TWRI Mills Scholarship Application 2015

1. Quantifying Water Exchange Between the Brazos River and the Brazos River Alluvial Aquifer
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4. Over the past few years Texas has started to see various disagreements over allotments of water resources, including the Brazos River. Some people have argued that irrigation pumps at farms along the river are taking river water pre-allocated to entities downstream. In the farmers' view, they are legally pumping groundwater for which they own rights. What is really happening? This question cannot be answered without understanding the interactions between the Brazos River and the alluvial aquifer surrounding it. The focus of my project will be to characterize the exchange of water between the Brazos River and the Brazos River Alluvial Aquifer so that future disputes can be resolved fairly and new laws can be written based on an accurate, detailed understanding of the system.

    For this project we will use four independent methods to estimate the net volume of exchange between these two resources: differential stream gauging, specific conductance measurements, radon measurements, and an analysis of the major ions in the water.

    Differential stream gauging compares volumetric discharge values at different cross-sections of a river to see what volume of water is lost or gained in between. For our project we will install four river gauges approximately 10 river-km apart. These gauges, along with one pre-existing USGS gauge, will collect river stage data for one year for four study stretches. We will use an Acoustic Doppler Current Profiler (ADCP) to measure river discharge at each gauge site at 6 different levels of flow, then plot this data against the river stage data to create a rating curve for each site. These rating curves will provide a simple way to continuously compare river discharge between the gauged sites. If discharge at a downstream gauge consistently increases (compared to the gauges upstream) during non-rain events and when tributary inflows are accounted for, the differential stream gauging method assumes the increase to be from groundwater flowing into the river. Decreased discharge at downstream gauges are likewise attributed to river water seeping into the aquifer. We will use the measured values at each of our gauges to estimate how much water is lost or gained by the river in each study stretch.

    Specific conductance tends to be much higher in shallow Texas aquifers than surface waters. Groundwater also usually has a high concentration of radon relative to nearby surface water. This contrast makes these measures useful indicators of groundwater discharge into surface water bodies. For this study we will use the results from our differential stream gauging to identify river reaches that appear to be gaining groundwater. We will collect high spatial density radon and specific conductance measurements in these stretches and use them to identify the precise locations of groundwater discharge. The conductance and radon concentration measurements relative to nearby groundwater will provide independent estimates of the volume of groundwater discharge to the river.

    We have existing monitoring wells at one location that indicate the groundwater table slopes toward the Brazos River and therefore that groundwater flows into the river. We will collaborate with the Post Oak Savannah and Brazos Valley groundwater conservation districts for access to more groundwater monitoring wells and groundwater monitoring well data all along our study stretches to

see if this holds true throughout. If the aquifer does discharge into the river, our final method to measure the volume of flow will be through analysis of major ions. We will analyze water samples from the river and nearby groundwater wells with an ion chromatograph to determine major anion and cation concentrations. With these results we will perform chemograph separation to estimate the percentage of groundwater and river water making up a given stretch of the river. River water more similar in chemistry to nearby groundwater indicates greater groundwater discharge. This will represent another independent measurement of the volume of exchange between the river and the aquifer.

Our study will provide a high resolution characterization of the exchange between the Brazos River and its surrounding alluvial aquifer. This detailed knowledge will allow much more accurate estimates of natural gains and losses through the banks of the river, allowing for more accurate estimates of river water usage by Texans and improved future management of the river.

5. I received an Association of Former Students Scholarship and a Lechner Graduate Scholarship for this academic year. These scholarships, however, will not continue through the next academic year, so my current plan is to apply the funds from this scholarship to tuition.
6. I plan to pursue a career in environmental consulting where I will be able to apply the knowledge about groundwater-surface water interactions that I gain from this project. It seems that few people study both ground and surface water in depth because each is a vast, complex field that varies greatly each from the other. These two types of water bodies interact a great deal, however, and somebody needs to understand the links between them. When cleaning up toxic spills or evaluating the risks of future spills, at many sites it will be vital to understand how the groundwater interacts with the surface water. I believe after completing this project I will be able to fill at least part of this need in future contamination evaluations. Doing this work would give me what I think will be an interesting, highly rewarding career that I can hardly wait to start.