

# Hydrology and Water Quality

**E**lk Grove is part of the Sacramento River watershed, which covers approximately 27,000 square miles, with 400 miles of river from Lake Shasta to the convergence of the Sacramento-San Joaquin Delta. The Planning Area is also a part of this larger watershed.

More specifically, surface water resources in Elk Grove are a part of the Morrison Creek Stream Group, and include Elder, Elk Grove, Laguna (and tributaries), Morrison, Strawberry, and Whitehouse Creeks. Florin, Gerber, and Unionhouse creeks are located close to the City. Deer Creek is located in the eastern portion of the City, parallel to the Cosumnes River. The Cosumnes River is the eastern border of the City, however, all of the creeks in the area drain into the Morrison Creek Stream Group, then eventually into the Sacramento River. Runoff from precipitation and snowmelt from the Sierra Nevada mountains are the main sources of surface water supply in the City.

Laguna Creek, the Cosumnes River, and the Sacramento River are the main surface hydrological features in the City (see **Figure 8-1**). The Morrison Creek Stream Group drainage basin covers 192 square miles. The nine creeks that drain into Morrison Creek flow southwest and eventually drain into the Beach Stone Lakes area west of Interstate 5.

Laguna Creek, the main creek that flows through the City of Elk Grove, has been altered by development. There have been channels, levees, and culverts created to alleviate the possibility of flooding, as well as to accommodate different development scenarios. Some of the other creeks in the City have also been altered to accommodate development or alleviate flooding potential.

## Precipitation

According to the National Weather Service, the annual average precipitation for the Planning Area ranges from 15 to 20 inches. There is very little snow that falls in the Sacramento Valley, so is not considered a

climatic feature of the valley floor. More characteristic of the valley is the dense fog occurring in mid-winter. Fog usually occurs in the morning hours, and may continue for several days in a row if atmospheric conditions are stagnant.

## Flooding

A large portion of the City is located in a Zone X designation, or areas determined by the Federal Emergency Management Agency (FEMA) to be located outside a 500-floodplain. However, there are areas around the Sacramento River and Laguna Creek inside the 500-year and 100-year floodplains. The entire eastern border of the City that is near the Cosumnes River, the entire southern border, and the majority of the western border are within the 100-year floodplain (see **Figure 8-2**). This data does not reflect the 1997 flood of the Cosumnes River, but is currently being updated.

## Water Quality

### *Storm Water*

The City of Elk Grove Department of Public Works has jurisdiction over aspects of stormwater management in the City of Elk Grove. The Sacramento County Department of Water Resources has jurisdiction over the remainder of the Planning Area. This department was formed to manage the County's surface water and groundwater resources using the powers of the County of Sacramento and the Sacramento County Water Agency (SCWA).

Upon incorporation in July 2000, Elk Grove adopted Ordinance No. 2000-1, "An Urgency Ordinance of the City Council or the City of Elk Grove Providing for Sacramento County Ordinances to Remain in Effect After Incorporation." By passing this ordinance, the City of Elk Grove adopted two important County ordinances that provide legal authority for the Stormwater Quality Improvement Program - the "Stormwater Management and Discharge

Control Ordinance” and the “Land Grading and Erosion Control Ordinance.”

Specific to the East Franklin Policy Area in Elk Grove, the Sacramento County Department of Water Resources prepared the East Franklin Drainage Corridor Alternative Design Project. In addition to this project, there are several other drainage plans throughout the City and Planning Area. These plans include the Lower Laguna Creek Drainage Master Plan, the Strawberry and Jacinto Creeks Drainage Master Plan, the Vineyard Springs Comprehensive Plan Drainage Master Plan, and the North Vineyard Station Specific Plan Drainage Master Plan. Refer to the individual descriptions later in this section for further information about each drainage plan.

The City of Elk Grove became a joint participant with Sacramento County’s National Pollutant Discharge Elimination System (NPDES). The permit was renewed in December 2002, and allows for the City to discharge urban runoff from Municipal Separate Storm Sewer Systems (MS4s) in their municipal jurisdictions. The permit requires that the City impose water quality and watershed protection measures for all development projects. The NPDES also requires a permit for every new construction project that implements the following measures:

- Eliminate or reduce non-storm water discharges to storm water systems and other waters of the nation;
- Develop and implement a storm water pollution prevention plan (SWPPP); and
- Perform inspections of storm water control structures and pollution prevention measures.

#### *Surface Water*

Currently, the Sacramento River portion from Red Bluff to the Delta, which includes the portion along the western border of the Planning Area, as well as Elder Creek, Elk Grove Creek, and Morrison Creek are listed

water bodies on the California Clean Water Act Section 303(d) list due to containing specific pollutants. Elder Creek, Elk Grove Creek, and Morrison Creek contain the pollutant Diazinon, which is an insecticide used to control pests on crops. A Total Maximum Daily Load (TMDL) is in process for all three water bodies, all of which began in January 1998, and are scheduled for completion in December 2011. Elder Creek also contains the contaminant Chlopyrifos, which is also an insecticide used to control pests on crops. The TMDL began in January 1998 and is scheduled for completion in December 2011.

The portion of the Sacramento River that borders the western side of the Planning Area contains Diazinon, Mercury, and an unknown toxicity. Both the Diazinon and Mercury pollutants have a TMDL in process, both of which began in January 1998 and are scheduled for completion in December 2005. The TMDL for the unknown toxicity began in January 2001 and is scheduled for completion in December 2011.

The Water Quality Control Plan (Basin Plan) for the California Regional Water Quality Control Board (RWQCB), Central Valley Region, for the Sacramento and San Joaquin River basins, identified objectives to maintain pesticide levels in the water bodies, and not to exceed the Maximum Contaminant Levels set forth in the California Code of Regulations, Title 22, Division 4, Chapter 15.

The RWQCB recently released a staff report to develop a Basin Plan for the Sacramento and Feather Rivers in order to control the discharge of diazinon and orchard runoff and establish a TMDL for diazinon for the Sacramento and Feather Rivers (CVRWQCB, 1998). According to the staff report, the designated study area is north of the Elk Grove Planning Area. Therefore, this new study will not affect the current studies being conducted within the Planning Area.

*Figure 8.1*

*Figure 8.1, cont.*

*Figure 8.2*

*Back of Figure 8-2 (color)*

## Groundwater Resources

### *Regional Aquifer System*

The Central Valley contains the largest basin-fill aquifer system in the state. The valley is in a structural trough about 400 miles long and from 20 to 70 miles wide and extends over more than 20,000 square miles. The trough is filled to great depths by marine and continental sediments, which are the result of millions of years of inundation by the ocean and erosion of the rocks that form the surrounding mountains. Sand and gravel beds in this great thickness of basin-fill material form an important aquifer system. From north to south, the aquifer system is divided into the Sacramento Valley, the Sacramento--San Joaquin Delta, and the San Joaquin Valley sub regions, on the basis of different characteristics of surface-water basins. The aquifer underlying the Planning Area is part of the Sacramento Valley sub-region.

The Sacramento Valley aquifer system is formed primarily of sand and gravel with significant amounts of silt and clay, all of which have been eroded mainly from older rocks at the boundaries of the valley. The environments in which the continental sediments were deposited varied, but most were deposited in fluvial environments; however, the deposits contain some lacustrine beds. Beds and lenses of fine-grained materials, such as silt and clay, constitute a significant percentage of the aquifer system. In most parts of the valley, fine-grained materials compose 50 percent or more of the aquifer system. The most extensive clay bed, which is informally named the "E-clay", consists primarily of the Corcoran Clay. Because beds of silt and clay do not readily transmit water under natural conditions, they act as barriers to vertical flow and cause differences in hydraulic head with depth.

Sacramento County contains a single heterogeneous aquifer system that contains water under unconfined, or water-table, conditions in the upper few hundred feet; these conditions grade into confined

conditions with depth. The confinement is the result of numerous overlapping lens-shaped clay beds. Geophysical well logs indicate that the "E-clay," although probably the largest single confining bed, constitutes only a small percentage of the total thickness of clay layers in the aquifer system. This indicates that the significance of the "E-clay" as a barrier to vertical flow may have been exaggerated. Further, the difference in hydraulic head directly above and below the "E-clay" is small when compared to head differences within intervals of the deep parts of the aquifer system.

Prior to urban development, the aquifer system was under steady-state conditions in which natural recharge balanced natural discharge. Groundwater in the shallow part of the aquifer system flowed from areas of high altitude at the valley margins, where most of the recharge took place, down gradient to discharge into rivers and marshes near the valley axis. Under predevelopment conditions, streams emanating from the Coast and Cascade Ranges and the Sierra Nevada primarily recharged the aquifer system. Most of the recharge was in the northern and eastern parts of the valley. Precipitation falling on the valley floor during the rainy season provided only a small part of the total recharge. Groundwater that was not evaporated or transpired by plants discharged either into the Sacramento and the San Joaquin Rivers that drained to San Francisco Bay or into the Tulare Basin from which it was eventually removed by evaporation or transpiration.

Additionally, under predevelopment conditions in Sacramento County, the hydraulic head in the shallow water-table aquifer where water entered the aquifer system at the valley margins was greater than the head in the deeper confined aquifer; thus, ground water moved downward. Conversely, the head gradient was reversed where water left the aquifer; typically by discharge to surface water bodies, and the hydraulic head in the water table aquifer was less than that in the confined aquifer. The difference in

hydraulic head created upward movement of the groundwater toward rivers and marshes. Precipitation that fell on the valley floor and was not lost to evapotranspiration recharged the water-table aquifer and moved down the head gradient toward the rivers and surrounding marshes. Upward vertical flow to discharge areas from the deep confined aquifer was impeded by confining clay beds, which caused a pressure head in the deep parts of the aquifer system. Because of the pressure head, wells that penetrated the deep aquifer in low-lying areas near the rivers and marshes flowed during the early years of development in the valley, and did not require additional groundwater extraction.

By the early 1960's, urban development and agricultural activities had lowered groundwater elevations and altered groundwater flow patterns in the aquifer system. Because the magnitude of the withdrawals caused hydraulic heads in the confined parts of the aquifer system to fall far below the altitude of the water table, the vertical hydraulic gradient was reversed over much of the Central Valley. As a result, much of the water in the upper unconfined zone of the aquifer system that flowed laterally toward the river under predevelopment conditions leaked downward through the confining beds into the lower confined aquifer. However, concurrent with an increase in surface-water imports in the early 1970's, groundwater withdrawals in the aquifer system decreased, which allowed groundwater levels in many areas to recover in the confined part of the aquifer system, in some cases to pre-1960 levels. With few exceptions, the groundwater flow patterns in the aquifer system today are similar to those in the mid 1970's (USGS, 1995).

#### *Local Setting*

Groundwater in the Planning Area occurs in both the upper shallow aquifer zone and in the underlying deeper aquifer zone. The deeper aquifer is composed primarily of the Mehrten Formation and is separated from

the shallow aquifer by a discontinuous clay layer. The thickness of the deep aquifer ranges from approximately 200 feet thick in the eastern portion of the county to over 2,000 in some of the western portions of the County. As mentioned above, a discontinuous clay layer that is not completely impermeable in some areas separates the shallow and deep aquifers. Therefore, there is a potential for vertical movement of groundwater between the two aquifers. Generally, the movement of groundwater between the aquifers occurs when a head differential exists between the aquifer systems. For instance, if heavy pumping in the deep aquifer reduces the pressure head in this system, then groundwater from the shallow aquifer will be induced to recharge the deeper aquifer. Conversely, if groundwater levels are decreased (by increased pumping) in the shallow aquifer, then the potential exists for the upward movement of groundwater to recharge the shallow aquifer.

Recharge to the aquifer system in the Planning Area occurs from a combination of three main sources: stream recharge (primarily from the Cosumnes and Sacramento rivers), subsurface inflows from adjacent areas, and percolation of rainfall and applied water. A large area on both sides of the Cosumnes River as well as a small portion around the Sacramento River have areas with high to moderate recharge capabilities (see **Figure 8-3**). The majority of the Planning Area has poor groundwater recharge capabilities. Additionally, a groundwater contour map of the Planning Area shows groundwater levels ranging from fifty feet below sea level to fifty feet above sea level (see **Figure 8-4**). The lowest point is located under Bruceville Road, south of Elk Grove Boulevard, just east of the town of Franklin. The highest point is located at the intersection of Grant Line Road and Cosumnes River in the northeast

#### *Groundwater Production*

Sacramento County Water Agency (SCWA) pumps its groundwater for municipal uses

Figure 8.3

Figure 8.3, cont.

Figure 8.4

Figure 8.4, cont.

from the deeper aquifer due to higher per well yields. The California-American Water Company (Cal-Am) and the Florin Resource Conservation District/Elk Grove Water Service (FRCD/EGWS) also obtain groundwater from the deeper aquifer. The well depths in the aquifer system are determined by the depth of permeable aquifer material and the quality of the ground water. Generally, municipal wells depths are usually less than 500 feet deep in the Planning Area. The greater depth of wells is a result of the low permeability of the sands in the unconfined aquifer and of highly mineralized water and water high in selenium in the upper parts of the aquifer system. Well yields of more than 1,000 gallons per minute are commonly obtainable throughout the aquifer system. The average yield of wells is approximately 800 gallons per minute, but yields as large as 4,000 gallons per minute have been recorded.

There are approximately 22 municipal wells in and around the Planning Area. Municipal wells are those that are operated and maintained by water purveyors to provide potable water supplies for domestic, commercial and industrial uses within the urbanized portions of Sacramento County. The average municipal well depth in the Planning Area exceeds 350 feet, with few wells having depths of less than 200 feet. Agricultural wells are classified as those that are primarily utilized for crop and pasture irrigation. Because agricultural wells in Sacramento County are privately owned and operated by individual farmers, the total number and specific locations are not readily available. However, the agricultural wells in the County generally range in depths from 60 to 600 feet. The deepest agricultural wells in the County are located in the Galt area where the depth to groundwater levels is the greatest. Rural domestic wells are those that are used to supply rural homes with water. The actual amount of rural wells in operation is difficult to determine as these wells are owned and maintained by private homeowners who use the water for landscaping, livestock, and pastures. There is estimated to be

approximately 667 rural wells in the County. Generally, municipal and agricultural wells require higher yields, which many times requiring tapping the deeper aquifer. Since rural domestic wells require smaller yields than both municipal and agricultural wells, the water is generally obtained from the upper shallow aquifer.

#### *Groundwater Quality*

The thickness of aquifer saturated with freshwater (water with less than 1,000 milligrams per liter dissolved-solids concentration) in the aquifer system varies greatly and depends, for the most part, on the depth to and permeability of the rocks that underlie continental deposits. In the Planning Area, the base of freshwater generally coincides with the base of continental deposits. The several isolated lenses of saline water that are within the freshwater zone may be evaporation residues or estuarine water that was trapped by subsequent sedimentation. The depth to the base of freshwater is as much as 2,500 feet in some portions of the Sacramento Valley.

Freshwater is available throughout the Central Valley. The concentration of dissolved solids in the ground water reflects the general chemical character of water in the streams that recharge the aquifer system. Dissolved-solids concentrations in the streams, in turn, are directly related to the type of rocks that form the geologic conditions of the area. Thus, groundwater in the Sacramento Valley has generally lower dissolved-solids concentrations than other sub-regions in the Central Valley. In general, dissolved-solids concentrations increase as the depth increases in the aquifer system. Therefore, the deeper wells are likely to produce water with larger dissolved-solids concentrations than the shallower wells in the aquifer system.

Groundwater in predominantly agricultural areas (i.e., southern and eastern Sacramento County) can become excessively saline and damaging to crops because evaporation of sprayed irrigation water and evapotranspiration of soil

moisture and shallow groundwater leaves behind dissolved salts. As a result, the concentration of salts in the soil and shallow groundwater increases and may reach levels detrimental to plant growth. Shallow irrigation wells worsen the problem by recirculating the saline shallow groundwater, thus accelerating the process. The potential for crop damage due to saline irrigation-return flow is widespread in some portions of the valley. Although several individual irrigation return-water drainage systems are operated, there is not a valley-wide system removes shallow saline groundwater. An estimated 400,000 to 700,000 acres of arable land may be lost by 2010 because of increasing soil and water salinity with an accompanying loss of from \$32 million to \$320 million annually.

Excessive concentrations of nitrate in water are potentially harmful to infants and young children, and the maximum recommended for drinking water by the U.S. Environmental Protection Agency is 10 milligrams per liter. Some crops may be affected by nitrate concentrations as low as 5 milligrams per liter. Generally, the contaminated wells are shallow, and the source of nitrate pollution can be attributed to effluent from waste-treatment facilities, discharge from septic tanks, or leaching of nitrogen fertilizers. Occurrences of nitrate in concentrations of greater than 5 milligrams per liter are sporadic in the Planning Area and seem to be confined mainly to the shallow parts of the aquifer. The contamination is usually attributable to local sources, such as septic tanks, feed lots, and dairies.

#### *Groundwater Yield*

In order to evaluate the groundwater resource availability in the Sacramento County area, the Integrated Groundwater-Surface water Model (IGSM) was developed by Montgomery Watson for use by the SCWA. The IGSM is a planning tool, which incorporates all of the major components of surface and groundwater hydrology in the county area. Additionally, the IGSM is capable of simulating the effects that

varying amounts of groundwater pumping can potentially have on groundwater levels in the aquifer system.

SCWA defines long-term sustainable yield, or the safe yield, as the amount of pumping that does not result in a long-term decline in groundwater levels. The determination of the safe yield of the groundwater system is dependent upon many factors. However, maintaining the yield of the aquifer system at lower levels may increase the yield of the system, and may have associated impacts. These impacts could include any of the following:

- Increased pumping costs due to lower groundwater levels;
- In-migration of lower-quality water from the deep aquifer system or adjacent areas;
- Causing wells to become inoperative due to lower groundwater levels;
- Land subsidence; and/or
- Increased rate of spreading or localized groundwater contamination.

SCWA projects that groundwater pumping of up to 273,000 acre-feet annually in the Central Area (which consists of the Planning Area) would result in the cone of depression in the Elk Grove area stabilizing at approximately 50 feet below existing levels.

#### *Agriculture and Urban Water Use*

According to the Sacramento County Department of Water Resources (DWR) projections, a net reduction of approximately 17,500 acres of irrigated cropland is anticipated in Sacramento County between 1990 and 2030. The largest decreases are expected in the northern and southern portions of the County as more agricultural land is converted to urbanization. The actual agricultural demands vary from year to year depending on hydrologic conditions. Based on the IGSM and DWR projections, there would be

a net decrease in agricultural demands of approximately 80,000 AF/yr in the County between 1990 and 2030. Agricultural water throughout the Planning Area is generally supplied through groundwater pumping.

Based on SCWA baseline conditions (existing), groundwater demand is projected to increase from approximately 530,000 AF/yr to approximately 649,000 AF/yr. Most of the increases in groundwater usage are projected to occur in the South Sacramento Area (i.e., the Sunrise area and Zone 40 sub-regions), where significant urbanization and water demand is anticipated to occur. The projected 2030 projected urban water use was obtained from the Sacramento Area Water Demand Study, which developed urban water demands estimates based on future land uses designated in the current Sacramento County General Plan. The total urban water use in the County is projected to increase significantly from approximately 389,000 AF/yr (1990) to approximately 695,000 AF/yr.

#### Cosumnes River Groundwater Studies

The University of California, Davis has collaborated with the Cosumnes River Preserve, the United States Fish and Wildlife Service (USFWS), and other non-profit organizations to create a university/agency/foundation partnership with the purpose of *advancing watershed science to support more effective and sustainable watershed restoration practices and, addressing the information needs of adaptive management in the North Delta and the Cosumnes and Mokelumne River watersheds*. A number of studies were conducted in a wide range of disciplines, including hydrology, geology, engineering, ecology, and wildlife biology. The focus of the studies was to identify the interaction between regional groundwater elevations and surface water flows in the Lower Cosumnes River. The studies conducted include, but are not limited to the following:

- Local and Regional Scale Investigation of Groundwater Surface Water Interaction in an

Over-Drafted Groundwater Basin (Jan Fleckenstein, Eriko Suzuki, and Graham Fogg, UC Davis/Cosumnes Research Group).

- Modeling Groundwater Surface Water Interactions to Restore Fall Flows in the Lower Cosumnes River Basin (Jan Fleckenstein, Eriko Suzuki, and Graham Fogg, UC Davis/Cosumnes Research Group).
- Investigations of Groundwater Surface Water Interactions and their Role in Declining Fall Flows in the Lower Cosumnes River Basin (Jan Fleckenstein, Eriko Suzuki, and Graham Fogg, UC Davis/Cosumnes Research Group).

Usually there is some form of hydraulic connection between the river and the groundwater system (aquifer), which means that changes in pressure or stage in one system have a direct effect on the other system and the exchange between the two. Base-flow is contributions to river flow from the groundwater or aquifer system. A hydraulic disconnection means that the groundwater levels lie below the elevation of the river channel bottom for extended reaches of the river. Under hydraulic connection the river can receive flow contributions from the aquifer system and be a gaining or influent river or it can lose flow to the groundwater aquifer and be a losing or effluent river. Additionally, the pumping of groundwater may affect baseflow contributions along various reaches of the river; thereby, potentially influencing aquifer and river interactions.

According to the studies, declining flows on the Cosumnes River may be linked to decreasing base-flows and the overall decline of groundwater tables; however, unequivocal proof of this relationship is difficult due to the limited amount of historical records on ground- and surface-water conditions in Sacramento County. The studies determined that groundwater levels around the river channel were possibly hydraulically connected with the river in the 1940's. However, the studies

indicated that the Lower Cosumnes River (river miles 0-36) channel is largely hydraulically disconnected from the regional aquifer.

The Cosumnes River may have been in contact with the aquifer system and received base-flow along its entire length before major groundwater development occurred in Sacramento County in the 1950's and 1960's. Under a no groundwater pumping scenario, the Cosumnes River, even under natural conditions, may have alternated between gaining (influent) and losing (effluent) in some stretches. Enormous amounts of water would be needed to locally recover groundwater tables and restore base-flows to the river.

The hydraulic disconnection is most pronounced in the middle reaches of the river (river miles 11 to 25.8), which is between State Route 99 (SR 99) and Meiss Road. Depth to the regional groundwater table from the river channel elevation steadily increases from 7 to 20 feet in the Dillard Road area (river mile 27.5) to approximately 35 to 55 feet near Wilton Road (river mile 17.3). Between Wilton Road and SR 99 (river mile 11) depth to the regional groundwater table decreases to approximately 15 to 30 feet and decreases even further to approximately 3 to 15 feet around the Twin Cities Road area (river mile 5). In some portions of the river downstream of Twin Cities Road, the water table lies above the channel elevation. Additionally, seasonal water fluctuations from monitored wells along these stretches ranges from 10 to 17 feet.

It was determined that significant lowering of the groundwater tables in these areas could have an adverse effect on river flows; however, river flows over the extended middle reaches of the river (between SR 99 and Meiss Road) are unaffected by groundwater level fluctuations under current conditions. Additionally, these reaches receive no base flow contributions; therefore, are considered to be predominantly effluent or losing. To restore and sustain baseflows along the entire lower

river, water table elevations between Dillard and Twin Cities Road would have to be raised by up to approximately 55 feet. Although the studies did indicate that drastic declines in groundwater tables are at least 'partially' responsible for the increasing low flows in the fall on the Lower Cosumnes, changes in groundwater levels were determined to have no immediate effect on flows in the river as long as no hydraulic connection is reestablished.

When a river aquifer system is hydraulically disconnected, the only exchange between the two systems is seepage losses from the river to the aquifer. The simulations indicated that annual seepage losses ranged from 10,000 AF/yr to 20,000 AF/yr in both the upper and lower reaches of the river. Additionally, the simulations indicated that the combining of upstream pumping reductions and flow augmentations from the Folsom South Canal (FSC) would result in the greatest increase in fall flows. This results from less of the augmented water being lost to seepage from a partially reestablished hydraulic connection between the river and the aquifer in the upper reaches.

Reducing seepage losses by reconnecting the regional aquifer with the river channel would require enormous amounts of water. Annual reductions in pumping of approximately 166,000 AF would be required to partially reconnect the river in the upper reaches. In the lower stretches of the river, annual reductions of approximately 250,000 AF (or approximately 50 percent of the annual baseline groundwater pumping) is required to even partially reconnect the aquifer and river.

In 2000, a reversal occurred in September before the first fall rains. The reversal could indicate that the river reaches upstream of Dillard Road had switched from losing conditions to gaining conditions, probably in response to rising water tables and initiated baseflow after the end of summer irrigation, which indicates that the reaches upstream of Dillard Road seasonally receive baseflow. Other reasons for gains in flow may be attributable to additional baseflow from

perched water tables that have built up from continuous irrigation return flows. Additionally, the general reaction of the groundwater system to additional recharge from floodplains suggests that large floods could significantly contribute to the recovery of regional groundwater levels.

Based on projected land uses and water use conditions in Sacramento County, groundwater levels tend to decline for approximately 20 years due to groundwater pumping that exceeds the level of groundwater recharge. However, groundwater recharge (mainly from stream recharge and subsurface boundary inflows) responds to the lowering of groundwater levels and eventually reaches a quasi-equilibrium position, in which groundwater levels stabilize. Under the quasi-equilibrium condition, groundwater levels fluctuate in response to hydrologic conditions (i.e., wet and dry years), with the long-term average levels remaining the same. It should be noted that generally, excess groundwater pumping beyond certain limits results in a continuous groundwater level decline, which could potentially result in a permanent mining condition of the groundwater basin. However, the results of the Baseline conditions indicated that this would not occur even under the projected level of groundwater pumping under cumulative 2030 conditions. Overall, the studies concluded that to better quantify effects of reconnecting the aquifer system and the river and to assess the potential efficiency of other artificial recharge efforts, a better understanding of local and regional scale hydrostratigraphy and geologic heterogeneity as well as more reliable numerical models would be needed. Additionally, the SCWA is currently working on new and updated models to identify the agencies activities and potential impacts on the Cosumnes River basin. The preliminary and final modeling results will be incorporated into the SCWA's Zone 40's EIR for its Water Supply Master Plan.