Salinity in the Colorado River Basin

Jeff Laird – ECL/GEO 290 Policy Brief

Executive Summary: In the Colorado river basin, salts from the surrounding geology as well as from urban and agricultural runoff flow into the Colorado River. This causes the overall salinity to increase as the river gets closer to its outlet in the Gulf of California, making it more difficult to meet water quality standards. Efforts to manage the salt input to the river cost hundreds of millions of dollars every year. The EPA, Bureau of Reclamation (BoR) and seven states affirmed that the US would maintain water quality flowing to Mexico through the Colorado River Basin Salinity Control program and continue to manage the water quality through monitoring and reduction efforts.

Water users in the Colorado River basin depend on its quality for drinking water supply, agricultural irrigation, and ecosystem services. These needs are complicated by the water quality degradation caused by salt inputs. Brackish water (containing a salt concentration of at least 500 mg/L) can create costly issues for water systems. Agricultural fields accumulate salt if not regularly flushed with cleaner water. Drinking water systems have to treat brackish water more extensively and are forced dispose of the waste brine with unsustainable methods. Transporting low quality water through metal pipes can also cause them to corrode and break. These damages caused by the salt inputs in the basin costs managers on the order of 380 million dollars annually.

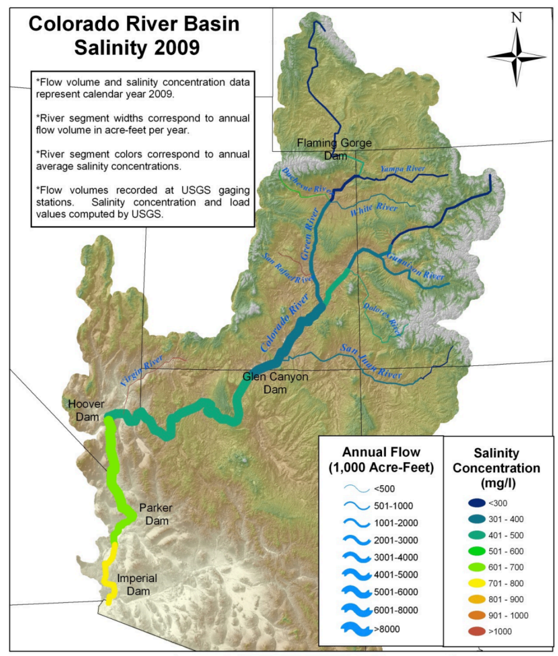

Figure 1: Colorado River Salinity and Flow Levels

The largest source of salinity in the Colorado River basin is the dissolution of minerals from the surrounding geology. These inputs can be point or non-point sources. Saline groundwater above the Mancos Shale layer in the upper basin drains into the Colorado river. Points sources include springs and salt domes spouting from saline aquifers. Irrigation on agricultural lands in the basin is the second leading contributor to salts in the Colorado. After crops are irrigated, the entrained salt from the water remains in the soil as it percolates. The salt will accumulate over time unless the fields are flushed, rotated, or fallowed. Additionally, when irrigators or municipalities divert high quality water, it leaves less in-stream to dilute salt inputs downstream. The many reservoirs on the Colorado River are another, albeit much smaller, source for salts. As water evaporates from the reservoir surface, it leaves behind its salts which accumulate in the reservoir.

A variety of legislation has been passed in the US obligating states or regions to maintain relatively clean water sources, such as the Water Quality Act, but until the Clean Water Act of 1972 there were not clear numerical benchmarks established for salinity levels. In particular on the Colorado River, salinity mandates below the Hoover, Parker, and Imperial Dams drive local reduction efforts. Additionally, the act states that the average salinity of the Colorado River must remain below 1972 levels, which is perhaps a more difficult target to maintain. The overseeing organizations re-evaluate successes or shortcomings on this front on a three-year interval. In 1974 the US passed the Colorado River Basin Salinity Control Act to regulate the quality of water flowing out of the US to Mexico in the Colorado River. Up until this act, the flow leaving California frequently consisted of low-quality agricultural tailings and difficult for Mexican farmers to utilize. In passing the act, the US approved construction on the Yuma Desalting plant (Title I) and committed funding for governmental organizations such as the Bureau of Reclamation, the Natural Resource Conservation Service, and the Bureau of Land Management to start salt-loading reduction programs (Title II). Managing salinity in the Colorado River basin is a continuous challenge to the multitude of local, state, and federal agencies involved. The main contributors to salt load reduction are the Bureau of Reclamation and the US Department of Agriculture. As a land manager and reservoir operator, BoR can change river flow and manage point and non-point sources. The USDA can change farming or irrigation practices to reduce salt contributions. And, as a last resort, the BoR can purify water using the Yuma Desalting plant mentioned above. This $245 million-dollar project has rarely been used since its construction due to the exorbitant operating costs. It does however provide a failsafe for meeting water delivery quality standards for exports leaving the US to Mexico.

Managing and controlling the salt inputs to the Colorado River is to be a costly and complicated process that will likely be exacerbated by climate change and highly variable water availability in the future. This necessitates the continued monitoring and evaluation of the existing salinity control measures in the basin and possibly will require a drastic expansion of all of these efforts. Some experts predict that managers will need to remove an additional ~380,000 tons of salt per year by 2035, an increase of about 5% from present values. Policy decisions made in the future will rely heavily on integrated modeling focused on variables that change salt inputs: precipitation, runoff, and groundwater.

References and Recommended Sources

"Salinity in the Colorado River Basin: Causes, Effects, and Implications," Presented by Nick Murphy, Ecogeomorphology