B. Integrated Water Management

Introduction

Groundwater and surface water supplies in Nevada are finite resources. As the driest state in the nation, with an average precipitation of nine inches annually, Nevada's water supplies must be managed to maximize their effectiveness. As in many western states, Nevada's water supplies are typically not present at the locations where and when they are most needed. Further, variations between high water years and low water years can be dramatic. As an example, in northern Nevada along the Humboldt River, water supplies may vary from 25 percent of average (1994) to 250 percent of average (1995) from one water year to the next. The hydrologic systems throughout the state are complex and highly varied. The State's rapidly expanding population is putting increased pressures on available water supplies, thus increasing the need for integrated groundwater and surface water management.

Water Supply

Surface water provides approximately 60 percent of the total water used in the state. Snowmelt contributes to most of the stream flow, especially in the northern half of the state. Stream discharge is typically greatest during the months of May and June as a result of snow melt in the mountains. October low flow measurements range from 0.01 percent to 1 percent of June peak flow. Summer convective storms create much of the stream flow in southern Nevada. Flows are typically greatest near the headwaters, declining in low-altitude reaches due to irrigation, public use, infiltration and evapotranspiration. Surface waters in Nevada are virtually fully appropriated, thus, future development will rely heavily on groundwater resources.

Groundwater provides approximately 40 percent of the water used throughout the state. In many communities, groundwater provides 100 percent of the water used for municipal supply. In years of low surface water supply, groundwater may be pumped to supplement surface water sources. Groundwater usage typically increases in years with less rainfall, and declines when surface water supplies are adequate. Most groundwater supplies in the state have been developed from relatively shallow aquifers, less than 500 feet below ground surface.

Water Quality

Groundwater and surface water quality regulations are administered by the Nevada Division of Environmental Protection (NDEP) and adopted by the State Environmental Commission. In general, surface water quality varies over time and between reaches as one moves downstream, dependent on the amount of water in the stream. The water quality constituents of greatest concern in surface water are total dissolved solids (TDS), temperature, pH, nutrients and dissolved oxygen. Concentrations of chemical constituents are typically greatest during periods of low flow. In contrast, concentrations of suspended solids are generally greatest during high flows. Stormwater runoff can impact surface water quality, contributing pesticides, petroleum products, and organic chemicals to

surface water supplies.

Impacts from geothermal groundwater and surface water are found in areas throughout the state. Typically, the water quality constituents of thermal waters include temperature, TDS and metals such as arsenic and boron, and high concentrations of chloride, sulfate, and fluoride. Geothermal water is generally not suitable for most consumptive uses.

Groundwater quality typically varies throughout the State, dependant upon the composition of the aquifer material and sources and types of pollution. Concentrations of naturally occurring contaminates such as TDS, metals, fluoride, and sulfates vary, but typically do not exceed State and Federal drinking water standards in the majority of aquifers used.

Integrated Management

Conjunctive Use

The State of Nevada encourages conjunctive management of groundwater and surface water resources, to improve the reliability, economics and yield of available water supplies. The goal of conjunctive use of water systems in Nevada is to maximize the total yield of water. One approach is to maximize the use of surface water supplies when they are available and only rely on groundwater when surface water is not available. For example, the Carson City Utility Division has permits from the State Engineer authorizing them to increase groundwater withdrawals up to an imposed maximum (based on the conditions of the permit) during times of low surface water availability, with the understanding that surface water will be used to the maximum extent feasible. Another goal of integrated water management is to encourage the use of higher quality water sources for uses such as public drinking water supply. Lower quality sources can then be used for agricultural and landscape irrigation, mining, and other commercial and industrial uses which do not require potable water.

The availability of water from the three major rivers in northern Nevada (Truckee, Carson, and Walker) is dependent in large part on what flows across the state line from California. The amount of groundwater available to augment these supplies is small by comparison to the surface water flows. However, in times of drought, groundwater is an important component of an overall water management strategy to meet water demand.

Water Storage

One component of an integrated water management program is storage of surplus surface water in underground aquifers or in above ground reservoirs. The stored water enhances groundwater supplies, which can then be withdrawn when available surface water supplies are inadequate to meet demand. Surface reservoirs are relatively straightforward in their construction, but may not be financially, environmentally, or administratively feasible. Evaporation losses from surface reservoirs are also a factor. In northern Nevada, evaporation rates range from 3 to 5 feet per year, while in southern Nevada evaporative losses can exceed 8 feet per year. Underground storage is legally and

administratively complex, however, underground storage is typically less costly than above ground storage and evaporation losses are non-existent. The Nevada Division of Water Resources (NDWR) administers the statute governing development of aquifer recharge/recovery systems in the State. One component of the statute is a requirement to establish a "storage account", which defines the amount of water which can be recovered after recharge.

Water Reuse

The use of previously used water or treated waste water effluent for commercial, industrial, and irrigation uses is becoming more common in Nevada. Treated effluent is currently used for irrigation at many golf courses in both northern and southern Nevada. Treated effluent is also used for cooling tower make-up water at the Nevada Power Company power generating station at Sunrise Mountain in southern Nevada. Sierra Pacific Power Company's power generating station at Valmy uses water generated from mine dewatering at Lone Tree for cooling tower make-up water. This kind of water reuse helps to minimize withdrawals of potable water and thus maximize the amount of potable water available for the drinking water supply.

Groundwater / Surface Water Connection

The degree of connection between groundwater and surface water and the impacts due to water use can vary and so too, any impacts due to water withdrawals. Thus, water resources must be evaluated on a case-by-case basis to assess the best management practices for each specific use. In Nevada's basin and range province, the mountain ranges are typically fractured, allowing recharge to deep aquifers to occur. In contrast, in many locations, the valley floors are composed of fine lake sediments which inhibit groundwater recharge, as demonstrated by the presence of playa lakes. In most locations throughout the state, shallow groundwater aquifers have some connection with surface water systems.

If there is a connection between shallow groundwater and surface waters, water withdrawals may affect both water supplies and water quality. Monitoring and proper management of groundwater pumping can avoid or minimize any potential depletion of surface water resources which depend on groundwater inflows. Well drilling regulations which require a 100 foot deep sanitary seal in wells located within one-quarter mile of a stream, canal, or other water body are designed to prevent impacts due to pumping. How land is used may also affect groundwater and surface water quality. Fuel storage, land surface disturbance, urbanization and wastewater disposal all have the potential to impact both surface and groundwater supplies.

In some locations, applied irrigation using surface water is the primary component of shallow groundwater recharge. In these areas, water levels in shallow aquifer systems will vary depending on surface water supply and applied irrigation. Typically, the deeper aquifers are confined by fine-grained lake bed sediments and may be under artesian pressure, thus water levels will remain relatively constant over time, regardless of withdrawals from the shallow aquifer unless the shallow aquifer is significantly over-pumped.

State Agency Roles

Several state agencies have a role in integrated water management. The Nevada Division of Water Resources (NDWR) is responsible for issuing permits for groundwater and surface water use in the State. The Nevada Division of Environmental Protection (NDEP) is responsible for protecting surface and ground water quality. The Nevada Division of Water Planning is responsible for developing effective plans for water resource management in the state.

Nevada Division of Water Resources

The Nevada Division of Water Resources (NDWR) is responsible for allocating, adjudicating, and managing surface and groundwater rights in the State through the office of the State Engineer. Authorization for groundwater use is dependant upon the availability of unappropriated water and protection of existing water rights. Groundwater and surface water use requires a permit which identifies the point of use, timing, and manner of beneficial use. The State Engineer encourages the practice of conjunctive use for both public water supply systems and irrigation systems in the State. When the State Engineer issues permits for supplemental water rights, the total volume of water (duty) that can be used from any and all sources is established in the permit conditions. The State Engineer is responsible for ensuring that groundwater withdrawals do not exceed the perennial yield for each basin, in part to avoid impacts on surface water resources. NDWR also issues permits for aquifer recharge/recovery projects and conjunctive use projects.

Nevada Division of Environmental Protection

Groundwater and surface water quality are regulated by the NDEP and the State Environmental Commission. The NDEP updated the State of Nevada Comprehensive State Ground Water Protection Program (CSGWPP) in March 1998. This program addresses water quality impacts from sources such as agricultural chemicals, mining, underground storage tanks, underground injection wells, landfills and hazardous waste disposal. The NDEP's approach emphasizes pollution prevention. The Division's regulations require preventive measures, such as leak containment, discharge permitting, and storm water management.

Nevada Division of Water Planning

The Division of Water Planning (NDWP) is charged with development and implementation of a plan for use of groundwater and surface water resources within the state (the State Water Plan). NDWP provides the State, counties, and local communities with information, alternatives and recommendations for regional water planning and action for acquisition or conservation of existing resources. NDWP is responsible for investigation of new sources of water, including importation and conservation. The Nevada legislature has recognized the critical nature of the State's limited water resources and the demands placed on that resource by an increasing population, in the Divisions's statute (NRS 540). The legislature also recognizes the relationship between quality and quantity of water in NRS 540, including among the duties of the Division a stipulation that water quality and water quantity issues be considered simultaneously in planning efforts.

Nevada Division of Wildlife

The Nevada Division of Wildlife (NDOW) is responsible for protection and management of wildlife

and its habitat in the state. NDOW has specific water management concerns at the Wildlife Management Areas (WMAs) throughout the state. Water for fish and wildlife has been recognized as a beneficial use in Nevada since 1982, and NDOW is authorized to acquire land and water rights for preservation and restoration of wildlife and its habitat. However, water supplies vary, depending on the seniority of water rights owned by NDOW, and drought periods can severely impact wildlife habitat. Integrated groundwater and surface water management is a key component in maintaining water supplies for fish and wildlife habitat throughout the State and minimizing drought impacts.

Issues

1. If we are to increase our water supply development opportunities in Nevada, we must increase our understanding of the water resource as a whole. Effective management of the surface and groundwater supplies depends on a clear understanding of the nature and interaction of the water resources.

2. Surface water and groundwater are managed as two separate sources in Nevada. The appropriation and adjudication of surface water and groundwater are covered in NRS 533, and additional groundwater management tools are included in NRS 534. Each application for a water right permit can include only one source of water, even if the intended use requires water from more than one source, or a supplemental source (NRS 533.330). Water allocation and management decisions need to incorporate state-of-the-art knowledge regarding the relationship between groundwater and surface water.

3. Groundwater withdrawals in excess of perennial yield from near surface aquifers may impact the surface water base flow by drawing water down below the reach of a nearby stream. Over pumping groundwater can impact not only stream flows, but over time, may cause ground subsidence as well. Ground subsidence of up to five feet has occurred in Las Vegas Valley.

4. Underground storage is a viable alternative to the use of surface water reservoirs. Underground storage also virtually eliminates evaporative losses, which can range from 3 to 8 feet annually in Nevada. However, where the valley fill is fully saturated or where the alluvium consists of fine-grained silts and clays, surface water storage may be the only alternative to dampen variations between times of plentiful water and drought. Few communities are actively exploring the potential for underground storage of water, and fewer still are actively storing water underground.

Recommendations

To address the issues identified above, the following recommendations are made:

1. The State should continue groundwater and surface water monitoring to refine the estimates of perennial yield of hydrographic basins, and provide an improved estimate of water availability in the state.

2. The State should support funding and development of an enhanced groundwater level and quality monitoring network to better quantify groundwater availability and use throughout the state and especially in areas of rapid growth.

3. The State should fund integrated water resource studies to assess the effects of groundwater pumping on surface water flows on critical streams and springs where impacts have been identified.

4. The State should encourage development of aquifer recharge/recovery projects where feasible throughout the state, and evaluate surface water storage options where underground storage is not feasible.

5. The State should encourage installation of dual piping in new developments to facilitate use of treated water for irrigation and other uses which are not required to meet drinking water standards.

6. The State should encourage the preferential use of reclaimed water, surface water, and stored water.

7. The State should ensure that water users who use a combination of surface water, groundwater, or alternative water sources (reclaimed water, grey water, etc.) do not use more than the total amount of water necessary to meet their needs efficiently within the limit of their water right.

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