, recognized this was no idle threat. This influenced many of them to join up with the subdistrict as their best chance at survival in farming in the Valley. Therefore, when it comes to the role of governance and political values, it is less about who makes the rules, than it is about the future. For those who oppose the subdistrict, the South Platte brought hope that the same thing could happen in the San Luis Valley. For these people, it is about the basic guarantee of protection of property and livelihoods. The main difference between supporters and opposers here is not their stance on governance, but on their access to water and water rights.

THE STATE OF THE LOCAL FARM-BASED COMMUNITY

Impressions of the impacts of the subdistrict plan on the state of the local economy and farming community play a role in whether farmers and ranchers see the plan as in their own interest or not. For some, without a larger community and local access to equipment, fertilizer, and schools, there is little incentive to remain. Since, at its root, this community is groundwater dependent, a plan to cut back the use of the aquifer will have impacts on this ability to access goods and services in the community. To those who have tenuous access to ground and surface water, the subdistrict is a win for them, but it is also a win for the broader community in their view because it supports the idea of everyone giving a little for the maximum amount of survival.

Harry, who arrived in the Valley in the early 2000s, works in water management and is involved at the state level as well. He feels that he has an overarching understanding of the issues facing the subdistrict and the long term survival of the area.

> If the concept doesn't provide some adequate economic benefit to producers as they change the manner in which they go about their business, with shutting their wells, paying to pump, fallowing their land, then that will manifest itself in all sorts of ways in terms of the economy of the Valley: reduced sales taxes, reduced purchases. I don't think we'll know the impacts on county property, tax income, agricultural ground isn't taxed very highly now, but if you take 40,000 acres out of production, then what does that do to property taxes? Hence, what's the rolling effect of that in terms of providing services to the community? None of these counties have historically been rich counties; we're not in Boulder County.

What Harry sees is an economic ripple effect due to groundwater management. If farmers have access to less water, they will grow less, some farmers will go out of business, others will be producing less out of necessity or prudence. With less income and fewer farmers the overall community will feel the impact of fewer resources circulating in the community. Unlike other counties in the state, Harry points out, there is no other industry or influx of resources.

Clint sits at his desk in the small office of the irrigation district he manages while we talk. He too sees that agriculture is a driving force in the Valley and in the state of Colorado as well, and this is a main reason why many people do not think the State Engineer's office will step in unless the subdistrict blatantly fails.

> I think that's the story that people forget is the agricultural economy is the driver for the SLV. That's why the state has invested a lot of money in this effort. This effort locally has cost a lot of money. But the state sees the importance of the agricultural economy for this part of the—well agriculture in general for Colorado. It's still bigger than tourism by a long shot… Agriculture is huge, when you look at the linkage to other jobs.

Clint touches on the spread of agricultural connections throughout the community. Not only does a change in groundwater use affect farmers and ranchers, but also fertilizer dealers, tractor and parts dealers, and the Coops. These people shop at the grocery store, bank at the local banks, and send their children to the schools. An impact to the base economy of the valley will ripple out in its impacts.

Several people, including Clint, perceived the importance of the agricultural economy particularly as it related to the schools. Several of the 14 school districts in the Valley received monies through the state of Colorado to build new school buildings in recent years. Eleven of these districts have enrollments that are less than 600 students and cover vast areas of land. Bruce, a soft-spoken and intelligent man in his early 50s, works in the potato business and is to almost all potato related decisions in the Valley and State of Colorado. Bruce believes that impact to the schools could be one of the most detrimental in the Valley, and is unfortunately related to location. "There are certain school districts located where there are not as many surface water rights and it's going to have an impact on land values over time and then that will effect their tax base," he thinks. If the agricultural community that supports the tax base goes away, those schools will lose enrollment—this indicates the loss of connection and community that has

built up in different areas and could drive families to leave their community as their children's schools suffer.

Not only are people's direct livelihoods potentially threatened, but so too are the goods and services that have made their way into the Valley. Rural communities often lack access to different services and opportunities such as excellent health care and activities for young people and Harry, who works with a variety of stakeholders on a daily basis and is connected to the non-profit and healthcare sector, wonders what will happen to the non-profits that provide resources to the community.

> What happens to the Boys and Girls Club? If there's less money in the community period, there is less money to go to the non-profits from the general population. I have no idea how much of their income comes from the ag community, but it just follows—that ripple effect. I think that perhaps to me is my biggest concern, what is the ripple effect in the community of what's going on?

What Harry also identifies is the uncertainty of how much of the community is actually dependent or impacted by a loss in the farming community. He still believes the ripple effect will have significant impacts throughout the Valley, but his comments also point to the fact that no one really knows how deeply the area is interconnected.

Several other interviewees expressed concerns about the state of the economy in the Valley, by discussing specific areas. When I accompanied Charlene, a first generation rancher and farmer, on a trip to the butcher, she expressed concern about the electric cooperative that supplies the area.

> The electric company—we're with the REC [Rural Electric Cooperative]—they put together a program whereby you disconnect your power on those circles you are not farming. They're not going—I mean our electric bill is usually like $90,000 and this year it'll be a few thousand.

Charlene's operation is on the margins of the subdistrict and the aquifer and they are close to retirement. Most likely, Charlene's operation will go out of business taking around 1,000 acres

out of production. But, Charlene and several others wonder, what happens to electricity prices when that impact is multiplied 40-fold to reach the acreage the subdistrict must take out of production?

Another aspect of the economic and social community are the parts and fertilizer dealers. Clark's involvement in the subdistrict has meant he attends most meetings involving water in the Valley and has spent many hours discussing and thinking about the topic. His farm is on the margins and he is actively working to both to improve his own chances, as well as the community at large. He shared an insight he had on what it means to have a robust farming community:

> I use the analogy that right now you could probably go, within the valley, maybe 7 to 10 places and buy a 1 inch bearing off-the-shelf any day, six days a week you can find those type of things. If you get to the point where you have one or two places where you can do that you've lost that competitive edge versus competition relative to pricing or maybe now you have to start stocking your own. If you have to stock your own that's tough, and people think that it'll never change, why won't it change?

Stores carry products because they have a market for them. If the market is reduced, simply put, the price will go up and fewer materials will be accessible. For the farmers who are left, costs go up as well. People whose livelihoods were dependent on those jobs are forced to transition or leave as well.

Tom, who grows a mixture of potatoes, barley, and wheat, took me to visit with Luke, who deals in fertilizers. The two middle-aged white men gave me a tour of the Luke's operation and discussed some of the finer points of the economic impact of the water situation on the local businesses. In Tom's reflection on their conversation he noted that Luke made

> … an excellent point about the Rio Grande Commodities and the Monte Vista Coop. They have grain elevators and, but, they're growing other varieties than Coors barley, but Coors is the best deal around. But they're kind of a pain to deal with, they're very picky and sometimes just a real pain. So some of these guys just don't like to grow from them. So they grow barley for Rio Grande or the Coop, barley and wheat. But with this lack of

> water and subdistrict I know Rio Grande doesn't have hardly anybody growing for them this summer and it's the same with the Coop. You don't see near the wheat or that scarlet barley around, so it will take its toll on those businesses.

A vast majority of the farmers I spoke with at some point in their lives grew barley for Coors. A few, including Tom, estimated that a majority of Coors' barley comes from the SLV, with the remainder originating in Idaho and Wyoming. However, a few others believe that only a small percentage of Coors barley comes from Colorado. But what Luke notices and Tom picked up on, was that the local businesses that purchase barley and wheat directly from the farmers—and keep money within the community—had almost no one growing for them. One of the distinctive benefits of these two businesses is that when Coors rejects the barley a farmer grows for them under contract, farmers can turn to Rio Grande Commodities or the Coop to purchase the barley. Thus, a farmer can still find an outlet to recoup some of their losses.

Every year the local banks provide a few million dollars in loans to farmers and ranchers. According to Sal, who runs a ranching and farming operation outside of the subdistrict, everyone, including banks, depend on farms. Sal takes a personal interest in the events that unfold in the subdistrict as he believes what happens in subdistrict #1 will determine what happens in all of the other subdistricts as they come together. Sal is a man of many hats, and one of his hats is banking.

> Everybody else depends on farms. You have the farm manager, employee, whatever else, and agriculture related businesses have loans. So we need to consider what the impact is going to be on the community in terms of them being able to surface loans….

Clark agrees with Sal's assessment through his experience visiting with farmers from other states at conferences. He describes a conversation he had with a farmer from Idaho who had trouble getting a loan because there were no banks local to his area.

> The person that ultimately said, "we approve your loan or we don't," they didn't know this guy, they had no clue who he was! The only thing they knew was what was on the

> paper: the numbers, the ratios. That was all he was to them, the numbers. That really opened my eyes a long time ago to the fact that we have people here that know what you do, they know that you are willing to work from seven to eleven to pay it off or whatever the situation may be. That just opened my eyes to the fact that, man, we've got it made.

Clark's assessment of the banking and loan situation in the valley demonstrates that farmers, ranchers, and bankers rely on their personal connections and relationships in doing business. But, if finances become strained, will the local banks still be able to function in the same manner?

In Clint's estimation, as someone who answers to a managing board made up of farmers, the answer to that question is fuzzy. Relationships and past-experience do mean something, but are they enough to justify a risky loan when water is short or expensive?

> So the question comes back: can that individual producer, "Farmer Jones," we'll call him—we have a few out that way (gestures over his shoulder). So "Farmer Jones" over here, can he weather the storm by cutting back 50%? Or is he so debt-heavy the banker won't let him do that? We tried to get the financial community engaged in this discussion five or six years ago and they kind of sat around the room like this [makes a blank expression on his face]. And I know these guys and they're good guys, but they're responding to a board and we have lots of banks here in the valley now that are not locally owned, they're owned by some banking corporation that have a board of directors somewhere other than the SLV. But the financial community has a huge stake and they have in the past been in this change.

Farmers live in a cycle of debt and plenitude. Many work off the farm themselves or have spouses that provide supplemental income. A woman, whose husband runs the farm while she works in Alamosa, showed me their tax forms. Their reported income was negative half a million dollars. "It was a bad year," she said, "but we'll make it up next year or the year after." Without the support of the banking community, farmers and ranchers face greater operational risks. If they lack the capital to start their operation in the spring, there is no next year.

Clark, who farms in the eastern part of the subdistrict, supports the subdistrict because it will protect his prospects, but also because he sees it as enabling his viability as a farmer, long term.

> I don't begrudge anybody for whether they have water rights for this or that because in the big scheme of things we're still united at the hip in the sense or first cousins when it comes to the economic part of the whole deal. You know we all participate in it in economic or agricultural infrastructure that I think is as good as any place in United States you know and specifically to the crops we raise. Qe have strong banks that can—they know what you're doing and they can write loans out—some big ones and do all that right here. And you have equipment dealers and parts dealers and fuel and chemical and fertilizer and all those things that play into it and we all participate in it. It doesn't matter where you live it doesn't matter what you're doing, that's part of what makes you viable as a Farmer, is having access to that.

Having access to the goods and resources that have come to the community enables farmers to stand a better chance at survival in difficult times. Clark also identifies what he sees as a larger connection—each farmer or rancher is not an island; there is a web of interconnection. The flaming out of one farm or farm-related business will invariably impact another.

For the supporters of the subdistrict creating the conditions for the survival of a larger percentage of the community is about more than farming or ranching. It's about whether or not they have the tools they need within an easy distance to make their operation viable. It's about there being schools local to their community. Schools provide more than a place for educating their children; gymnasiums provide a meeting place for the community and school events serve as a source of community cohesion. One of the main reasons people support the subdistrict, besides their relationship with water rights and access, is because it allows for the ability of the community to support goods and services in the periphery of the farming industry. It is about farmers and ranchers choosing what they want the future of their community to look like.

PERCEPTIONS OF THE FUTURE

The subdistrict will accomplish more than simply managing a stressed resource, it will fundamentally shape the future of the San Luis Valley. As the other plans come online they too will change the face of agriculture. So when people discuss their support or opposition for the plan they are also discussing their sense of agency in shaping and vision of that future. As

discussed already, these views are shaped by people's legal and geographic relationships with water, and their views on the local farm-based economy. Another factor in people's perceptions is their sense of agency. Farmers and ranchers are more likely to engage in their continued survival in agriculture if they feel a sense of purpose or personal agency. This is cultivated through a variety of factors including family history, protection of private property, and the perception of other viable options in combination with their previously discussed relationship with rights and access. Outside threats have played a considerable role in water management in the past, and still play a large role in perceived threats. Finally, generational differences play a role in how people perceive the subdistrict plan with younger farmers more likely to look for new opportunities and create new connections to ensure their survival.

The Role of Familial Relations

Family history and connection plays a considerable role for some farmers and ranchers when contemplating the future of agriculture in the Valley. Viewpoints are influenced by age, family legacy in the area, and reputations just as much as they are shaped by overall connection within the community. Having children ties people to their land in a different way than it does for people without children, or whose children do not wish to continue in the business. The type of operation, whether it is a family farm or industrial agricultural operation, conditions people's sense of agency and viability in that future. For those with senior rights, some argue it's a brighter future, while those who are without senior rights and exist on smaller family-style operations the situation is tenuous.

Though many of the farmers and ranchers interviewed had children who were already taking over the farming or ranching operation, or they anticipated would, Bruce, who works for a statewide agricultural organization, sees a different impact on those without kids.

> I think when you look at it objectively though, if you've been a successful farmer and you don't have a lot of surface rights, you have choices there, they're difficult choices, don't get me wrong. You may see some of the older farmers who don't have younger generations say "I don't need this." They may try to lease out their land. Rather than get angry, they may just say, "I don't need this."

People who have no one to pass the farm along to are provided a way out to retirement with the subdistrict. They can either lease their land and water rights to other farmers or enter into fallowing contracts. Though the fallowing payments are temporary, they can provide a significant monetary resource to supplement the transition out of the farming cycle. In this way, farmers and ranchers, like Charlene, without familial connections may still have a sense of agency in their future, instead of despair or anger.

People like Larry, with mediocre water rights, a moderate amount of land and relatively stable potato contracts, face a future with increased water costs in operation, but enough water rights that will hopefully stave off massive financial pitfalls. Larry is close to retirement; he and his wife own a second home down in Mexico, and Larry is looking forward to the day when he can spend more time there. However, his son joined the business several years back. While on the one hand, the subdistrict would enable Larry to retire his fields and move to Mexico, it also creates the space for his son to have a more stable future.

> Some people see that their water is going to be worth a lot and they'll sell out and move to Mexico. You have that attitude. Then there's my son, and he's living his dream, he just wants to get up in the morning and go farm and so it'd guarantee him a future—different than what I've lived, but, it's in flux right now.

The subdistrict provides a way for Larry to pass along a viable operation to his son, who otherwise would have a difficult time accessing land and water rights. But for Larry and others closer to the end of their careers, it's a way out—people can fallow some land out of production or transition the operation to the next generation.

While it's a way out for the older generation, the subdistrict is a suggestion of hope in an increasingly water short future for the younger. David and his brother inherited their operation from their father and uncle, and are both in their 30s. Though their operation is small, their focus on seed potatoes, among other factors, makes the size viable.

> Like I said, I'm young, I have to look at it as—we still need to be doing this in the next 40 years to keep my family—even though my brother and I have all little girls, that's ok, they might want to come back and do something with the land. It's been in the family for a while. It's more about them and the next 20 years, instead of just this next year.

David explains that he is trying to think about their operation in terms of what he can do to make sure it is still viable for the next 40 years so that he and brother can support their families and have a future to pass along to their children. This perspective influences his overall optimism about the future, because he is looking at the subdistrict as a long-term solution. Developing augmentation plans for all his wells would mean the loss of at least one, possibly two or more years of planning as he waited for the individual plans to make it through the water court. Thus the subdistrict provides him with a safety net that allows for he and his brother to focus on diversifying and growing their operation even in the midst of changes in water management.

Hispanic settlers were the first to create permanent settlements in the Valley in the mid-1800s. That's when Jack's family moved up from northern New Mexico to ranch. Though outside of the subdistrict, Jack discussed how the formation and success of subdistrict #1 would influence all of the other subdistricts and his family's future.

> We've been here close to 150 years. I'm the fifth generation on the ranch and I have a son that's sixth generation. My family had been farmers and ranchers living in northern New Mexico and they came into the Valley to farm and ranch… [my brother's son] is hopefully the next generation on the farm if we can keep the farm going and get the water situation squared away. So, I'm working really hard with my … background. I'm representing this area on trying to figure out solutions and figure out how we are going to keep things going.

The legacy of Jack's family connects him to the land, the community, and the future. It also grounds his opinions in the formation of the subdistrict plan. Jack has a history in water management in the Valley and is watching the movement of subdistrict #1 closely so that he can move to protect his family's interests in the future. In this way, his connection to the past drives his actions in water management as he moves forward.

Similar to Jack, Mike's family has been in the Valley since just after the Civil War. They were German immigrants who at first settled near Hooper, but moved down to land along the Rio Grande to ranch. With very senior water rights, Mike has never needed a well, and though he does not own land in subdistrict #1 he sits on the RGWCD board that oversees the subdistrict board, and as previously discussed, he feels his interests are at stake in its success.

> There are guys… who are [fighting the subdistrict]. But to me they're people who've moved here in the last 30 years—I got history here. Everybody in this valley knows my family and it's been that way for years. There's not a town in this valley that I can't go into and somebody will know my family. Anyway, so you know that's the way I live. I've known them, I want to know them, I want to live with them. I didn't want to come into a place a have them say, "oh there's that stupid [Mike's last name] kid, he wants all the wells shut off." Well I wanted to figure out a way—well a lot of them have to be shut off—but there's a way to figure it out.

From Mike's perspective as a person with deep familial roots in the Valley and a social reputation to uphold, he feels a strong connection to seeing as many people survive the management transition as possible. In looking at the present and the future, Mike places a high value on having good neighbors, friends, and community, and considers their survival as part of his vital interests. Mike and Jack both draw from their positions and familial reputation within the community to shape what they each see as the best possible future for themselves and their community.

Jeff feels differently. Jeff is one of the people Mike is referring to when Mike mentioned that the people fighting the subdistrict have moved to the area in the last 30 years. Though Jeff

visited the Valley as a child, he did not live in the Valley permanently until just after 2000. He owns very senior water rights and ranches just outside of the district. To Jeff, fighting the subdistrict is about protecting his rights and what they symbolize so he has something to pass onto his daughter. “I'm 62 and I'm fighting for my daughter's rights. They chiseled this and chiseled that, and I’m showing her that ownership's not easy; you've got to work at it.” The subdistricting of the Valley is an affront to Jeff’s sense of ownership. In his perspective, in order to have something of value to pass along to his daughter he needs to protect the seniority of his rights, as that’s where the value exists. If wells are allowed to continue pumping outside of a priority arrangement, in Jeff’s view, he is being robbed. Therefore, fighting the subdistrict is about protecting his daughter’s interests, as well as setting an example about the responsibilities of ownership.

Another aspect in considering the role of connection with family is whether or not the farm is corporate or still unlinked with a larger industrial structure. Some farmers work on corporately owned farms or for other farmers. Corporate-owned farms have more overhead support than do most of the smaller family farms. Larry argues that those connected to larger farms will survive the transition of the subdistrict better than the smaller family farms.

> Larger farms that are well heeled and have money in the bank can survive for a year. But, you take your small farmers out here or people that don't have some surface rights to buffer with and are having to pay for all of their water—they can't survive. In this business, nowadays, our costs are so exorbitant. Back when I first started in the 70s you could have a bad year; you didn't lose that much money. But with today’s costs with fuel, fertilizer, and tractors, one really bad year will take you out. Take you out. That's why we buy insurance, you participate in the government programs because when that doomsday scenario does unfold you want all the help you can to keep you in the game so you can roll the dice one more time. A lot these smaller guys won't be able to do that with all of these increases in costs.

Charlene is one of the small family farmers who sees her operation going away as a result of shrinking access to groundwater and poor surface rights. Her son will not be taking over the

operation, but there also will not be much to have with their very junior water rights. For Charlene and her husband, the subdistrict offers them the ability to retire and take their small farm out of the groundwater-use equation.

> In the end I think the way our subdistrict ended up arriving at what they gave us was equitable, they're giving us less money than had I been a big potato producer with lots of access to water. They're going to make like three times what I'm making, but I'm still able to do something with them that works. They threw a number at us and we had to bounce it around, and would it work with what we were doing? And yeah, it would.

Charlene's experience demonstrates that for smaller, more tenuous farming situations, the subdistrict supports their transition out of farming, even if they are paid less than larger farms. The easier out provided by the subdistrict gives Charlene a sense of security, even though things will continue to be tight for her and her husband as they transition out of farming. Their future in farming in the Valley is coming to an end, but she does not feel powerless, in fact, Charlene has become more involved in ranching cooperatives and a burgeoning local foods movement.

Seeing farmers like Charlene go out of business frustrates Mike, who also runs a family operation.

> To me industrial farming is the biggest problem. It's agribusiness now, it's not farming. Family farms. You know I'm a family farm. I wanted to get big a few years ago, but we didn't. They're all corporations, LLC, they're huge, the big ones and there's very few of us family farm types. Slowly but surely we're going down.

Mike foresees a future with more and more corporately owned farms. He's frustrated that the subdistrict seems to facilitate the larger corporate farms remaining in business as opposed to the family farms. Supporting the subdistrict, Mike hoped fewer family farms would be hurt in the process, but at least for now, his view is pessimistic for the survival of the smaller farms as overall costs increase for those without decent or even any surface rights.

For large corporate farms, the subdistrict is just another expense to put down in a spreadsheet. Sam's job in providing oversight to the subdistrict process means he sees how

different stakeholders handle the increased cost. “Well guess what? Everybody goes, ‘I'm not cutting back anything, just tell me what I owe you, I'll right you a check, it's just another business expense, and I've got money still running out of my ears.'” To Sam, involvement in the subdistrict means buying into the ‘if everyone gives a little, more can survive’ ideal exemplified by Clint at the beginning of this chapter. Corporate farms have the financial resources available to weather and increased cost without consideration to engaging a process that sees value in preserving the surrounding family farms. In this regard corporate farms experience less social dislocation and insecurity than family farms and can face a future, confident in their ability to continue operations.

Implementing “New” Farming Ideas & Practices

While it will be easier for larger corporate farms to absorb the additional cost of water than it will be for smaller farms, smaller farms, in theory, will be more able to respond in a flexible manner to the change through innovation or diversifying their practices. An unintentional consequence of the subdistrict plan is that some sustainable practices become more appealing and practical in an environment where every drop of water now has a monetary value. Small farmers and strained ranchers, some argue, have the “opportunity” to think about their operations in new ways, investing in innovative approaches and practices they otherwise would not have tried before in order to stay competitive and protect their livelihoods.

At a time when most other farmers and ranchers, like Alfred, are pessimistic or fearful about the future of their operations and their ability to even maintain what they have, David is expanding his third generation operation. Here he describes how he and his brother are joining forces with another farmer who owns land on the opposite side of the subdistrict in the sand:

> It'll be good; it was a way for us to expand without buying more land and using more water. We're just going to work with other growers… We're actually in really gravely soil

> and [this type of potato is] harder to harvest because they pick up a lot more rock. So we need to grow them over on the Mosca/Hooper area anyways because they're sandier… We could get more land, but if we buy more land we need more storage, more equipment, more people. So this is a way to get around that; we're buying more equipment but it's different. We're using the same amount of people we were using so we didn't have to expand. We're combining our crews to make one crew. More efficient—a lot more efficient because we'll be able to pack a lot faster… So it's like, we didn't have to think, it's time to move forward. It's going to be a lot more efficient.

By joining with another operation in another part of the Valley, David and his brother are able to expand through greater efficiency without redundancy. David is confident that their venture will be successful particularly as the subdistrict moves forward because they are creating a stronger, diverse, and more resilient operation.

A majority of the people interviewed commented that the SLV is an incubator for innovation in farming and ranching. Many felt that it this was due to the intensity of the farming season with only 90 growing days. For both farmers and ranchers, the intensity at which they must operate is among the highest in the country. Clark identifies what he views as one of the major strengths of the community that will aid in its resiliency as they move into the uncertain future.

> I think we've got it made. It's a strong, a very strong agricultural community in my mind. I mean there are some real innovators. When I think of, well all things really, even into the ranching sector there are people that are really innovative. In the potatoes that I know a little better—definitely. There are potatoes that are tried here, a variety that might be tried for 1 or 2 years and everybody knows… The dissemination of information is really fast. In a funny way this is just a giant research farm because… if it's positive everybody will be doing [it] in two years. What negative—it's done. Like in Idaho… they went to their potato conference and said they were kind of excited because they had changed varieties and they'd been Burbanks forever and they tried something different and they were just ecstatic over how much progress they'd made. And I mean this country changes varieties almost daily.

What Clark identifies here is that there is a recognition that a necessity for innovation undergirds many operations in the Valley and that will help move the area forward to make huge changes in water use. Clark too has invested in new practices by working with a local agricultural

engineering group, trying to increase the health of his own soil. In some ways, the plan for water management may provide a safe space to practice new ways of operating.

A number of farmers see the formation of the subdistrict as closing one door, but potentially opening another: it allows them to invest in more sustainable practices increasing their soil health and reducing water use. The drive to produce a high yield crop has driven much of American agriculture for the last 50 years and in that process soil health has deteriorated and in some cases large amounts of top soil have been lost due to erosion and tillage practices. Tom operates in a very different location than Clark, but feels similarly about the prospects for the Valley and the opportunity that can be found in the change.

> So maybe one guy suffers, but another, it helps him. So maybe the overall picture stays the same. The overall improvement of soil health, plus the reduction in water usage would improve the whole situation. Because we have the opportunity to improve some things by reducing water usage. What a great opportunity it is to improve on your fields, improve our soil. Not everybody sees it that way, but there is a lot of this green manure being grown. Everywhere you go you see half circles, full circles of it where there used to be potatoes or barley.

Luke, whose compost operation has seen steadily increasing business, is also hopeful in his outlook:

> We may find out that there is just as much by improving the soil and hopefully increasing potato yields and quality and so forth and actually putting about just as much money in the farmer's pocket as they were before… Hopefully, that's the case… Because you've got to do something to keep food on the table.

Unlike large corporate farms, smaller, more stressed farmers and business people can engage in innovation and major changes in practice in order to stay competitive in the market. What Tom and Luke see in the subdistrict is the space to make a change that before would have been considered unwise and risky. To put half your acreage in a cover crop for a season cuts your yield in half and thus cuts your profit in half. But, with the availability of fallowing contracts, and for some farmers on the margins, the inability to access enough water for a whole field,

improving soil health has become a prudent choice for bankers, water management professionals, and farmers.

In fact, cover crops have the potential to become the new normal in the SLV. Most of the farmers I spoke to were using cover crops or thinking about using them in the next season—even a large corporation. Ben, who is around 30, followed his father into the business farming potatoes and barley after returning from college. He brought several new practices back with him and cover cropping is one of them.

> Ever since I've farmed—I've been farming on my own for seven years—I've had a cover crop every year… Three years ago I started doing multi-species… This year I have oilseed, radish, sudan, mustard, peas, vetch, one that I can't remember the name of… and then buckwheat… I signed up under the preventive planning insurance, otherwise, I've always just done it anyway.

For Ben, cover crops are the way to do things responsibly for his business. With the increased recognition of the importance of soil health, practices like this may become the new normal as water becomes more expensive. Healthier soil holds moisture longer. Several farmers, including Ben are trying out new practices such as reduced or no tillage to reduce soil erosion. Others are utilizing GPS to engage in precision farming where farmers are able to program their tractors to till based on GPS coordinates. One thing almost all farmers talked about in reducing their water usage was the adjustments they could make to their sprinkler units. By adding drops, which release the water closer to the ground, changing the nozzles where the spray comes out, as well as eliminating end guns, many farmers felt they reduced evaporative losses dramatically. Though many of these adjustments have been going on for at least 20 years (Charlene and her husband removed end guns in the early 1990s), not everyone engages in sprinkler adjustments still, which is discussed previously.

Not everyone is as optimistic though. While many are engaging in these practices because it benefits their operation and protects their livelihoods, they are still individual practices. Alfred fears that systemic social change will not take hold and that without a massive shift in the valuing of water and soil, the situation will not improve, regardless of the subdistrict.

> There's a point in time when you went to the doctor and he treated the symptom. You had a swollen foot and they treated that—they didn't know you had diabetes. But, here we take all these individual issues and we treat them as individual issues and there's not a concerted effort to do anything really smart. So we have all this effort around water, but in reality people have farmed well but don't use near as much water. There has to be this whole paradigm shift where you do a better job… we actually bought a piece of property and we're making it into a demonstration farm where we do crop rotations, build up the soil, because you can use half as much water for the same crop. So, there are a lot of things that need to happen here, and I'm not sure they're going to happen.

To Alfred, it does not matter if some farmers take up soil enrichment practices if it does not become systemic throughout the Valley, shifting the way agribusiness is valued and done. To him, the subdistrict is fragile and tenuous enough that its success rests on the process of farmers and ranchers changing their understanding of their larger role in the health and wellbeing of their soil. Alfred's pessimism is based in his concern that people are more apprehensive about protecting their financial interests than engaging in beneficial practices.

Difficult and harsh conditions often drive innovation and new ways of thinking about things. These conditions also can create the space to attempt practices that prior to the change in conditions were considered unnecessary or impractical—particularly from a monetary standpoint. If you did not need to plant cover crops because fertilizer was cheap and water was free, why would you take the extra time and money to do it? But, now, when many farmers do not have enough water to plant a whole circle, it suddenly seems more reasonable because it protects the soil from erosion, nematodes, and enriches the overall health. But, with costs increasing due to payments for water and reduction of acreage in active production, the question

becomes: can innovative farmers in the Valley remain competitive in the overall market without a massive change in the values of the agribusiness complex?

The Future of Agriculture in the Valley

Is a new normal possible for agriculture in the Valley? If more sustainable practices become the standard practice, the culture around farming and ranching in the Valley can shift. Now that meters are the norm on pumps and there is an increasing recognition that overuse of the aquifer damages everyone's chances at survival, some feel that farmers and ranchers are able to engage in conservationist and sustainable practices, hopefully enabling a future for their descendants and other young farmers.

For some of the older farmers near retirement, like Jim, the future is not threatening.

> [The future looks] very positive. I can rent my pumping credits; I can rent to [the young farmers]. That's a market that's made it tough on the young farmer, which bothers me. That's why I'm renting two circles to two young farmers for $10,000 per circle under the market [value] because we need young farmers. We're at 60 now as the average age of the farmer? And it's impossible for a young farmer to get started now with the capital cost, cost of capital goods. So, tough on them, great for me personally.

Jim, who will probably not return to farming next season, has benefited from a career in which costs were considerably less than they will be in the future. His concern for young farmers as he transitions out of farming is visible in his willingness to undercut the market price to support new farmers. However, will all farmers do this? Can young farmers survive without people like Jim, who can reduce the financial risk as they begin their operations?

Ben, who has spent his whole life in the valley and married a woman from the valley, is about 30, with two young children. His outlook is still positive.

> I still think it's bright for young farmers as long as you're willing to take a risk. Most of the people I'm friends with, there's only some of us that are trying to get a farm going on our own that isn't just waiting for the family farm to come to them… But it's worked out for me in the last seven years. I've got quite a bit of equipment of my own now. I think, I think it'll work, but it's going to get a lot harder now. When you're having to pay for

> water that's just that much less that you'll be able to do as far as investing in equipment or land, or your family's pocket too. You're just going to have to farm that much more ground to have the same income as you would three or four years ago, due to expense. That water expense is never going to go away now, from here on out.

Ben feels hopeful about his future in farming. His father did not have to pay for water for most of his farming career, whereas Ben will pay for it throughout most of his. But Ben still sees opportunity in his operation and feels a draw to farming in spite of changing and more risky circumstances.

Bradley, also a young farmer, feels differently. For many in the Valley paying for water could mean the loss of the family farm when they cannot make water payments, pump enough water, or the stress becomes too great. Now in her mid-30s, Bradley only farms a few of the circles she owns. She rents the rest to relatives or other farmers and runs another business off the farm.

> For me, I don't feel like my situation is sustainable. I'm seriously considering going ahead and selling my land and getting out of it because I don't feel like my water rights are senior enough to make them extremely valuable. They're still valuable. I don't know what else we would do here in this spot for a living. I think actually for this area it is going to end up meaning less irrigated farmland. I think we'll still have some, always, because it is really good farmland, it's in a good geographical area, it's somewhat protected… and the situation with the water basin unique. [But] I think it'll end up meaning less.

The combination of her location and lack of senior water rights, the increased cost of farming, and the pull towards an easier life off the farm, means Bradley may sell the family land. A number of interviewees believe that—though necessary to maintain agriculture—paying for water will cause a loss of small family farms, and increase in the size of the corporate farms, which will change the face of agriculture in the Valley.

The biggest concern among farmers and ranchers in looking to the future centers around their past experience with the corporate entity AWDI who, through purchasing water rights, proposed to build a pipeline to transport and sell water to the Denver Metro area. Alfred, who

ranches on the west side of the Valley and possesses senior water rights, feels openly pessimistic about the future of agriculture in the Valley.

> I think [agriculture is] going to scale back naturally, if it doesn't get shut down. But, honestly, if you go out further than that there's going to be very little farming here. How can there be? Crop rotation, the types of crops we grow here is so limited. It's so limited. And the environment is so harsh here. And there is such value in the water. Cities are going to take the water eventually. Absolutely… When El Paso wants our water, if they're smart they'll buy it and they'll do it above board. That'd be the cheapest thing for them to do.

Alfred's perspective on the water situation is that subdistrict is just the beginning of the long decrease in farming in the Valley—both because of unsustainable practices and the decreasing supply and thus the increasing recognition of the value of water. As freshwater supplies continue to become more tenuous and sought after in the West, large municipalities with deep pocketbooks and more political power based on larger populations will be looking for water. Based on this and combined with impacts of drought and climate change, Alfred predicts that water developers will return to the Valley. In Alfred's future, the combination of difficult and harsh conditions in agriculture with well-timed offers by municipalities and developers, water will flow towards the money.

Farmers and ranchers, not just in the first subdistrict, but also in the entire Valley are facing a huge shift in perspective. Todd's perspective, as someone who is trying to see the situation from the outside, is that this huge shift will usher in a new generation of agriculture.

> We are coming into a time where people are going to have to pay the true cost of water. It's no longer unregulated. For most of this Valley's history anything that got pulled out of the ground has not been regulated and anything coming down the stream has always been regulated. So, it's definitely going to be a new era. When [the people here] have to operate under rules and regulations or a subdistrict, it's definitely going to be a new era.

CONCLUSION

Agriculture in the Valley is currently in a period of transition. Regardless, of what things look like in 10 or 20 years, this is the end of an unregulated period in which agriculture did not have account for the use of one of its primary inputs—water. Returning to Alfred and Clint's question at the beginning of this chapter, how people answer the question "what is a better future for the Valley?" illustrates their response to the subdistrict management plan. Should the future of the Valley be geared towards protecting everyone or just the most viable? Is it fair for everyone to suffer to provide a "soft landing" while transitioning to a more costly agriculture climate? Or, should some farmers and ranchers be shut down so that fewer can thrive? It is also important to consider what it means when not everyone sacrifices to the same extent and the community experiences "free riders" who do not fallow, but still benefit. Are some expected to sacrifice more than others? Whose interests are being protected and who is sacrificed in the transition?

The first subdistrict is already in motion, but even now it faces significant barriers, as fallowing contracts are still minimal. How people perceive the subdistrict depends on their socio-historical context and relationship with water. Not everyone has the same relationship to the problem, which means that people have divergent ideas about what is in their best interest. This chapter explored factors that influence farmers and ranchers as they make decisions in the face of uncertainty. The factors that shape perceptions of subdistrict #1 center on people's relationship with water rights and access, awareness of the importance (or lack thereof) of the local farm-based economy and community, and sense of personal agency of their future in agriculture. Recognizing and understanding these factors provides indications of alternative incentives the subdistrict could use to reach out to dissenting or resisting parties, creating more buy-in and

impact on the health of the aquifer. The future of the Valley is dependent on how the RGWCD, subdistrict boards, and larger community continue to answer Alfred and Clint's question as the first subdistrict and others take shape: what do we want our community to look like? But for there to be increased action, everyone must be at the table.

CHAPTER 6: CONCLUSION

> Of course we, being European, and not really understanding the desert and how to live in the desert and how to be, we've made Europe out of this place...And you know, we all live on that. That's our life, our economy, everything about us is tied to that—that idea that we own that water and that we can take it.
>
> Gary, rancher

> Angry as one may be at what heedless men have done and still do to a noble habitat, one cannot be pessimistic about the West. This is the native home of hope. When it fully learns that cooperation, not rugged individualism, is the quality that most characterizes and preserves it, then it will have achieved itself and outlived its origins. Then it has a chance to create a society to match its scenery.
>
> Wallace Stegner, The Sound of Mountain Water

This thesis is a case study of a rural community in south-central Colorado facing the decline of one of their most vital resources: groundwater. Without the plethora of water held in underground aquifers supporting the surface flows of rivers and streams as well as crop production, there would be no Valley agriculture or community. The importance of groundwater to the people of the Valley cannot be understated, whether it is recognized or not. Hardin (1968) argues that in common pool resources like groundwater, tragedy is inevitable, as people will seek to maximize their own benefit, while the cost of doing so is distributed between everyone. The only solution, argues Hardin, is government regulation or privatization of the resource. Ostrom (1990) offers a third way; she contends that collective action is possible because actors do not act in isolation. She identifies several factors that facilitate an environment in which cooperation in management is possible. However, collective action is difficult and Ostrom (1990) still bases her framework on a rational actor. Therefore, this thesis serves as a critique of Ostrom's (1990) Institutional Choice framework, as it argues that actor exist and act in different socio-historical contexts that shape the choices they face and the decisions they make.

Throughout my findings I referred back to a phrase that came up repeatedly in my interviews: the concept of being 'whole.' In interviews, being closer to 'whole' refers to a farmer

or rancher's completeness in terms of water; whether their input of surface rights equals extraction of groundwater, a vital part of their relationship with water. Another interpretation of being whole is that of a rancher who has a senior enough surface right making her "drought-proof", and thus relying on groundwater is unnecessary. Being whole has taken on a new meaning with the implementation of Subdistrict #1. Farmers who are closer to whole do not have a new cost for water added to their production. In the larger groundwater picture, the Valley is not whole and without major adjustments, many will pay for it with loss of livelihoods and community.

To explore the impacts of the first subdistrict and the accompanying plan for water management, I returned to my former home, Alamosa, for the months of June and July 2012 to conduct 23 in-depth, semi-structured interviews with 25 stakeholders. These stakeholders included farmers, ranchers, water management professionals, engineers, business owners, agronomists, a migrant farmworker health care provider, and a journalist. Due to the nature of rural communities, most of these people wore multiple hats in their daily life. My interviewees sat on school boards, local bank boards, the subdistrict board, irrigation district boards, soil conservation boards, the RGWCD board, and state level boards including Colorado Water Congress. A few had jobs or owned businesses outside of their farming or ranching responsibilities and many had children who previously or currently attended local schools. These were people who did not just live in a community, but constituted the community, with distinct senses of belonging and place.

In order to enhance my understanding of the meaning water and the formation of subdistricts had in their lives and to aid in the validity of the interviews, I engaged in participant observation as well. The summer months are incredibly busy for both farmers and ranchers, full

with the obligations and responsibilities of cultivating food. No farmer or rancher I spoke with turned me down for an interview, however, several invited me to join in with their daily operations, both to provide me with a picture of their daily life and for the more practical purpose of getting work done. I rode along to the butcher to pick up a processed cow, I herded cattle along the Rio Grande, I toured fifteen fields following a thunderstorm with an agronomist checking the growth and health of potato plants, I visited numerous irrigation ditches and a reservoir, and got my hands dirty digging. I was gifted multiple pounds of potatoes, and informed that fingerlings taste best roasted with a little butter and salt. I also attended local board meetings for the subdistrict, the RGWCD, and the Rio Grande watershed round table. These observations, in conjunction with interviews, provided the rich and textured data for this research, which I transcribed, coded, wrote memos and compiled into this thesis.

In Chapter four I discussed the agency of groundwater as an invisible resource and its role in shaping agricultural expansion and social systems in the Valley. Hidden resources, like groundwater or subsoil materials, are unique because they cannot be readily seen or accessed. Without modern technologies, people often are unaware they exist. With the advent of cheap submersible pumps, groundwater was literally brought to the surface and fundamentally altered the social structure of the Valley. The ease and reliability of groundwater brought prosperity and certainty to farmers as they could rely on groundwater in times of drought or at the end of the season when surface waters were running low. This led to an expansion in planting, taking the form of crop circles around a center pivot sprinkler, which facilitated monocultures. Farmers began planting higher value crops because they could trust that they would have the water to finish the crop and not lose it due to lack of water. Throughout this process, the amount of help needed on the farm decreased while profits increased and children began leaving for college.

Small farms were not as profitable as the size and cost of farm equipment increased, thus making larger farms more practical.

The invisibility of groundwater also led to the perception that water was plentiful. Though no person would likely argue that the supply was infinite, it was treated as such. Many farmers spoke of a lack of awareness of the finitude of groundwater in their use and flagrantly wasteful practices. This could be seen in the number of wells that were dug without permits and in the farmers who never saw the need to purchase surface rights to support their operation. Groundwater was better and more reliable than surface water, and you did not need to pay ditch or canal company fees. The perception of groundwater as plentiful and the prosperity it could bring also led to the considerable expansion of farming in the Valley. Much of this land was not suited for farming in the first place as it was poor soil, but is still in production. The state did little to discourage the expansion as its reliability brought prosperity to the Valley.

When the drought of 2002 hit, it precipitated the realization that this was a groundwater dependent community, which had been undervaluing its main support. The invisibility of groundwater and the perception of its infinitude meant people were blind to the clues that their use was overtaxing the resource. As the water table dropped, impacts could first be seen in the loss of soil stabilizing plants with deep taproots—phreatophytes. Over the last several years as the aquifer has continued to drop, some farmers on the margins of the aquifer have experienced surging or dried up wells. In response a plan was developed to recharge the aquifer and preserve the livelihoods of as many farmers in the area as possible. Some see this plan as altering 130 years of Colorado water law. In practice, the plan facilitates creating a meaningful and conscious relationship with groundwater as it becomes more visible and thus, valuable. This occurs through a groundwater model, the RGDSS, mandated meters on each pump in the subdistrict, requiring

groundwater users to pay for the water they pump, and the threat of the State Engineer, an outsider, shutting down wells. In this regard, making groundwater visible or meaningful, changes the meaning of acts of water conservation, which now are viewed as acts that protect the larger community.

In chapter five I explored four factors that emerged from my data that affect how stakeholders interact with the subdistrict formation and groundwater management plan. Adding nuance to Ostrom's (1990) framework, I argue that humans are not just rational actors as they are embedded in particular contrasting contexts; their relationships with the problem of groundwater overuse are different and there is no one "right" choice. Thus, one collective solution is not adequate to address the different needs and perspectives of the larger community. Therefore, it is important to identify and examine these factors in order to discern what alternative incentives to fallowing and water use reduction may be.

The first factor, relationship to water rights and access, builds on Ribot and Peluso's (2003) theory of access by adding geographic relationships to their list of structural mechanisms affecting access. People in the subdistrict can have differing experiences and perceptions of Subdistrict #1 due to their proximity to the "holy land" with its plentiful water, or the margins, which are experiencing the falling water table first. Different relationships with water rights also color people's perception of the groundwater management plan. This includes whether people have senior, junior, or no surface rights as well as whether they are entirely surface water or ground water dependent or use both.

The second factor that affects people's perception of subdistrict formation revolves around contestation over who should be responsible for the management of the aquifer: the state or the local population. How people answer this question is dependent on their relationship with

and access to water as well as how they view the survival of the larger community that has built up around the farm and ranching sector. Many interviewees spoke about the need for less government in their lives, yet supported the government approved management plan or invited the state to step in and enforce the shut down of wells. As farmers who are less whole recognized the uncertainty they faced in their future water use, the idea of the State Engineer shutting down wells on the South Platte suddenly appeared more threatening; whereas farmers and ranchers who are more whole face less uncertainty. Thus, perceptions about the subdistrict can be understood as mechanisms for survival and livelihood preservation more than political ideology.

The larger community and economy of the Valley is dependent upon agriculture, and thus, groundwater. Therefore, perceptions of whether the subdistrict is in their best interest are also based on the role the larger farming economy plays in the lives of farmers and ranchers. Some people feel that without fertilizer dealers, parts suppliers, local schools, and people nearby, there is little incentive to remain in the Valley to continue farming. Thus, the survival of the community is essential to their future, not just for farming and ranching, but whether they can access the things they need to keep their operation viable, whether their children have a school nearby, or whether there are neighbors to have coffee with. Fundamentally, it is a choice about what the future of the community looks like.

The final factor in how stakeholders view the subdistrict concerns how farmers and ranchers perceive the future of farming and ranching in the Valley, as well as their own sense of agency in the face of change. As previously mentioned, the first subdistrict and all the ones following will foundationally shape the future of the Valley. Thus, when people engage in support or opposition to groundwater management plans, they are also making a statement about their sense of agency in shaping that future. The sense of agency is enriched through family

history in the area, connection to private property, and the perception of possibility in the future. The threat of outsiders also holds a strong sway over people in the Valley, and resistance to outsiders can still conjure a united front, as was seen with the AWDI fight. Younger farmers, already in agriculture, are also more likely to look for new opportunities and connections to secure their future.

Groundwater use in the Valley does not need to be a "Tragedy of the Commons" (Hardin 1968) because people are creative, reflective, and adaptive. However, social vulnerability is distributed unevenly across the spectrum of farmers and ranchers because they have different relationships with the problem, which means they may have varying needs when it comes to formulating solutions. Recognizing this is key to returning the aquifer to a healthy state.

Based on my research I wish to make two recommendations: first, that the subdistrict invite and take seriously the input of all stakeholders, even those outside of the defined boundaries. And second, distinct messaging for people in different contexts in order to increase buy-in related to fallowing contracts. Though the subdistrict has defined boundaries, the implications of the formation, framework, and success of the first subdistrict are far reaching and many people outside of it feel this. Thus, it is important for the subdistrict board to recognize that the success of the subdistrict may rely on allowing stakeholders outside of its boundaries to participate. In spite of the inadequacies of Ostrom's (1990) framework, it would behoove the subdistrict board to take note of her design principles and work to institute her suggestions. Also, the subdistrict must take a multi-faceted approach and utilize different messages to reach different people in the community. Based on my research it appears that the people most likely to fallow are: close to retirement, those already on the fringes, and those who believe in preserving the larger community. Farmers in the Holy Land do not appear to be fallowing to the same extent

as those on the fringes, thus, it is important to reach them and it is clear that higher monetary incentives are not enough. Using differential messaging and alternative incentives are necessary—messaging that appeals to participating in the health of the larger community.

Possibilities for future research include further exploration of why farmers chose to enter into fallowing contracts. What motivates the farmers who are fallowing in the Holy Land to do so? What motivates groundwater only users? What ideas or incentives motivated them to take land out of production? Are these values and incentives able to inform the appeals of the subdistrict? Also, the conflict around the Closed Basin and the controversy in using closed basin water to meet the Rio Grande compact agreement with New Mexico and Texas was larger than the scope of this paper. Another issue I was unable to touch in this project was the 60/40 agreement stipulating that the Rio Grande provide 60% of the compact water, and the Conejos 40%. This issue reflects what some people see as a larger structure of inequality stemming from challenges to Hispanic land grants by whites. In order to accomplish this project in a timely manner, I also was unable to spend time with the objections of an acequia association from the southern part of the Valley. Research here could lead to a fruitful and illuminating comparison of cultural differences in the meanings people have for water and community.

In sum, the story of groundwater in the Valley is about the future of a community coming to terms—through a collective action plan—with its reliance on a common pool resource vulnerable to exploitation because it is invisible. Groundwater has fundamentally shaped the community and it takes on meaning when it is consciously recognized as another actor in the commons. Managing groundwater is about more than an environmental ethic; rather it is a choice about where one wants to live. People do not conserve or restrict use of a resource solely for environmental considerations, but because they imbue their action with meaning. However, it is

vital to acknowledge that social vulnerability is often unevenly distributed as actors come from different socio-historical and geographic contexts. Thus, a one-size-fits-all solution will not work for everyone and generates division. This is important to remember as other communities face issues of resource depletion or degradation. Understanding how people create meaning when it comes to water in the American West, as well as identifying and responding to divergent experiences within a community, can facilitate better management of resources. Thus, preventing a tragedy of the commons and creating the possibility for a 'whole' future.

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APPENDIX A: CONSENT FORM

CONSENT TO PARTICIPATE IN A RESEARCH STUDY
Colorado State University

TITLE OF STUDY: *A Sociological Case Study on the Impacts of the Groundwater Management Plan in the San Luis Valley*

PRINCIPAL INVESTIGATOR: Peter Leigh Taylor, Ph.D., Associate Professor, Sociology Dept., at 970-491-6043 or pete.taylor@colostate.edu
CO-PRINCIPAL INVESTIGATOR: Kelsea MacIlroy, Master's Candidate, Sociology Dept., at 602-616-9960 or kelsea.macilroy@colostate.edu

WHY AM I BEING INVITED TO TAKE PART IN THIS RESEARCH?
You are being asked to take part in a research study on the effects of the groundwater management plan in the San Luis Valley on the community and people who use groundwater. I am asking you to participate in this study based on your knowledge of the situation. Please read this form carefully and ask any questions you may have before agreeing to take part in this study.

WHAT IS THIS STUDY ABOUT?
The purpose of this study is to learn how the groundwater management plan will impact people's quality of life and their community.

WHAT WILL I BE ASKED TO DO?
If you agree to be in this study, I will conduct and interview with you. The interview will include questions about your job, water in the San Luis Valley, and your thoughts on what is happening and what should happen. The interview will take about 45-90 minutes. If you allow, I would like to record the interview on a digital recorder. You may also be asked if I can spend time observing you in your job. You may tell me when, where, and how long this observation will be.

RISKS AND BENEFITS:

- I do not anticipate any risks to you participating in this study other than those encountered in day-to-day life. It is not possible to identify all potential risks in research procedures, but the researcher(s) have taken reasonable safeguards to minimize any known and potential, but unknown, risks.
- There are no direct benefits to you participating in this study. However, I hope the opportunity to share your story and thoughts on water and agriculture in the San Luis Valley will be useful to you. The potential effects on the social world of the San Luis Valley from the groundwater management plan have not been researched. The data gained from these interviews and observations will be used to add to the current conversation on the topic.

DO I HAVE TO TAKE PART IN THE STUDY?
Your participation in this research is voluntary. If you decide to participate in the study, you may withdraw your consent and stop participating at any time without penalty or loss of benefits to which you are otherwise entitled.

WHO WILL SEE THE INFORMATION THAT I GIVE?
We will keep private all research records that identify you, to the extent allowed by law. The records of this study will be kept private. In any sort of report we make public, we will not include any information that will make it possible to identify you. Research records will be kept in a locked file; only the researchers will have access to the records. If we digitally record the interview, we will destroy the audio file after it has been transcribed, which we anticipate will be within two months of its taping. Your data may be reviewed by the CSU IRB for auditing purposes.

IF YOU HAVE QUESTIONS:
Before you decide whether to accept this invitation to take part in the study, please ask any questions that might come to mind now. Later, if you have questions about the study, you can contact the principal investigator Peter Leigh Taylor at 970-491-6043 or the co-principal investigator Kelsea MacIlroy at Kelsea.macilroy@colostate.edu. If you have any questions about your rights as a volunteer in this research, contact Janell Barker, Human Research Administrator at 970-491-1655. We will give you a copy of this consent form to take with you.

This consent form was approved by the CSU Institutional Review Board for the protection of human subjects in research on June 15, 2012.

Statement of Consent: Your signature acknowledges that you have read the information stated and willingly sign this consent form. Your signature also acknowledges that you have received, on the date signed, a copy of this document containing 2 pages.

_____ _____
Signature of person agreeing to take part in the study Date

_____
Printed name of person agreeing to take part in the study

_____ _____
Name of person providing information to participant Date

In addition to agreeing to participate, I also consent to having the interview tape-recorded.

_____ _____
Signature of person agreeing to take part in the study Date

_____
Printed name of person agreeing to take part in the study

APPENDIX B: FACE SHEET

INTERVIEW #_____

NAME: _____

MAILING ADDRESS: _____

CITY: _____ STATE: _____ ZIP CODE:_____

EMAIL ADDRESS: _____

PHONE NUMBER: _____

ADDITIONAL COMMENTS:

APPENDIX C: INTERVIEW SCHEDULE

Interview/Focus Group Guide

1. *Experience as a farmer or rancher/water or agricultural professional/Community member*
    a. How long have/has you(r family) been in the San Luis Valley?
    b. How did you come to manage your land/your position?
    c. What do you see as your role in managing your land/in the community?
    d. How do you access water for your land/animals?
2. *Situation of Water in the San Luis Valley*
    a. Can you tell me what you know about
        i. Your individual water situation?
        ii. The situation in the Valley overall?
3. *Social Networks & Organizations*
    a. So, where did the groundwater management plan come from?
        i. Who was involved?
        ii. Who was not there that should have been?
        iii. What was controversial?
        iv. What did everyone agree on?
        v. How has the process changed over time?
4. *Benefits & Costs of the plan*
    a. From your perspective
        i. What do you think works well?
        ii. What does not work?
    b. Thinking about the community,
        i. Who will benefit from the plan?
        ii. Who will be hurt by the plan?
        iii. What will happen to this community?
5. *Future*
    a. What do you think is the future of groundwater in the San Luis Valley?
        i. And what leads you to think this?
    b. What do you think is the future of agriculture in the San Luis Valley?
        i. And what leads you to think this?
    c. In your perspective, what should need done about groundwater and agriculture?
6. *Conclusion*
    a. Who else should I talk to?
    b. Anything else you want to tell me about the impacts of the groundwater management plan?
    c. Do you have any questions for me?
7. *Contact Information for Reporting purposes—ask respondents to fill out the form.*