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2018-19 Water Quantity and Quality Study of the Lower Santa Fe River, Santa Fe County, NM: Progress Report, May 15, 2019

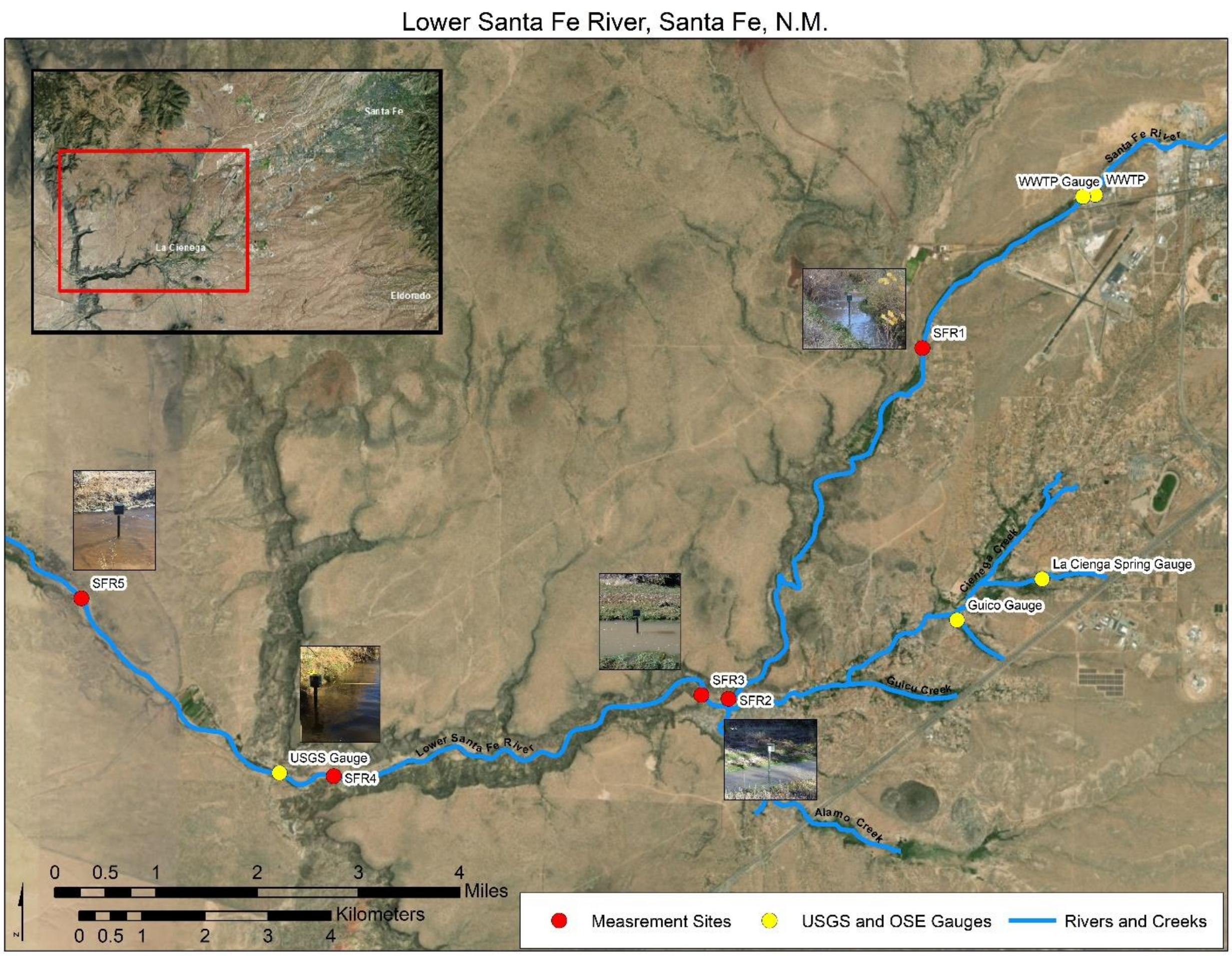

Figure 1. Map of the research area.

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Abstract

The City of Santa Fe relies heavily on the Santa Fe River for its potable supply. The River originates in the Sangre de Cristo Mountains before being impounded within McClure and Nichols reservoirs until it is called for by the City's municipal and agricultural customers. Streamflows are variable and dependent on winter snowpack and summer monsoonal rains, which provide approximately 40% of the City's water. The remainder comes from the Rio Grande Buckman Direct Diversion and the San Juan-Chama Project. Santa Fe's water refuse is treated at the Wastewater Treatment Plant (WWTP) and discharged back into the lower Santa Fe River, which then flows through the historic communities of La Cienega and La Bajada before entering Cochiti Pueblo. Outputs of the lower Santa Fe River have amplified, with increased development, groundwater pumping, irrigation diversions, and evapotranspiration. Rarely does the river reach its confluence with the Rio Grande, its termination occurring somewhere within Cochiti Pueblo.

There is little information about the quantity and quality of the water in the lower Santa Fe River after its discharge from the WWTP. This project will focus on the lower Santa Fe River's water budget and chemistry to determine how land usage impacts its instream flow and water quality. This will be achieved by taking streamflow measurements and water samples at several sites during the 2018-19 year. This water study will constrain the stress on existing supplies and assist with evaluating possible water resource management options to supplement traditional water-supply approaches.

Introduction

Every day, approximately 5 million gallons of effluent is discharged from the Paseo Real WWTP and is the primary source of streamflow for the lower Santa Fe River. Additionally, the Santa Fe River receives inputs from seasonal precipitation and the springs at La Cienega. Outputs of the lower Santa Fe River have increased, due to a recent influx of suburban development, increased ground water pumping, irrigation diversions, evapotranspiration and streambed seepage. The total combined outputs have contributed to the diminishing flows within the lower Santa Fe River and its termination preceding the confluence with the Rio Grande River.

The Santa Fe River of northern New Mexico flows 74 km to its confluence with the Rio Grande. The La Cienega Valley is the site of former Puebloan settlements as well as one of the oldest Hispanic communities in New Mexico. The community is presently experiencing shifts in land use from agriculture towards suburban housing developments that rely entirely on domestic wells. La Cienega hosts a multitude of seeps, springs, and wetlands that historically were recharged from groundwater that is now being diverted by the numerous wells in the area. The City's effluent provides a majority of surface water flows and also seepage losses that recharge the shallow groundwater system. Discharge returns more water into the river than nature would normally provide; however, the surplus of water rarely makes it to the Rio Grande.

Increasing withdrawals from groundwater wells and increasing demands for instream flows that supply water to the downstream community's acequia system are limiting the amount of Santa Fe River water that returns to the Rio Grande. Several recent surface water-hydrology studies have looked at streamflow in Cienega Creek and its tributaries (NM Hydrologic, LLC and the New Mexico Office of the State Engineer, 2012a, b; and Petronis et al., 2012) as well as La Cienega wetlands (Johnson et al., 2016) with goals to quantify Cienega Creek streamflow and assess wetlands-groundwater connections. This study will build upon these datasets by gathering streamflow and water quality information along the Santa Fe River downstream of the wastewater treatment plant and at several sites along its course to the Rio Grande during the 2018-19 water year to quantify the Lower Santa Fe River's total water budget. In addition, water samples will be collected at 12 monitoring sites during the summer and winter seasons to test the general chemistry of the water. Water chemistry will examine spatial changes in water quality throughout the La Cienega/Cineguilla reaches of the watershed. This study aims to determine how land usage in the lower Santa Fe watershed impacts its instream flow and water quality before connecting with the Rio Grande.

Previous studies have primarily focused on the Santa Fe River as it flows through Santa Fe; however, there has been little investigation into the water usage of the lower Santa Fe River after being discharged from the WWTP. This project will be focused on the lower Santa Fe River's total water budget and water quality and aims to determine how land usage in the lower

Santa Fe watershed impacts its instream flow and water quality on its course to the Rio Grande River. This will be achieved by taking streamflow measurements and collecting water samples at several sites along the Santa Fe River's course to the Rio Grande River Beginning in November 2018 and ongoing for the course of one year. Overall, this water quantity and quality study will constrain the stress on existing supplies and assist with evaluating possible water-supply management options to supplement traditional water-supply approaches.

Regional History

The historic communities of Cochiti Pueblo, La Bajada, La Cienega, Agua Fria and Santa Fe are located within the high desert of Northern New Mexico along the ancient El Camino Real de Tierra Adentro trade route. The land along this corridor was isolated and inhospitable to those that traveled and ultimately settled in this region of the southwest. Northern New Mexico is a land of extremes, with temperatures that can fluctuate upwards of thirty degrees on a given day and can be extremely hot in the summer and very cold during the winter months. It is a parched landscape that has few navigable rivers and receives and average of fifteen inches per year that had limited accessible resources for the inhabitants of the time (Racciti, 2003). Water played a vital role in the settlement of northern New Mexico and the major source of water came from the rivers that carved and shaped the rugged landscape. Water needed to be controlled in order to be useful so the indigenous people that occupied the land developed a system of ditches that was used to convey water from nearby rivers to irrigated farmlands. The early native inhabitants had become extremely resourceful and employed the use of cisterns to catch and store storm water for use in cooking and cleaning, in addition to irrigating. There was no distribution of land and water, as these resources were communal and the concept of privately-owned land was unheard of, labors of the land were shared equally for the benefit of all (Clark, 1987). The arrival of Spanish colonists brought about a shift in land use patterns when they introduced their sedentary, agrarian lifestyle, which influenced and modernized the native acequia system, allowing the lifestyle and farming culture of New Mexico to flourish (Jaramillo, 1973). The water conveyance systems shaped and influenced the land and water use patterns of northern New Mexico, and although these systems and lifestyle are in decline, are still in practice throughout the state. However, with recent influxes of outside populaces and housing development, coupled with a transition from a rural lifestyle to a suburban lifestyle, the landscape of the capital region has been transformed and the water use patterns have been significantly altered.

Geologic Setting

The Rio Grande River runs through Cochiti Pueblo and makes up the western boundary of the study area, and is bounded to the East Sangre de Cristo Mountains, the southernmost extension of the Rocky Mountains. To the North lies the Caja del Rio Volcanic Plateau and to the South is the Santo Domingo Basin. The City of Santa Fe is located within the southern Espanola Basin and maintains a municipal watershed of approximately 17,200 acres, with an overall size of 182,000 acres for the entire watershed (Municipal Watershed Management, n.d.). The perennial Santa Fe River flows from the highlands of the Sangre de Cristo Mountains into the Santo Domingo Sub-Basin of the Middle Rio Grande Basin where it meets the Rio Grande River (Thomas et al, 2000). Along its course, the river flows through Precambrian igneous and metamorphic rocks of the Sangre de Cristo Mountains before entering Pennsylvanian, Permian and Mesozoic aged sediments before entering the Tertiary sedimentary units that surround the research area and comprise the regions underground water storage (Speigel et al, 1963). The landscape is home to Cerros del Rio volcanic filed, which is responsible for the intermittent volcanic flows and breccias that pepper the area. The regions complex geology, coupled by the numerous volcanic intrusions and system of faults has transformed the regions underground water storage and is responsible for channeling water to the surface, forming the regions numerous springs and seeps.

Methods

Stilling wells will be installed at five sites along the lower Santa Fe River for streamflow measurement below the outfall of the Paseo Real WWTP. The stilling wells will be installed into the riverbed using a three-inch perforated steel pipe, and sites were chosen for their lack of hydrologic features, ensuring there is a straight channel, with no eddy's or obstructions that could change or impede the flow of water through the monitoring well. Sites will be monitored on a weekly or bi-weekly basis for the period of one year. Water sample data will be collected for temperature, pH, conductivity, dissolved oxygen and hardness using a handheld multi-parameter water tester each time data is downloaded from the stilling wells. Additionally, general cation and anion balances of the river's water will be performed four times over the duration of the water monitoring and metals concentrations will be looked at in the winter of 2019.

Project Status

Water level monitoring is ongoing and will continue through November of 2019. Additionally, discharge measurements will be collected over the next few months until a rating curve can be developed for each of the monitoring sites. Stream flow monitoring results thus far show diurnal variations and intermittent storm events with overall steady flow stage (0.50-2.25) throughout the winter months. The real time monitoring of flow will be analyzed to estimate the seepage gains and losses between the WWTP and the Rio Grande River to better quantify the contributions from tributaries and springs and losses from acequia diversions, well pumping, and evapotranspiration.

To date, water samples have been collected two times (winter and spring of 2019) and analyzed for basic cations and anions at all sites to better understand water chemistry of the lower Santa Fe River. Samples were also collected in the winter of 2019 and analyzed for a full suite of metals at sites SFR1 and SFR5 to assess the water quality along the rivers course. Cation and anion samples will be collected two more times (summer and fall of 2019) for the remainder of the monitoring project.

Conclusion and Suggested Solutions

Constant drought, increased demands on surface and groundwater supplies and the ongoing influx of residents to the area are having a negative impact on the water supply for the region. Changes must be made soon to slow down and hopefully reverse this ongoing issue before it gets too late.

Implementation of modern farm practices such as drip irrigation have become more efficient in recent years and those that have employed these techniques have had greater success with the diminished amounts of water than using older flood irrigation practices (Dickens, 2019). Individuals who are meticulous about the way they use their water and plant their crops will do well during this ongoing drought. The employment of greenhouses in the areas will help residents conserve more water and increase their growing season, possibly making it a yearlong endeavor, creating an economic boost for the community. Water conveyance can be altered from an open ditch system to underground network of pipes; although this would be expensive it would reduce evaporative losses and channel water more efficiently. Overgrowth of invasive riparian vegetation in the area needs to be curtailed and the replanting of native Cottonwood trees will anchor the soil, preventing erosion and reduce evapotranspiration.

There needs to better be thought given to future residential development and zoning laws that prevent the number of houses that can built on one lot within the La Cienega Valley as there is in areas within Santa Fe and surrounding neighborhoods. The Office of the State Engineer needs to install meters and gauges at all diversions and watercourses along the Lower Santa Fe River beneath the outfall of the wastewater treatment plant and along Cienega Creek, its springs and tributaries. Additionally, there needs to be a limit on how many wells can drilled on a property to reduce the density of wells to any given area, or better yet connect these newly formed residential areas to the city’s water system so use can be better monitored. These changes, although expensive to implement will help to preserve the limited most valuable resource the region has, because without water there we have nothing. County Commissioners, Office of the State Engineer and City of Santa Fe need to address this significant issue, but ultimately, it’s up to the residents of these areas to make these changes. Unfortunately, most people are unaware of this serious problem; they need to be informed of the problems and learn how they can remedy the issue.

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