

Water and Water Use in Southern Nevada

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Executive Summary

Water and water use in southern Nevada is an important issue. The scarcity of water resources for both human and biologic communities often leads to intense competition for both surface and ground waters. Anthropogenic and climate change impacts on scarce water resources need to be understood to assess human and ecosystem health for southern Nevada. Chapter 3 outlines the state of the knowledge for hydrology in southern Nevada – ground water, surface water, and water quality – and provides recommendations for filling knowledge gaps. Information is presented that will help land managers develop strategies to achieve Sub-goal 1.3 in the SNAP Science Research Strategy, which is to “Restore and sustain proper function of southern Nevada’s Watersheds and Landscapes” (see table 1.1).

Groundwater

In southern Nevada, groundwater flow is strongly influenced by the physical framework of the system, which is characterized by aquifers, confining units, and flow barriers. Groundwater flows through a diverse assemblage of rocks and sediments in the region, and geologic structures exert significant control on groundwater movement.

The groundwater hydrology of southern Nevada, as in all flow systems, is influenced by geology and climate and varies with time. In general, groundwater moves through permeable zones under the influence of hydraulic gradients from areas of recharge to areas of discharge in the regional system. The topography produces numerous local subsystems within the major flow system. Water that enters the flow system in a recharge area may be discharged in the nearest topographic low, or it may be transmitted to a regional discharge area.

Three principal aquifer types exist within southern Nevada: (1) volcanic-rock aquifers, which are primarily tuff, rhyolite, or basalt of Tertiary age; (2) carbonate-rock aquifers, which are primarily limestones and dolomites of Mesozoic and Paleozoic age; and (3) basin-fill aquifers, which are primarily unconsolidated sand and gravel of Quaternary and Tertiary age. Any or all three aquifer types may be in, or underlie, a particular basin and constitute three separate sources of water; however, the aquifers may be hydraulically connected to form a single source. Other rock types within the region have low permeability and act as boundaries to the flow of fresh ground water.

In the prevailing conceptual model of interbasin flow, water enters the system as interbasin underflow and as recharge from precipitation in upland areas. Because of present-day arid conditions, recharge currently is restricted to higher altitudes; virtually no recharge occurs and no perennial surface water flows in the lowlands and valley floors (except the Colorado River and its tributaries). Ground-water flow paths within the system diverge from the highlands and are superimposed on deeper regional flow paths that are controlled largely by flow in the regional carbonate-rock aquifer. The

SNAP area is contained within two regional groundwater flow systems: the Death Valley flow system and the Colorado flow system. The Death Valley flow system is located in the southern part of the Great Basin province and is approximately 100,000 sq. km. in area. It consists of recharge areas in the mountains of central and southern Nevada and discharge areas of wet playas and springs south and west of the Nevada National Security Site and in Death Valley, California. The Colorado flow system is located in the Colorado River drainage system just east of the southern part of the Great Basin and is approximately 42,000 sq. km. in area. Recharge areas are in some mountainous areas within the flow system, but recharge to the system is also from groundwater flow from adjacent river systems. The Virgin and Colorado Rivers are the major discharge areas of the system.

Current sources of groundwater flow in the region are (1) recharge from precipitation in the mountains (usually winter storms) within the model domain; and (2) lateral flow into the area, predominantly through the carbonate-rock aquifer. Most groundwater recharge results from infiltration of precipitation and runoff on the mountain ranges. Water may infiltrate from melting snowpack in the mountains primarily on volcanic or carbonate rocks or adjacent to the mountains from streams flowing over alluvium (fans and channels).

Groundwater discharge in the region is from (1) seeps and spring flow from the regional carbonate-rock aquifer and local systems; (2) evapotranspiration (ET); (3) pumpage for irrigation, mining, public supply, commercial, and domestic uses; and (4) subsurface flow in or out of the area.

Surface Water

In southern Nevada, perennial streamflow is sparse, except in the Colorado River drainage. Most surface water in the region is either runoff or spring discharge. Precipitation falling on the slopes of the mountains forms small, intermittent streams that quickly disappear and infiltrate as groundwater recharge. In addition, several streams originate from snowmelt in the high altitudes of the Spring Mountains. Both of these types of streams have highly variable base flows and in dry years have almost imperceptible discharges. Springs maintain perennial flow for short distances in some of the drainages.

In most of Nevada, nearly all the streams that originate in the mountains are ephemeral and lose flow to alluvial aquifers as the streams emerge onto the valley floors. In southern Nevada, there are three main fluvial systems: the Colorado River (Lake Mead), the Virgin and Muddy Rivers, and the Las Vegas Wash. The Colorado River is supplied primarily by runoff from the Rocky Mountains. The Virgin and Muddy Rivers and the Las Vegas Wash are all tributaries to the Colorado River. The Muddy River begins as a series of regional springs in Moapa Valley and drains into the northern arm of Lake Mead (Colorado River). The Virgin River originates in Navajo Reservoir in southwestern Utah and enters Lake Mead from the north (forming the northern arm of the lake). Prior to the construction of Hoover Dam, the Muddy River joined the Virgin River. The Las Vegas Wash, which supports a large wetland, drains Las Vegas Valley and largely contains urban runoff, shallow ground water, reclaimed water, and storm water runoff. USGS measures discharge on all four of these rivers.

Ground-water discharges at Ash Meadows National Wildlife Refuge, Pahrangat National Wildlife Refuge, the Moapa Valley, at numerous springs and seeps in the mountainous areas, and along parts of the Amargosa River. Additionally, ground water is intersected at Devils Hole, a fissure in the regional carbonate-rock aquifer in the Ash Meadows area. Most springs can be classified as local (low discharge and cool temperatures) or regional (high discharge and warmer temperatures).

Knowledge Gaps and Management Implications

There are many actual and potential water-quality issues on and within the Federal lands of southern Nevada with respect to consumptive use, anthropogenic impacts, and preservation of habitat for endangered and threatened species. Desert Research Institute (DRI) has conducted extensive work assessing the water quality of local springs in southern Nevada as it relates to the viability of biologic communities. USGS, the U.S. Environmental Protection Agency, the National Park Service, U.S. Fish and Wildlife Service, the Bureau of Land Management, and other Federal, state, and local agencies collect water quality information on a somewhat routine basis.

As climate change and increasing population potentially reduce available water supplies for both human and biologic communities, the collection and interpretation of information to define and assess local and regional hydrologic conditions becomes vital. Assessing the information that is regularly collected by Federal agencies in southern Nevada has indicated that there are several gaps in data collection. Since there tends to be a project-by-project approach to data collection, at times there is no long-term program(s) to collect data. Data are collected for the goals of a certain project and once the project is completed, data collection ends. There is very little long-term continuity or planning on basic data collection that could be used to assess the hydrologic and biologic health of southern Nevada. A long-term consistent data collection effort will ensure that the right data are collected for evaluation of baseline conditions and assessment of long-term trends.

Recommendations for long-term data collection include: pumping inventories, evapotranspiration, recharge, spring discharge, and stream flow.

For a complete discussion of topics in this executive summary, see *Chapter 3, Water and Water Use in Southern Nevada*, in “The Southern Nevada Agency Partnership Science and Research Synthesis—Science to Support Land Management in Southern Nevada” (RMRS GTR-303).

Key References

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