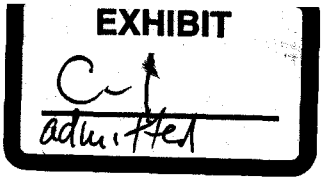

ARIZONA DEPARTMENT OF WATER RESOURCES

HYDROLOGY DIVISION

MEMORANDUM

TO: Dennis Sundie,
Power Plant and Transmission Line Siting Committee

Greg Wallace
Chief Hydrologist

FROM: Dale Mason, Supervisor,
Groundwater Modeling Section
Hydrology Division

DATE: August 31, 2000

RE: Hydrologic Review of Sempra Energy Resources Power Plant Application, Docket Number L-00000S-00-0101.

This memo details the Arizona Department of Water Resources (ADWR) review of the potential affect on local groundwater conditions of Sempra Energy Resources' proposed Mesquite power plant. This review consists of two sections, the first is an analysis of water level records and reported pumpage for the area around the proposed plant site. The second section is a review of a numerical groundwater flow model developed for the Centennial Wash area. Sempra Energy Resources, Duke Energy, and Pinnacle West have proposed to build and operate three power plants in the area around Centennial Wash, in western Maricopa County. To determine the cumulative affects of groundwater pumpage on local water levels by the three plants, Sempra, Duke, and Pinnacle West funded a joint numerical groundwater modeling study of the Centennial Wash area.

Current Water Level Status

The proposed plant site is located in the southern part of the Hassayampa sub basin of the Phoenix AMA in Township 1 South, Range 6 West. Water level records for the entire township were reviewed to determine current depth to water and recent trends in water levels. As part of an ongoing water level data collection program, the ADWR conducts periodic water level sweeps of the Phoenix Active Management Area (AMA). The most recent water level sweeps were done in 1991 and 1997. In addition to the periodic water level sweeps, the ADWR measures water levels annually in selected wells throughout the State. The water levels from these wells, called index wells, can be used to identify long-term changes in the water table.

The earliest available depth to water records for the area around the proposed plant site are from the late 1940s and early 1950s. The depth to water ranged from about 115 to 130 feet below land surface at that time. Hydrographs of wells near the proposed plant site indicate a steady regional water-level decline from the early 1950s to the mid-1980s. A cone of depression centered in the southern part of Township 1 South, Range 6 West, formed during the years of peak groundwater pumpage in the 1960s and 1970s, when groundwater pumpage for agricultural irrigation over-drafted the regional aquifer. Water level declines in the center of the cone totaled as much as 120 feet.

Since the mid-1980s, the regional water level decline has stopped and water levels have steadily recovered. Wells in the area around the proposed plant have measured water level recoveries ranging from 20 to 45 feet since the early 1980s. There are three index wells in the area of the proposed plant site with water

level records dating from the early 1950s to the present. These wells show measured water level recoveries of 40 to 50 feet from 1981 to the present. Overall, it appears that since the mid-1980s, water levels in the general vicinity of the proposed plant site have recovered at a rate of 1 to 3 feet per year. The current depth to water in the area ranges from about 160 to 220 feet below land surface. However, despite the recent water level recoveries the current direction of groundwater flow is still generally to the south towards the center of the cone of depression.

Groundwater Pumpage

Most historic pumpage in the area around the proposed plant site was for agricultural irrigation, domestic and stock pumpage is a very minor component of the total groundwater pumpage. Prior to 1984, groundwater pumpage in the Phoenix AMA was not required to be reported to the Department. However, the U. S. Geological Survey (USGS) estimated pumpage for many areas of the state based on power consumption records. Pumpage estimates made by the USGS for the Centennial Wash area from the 1950s, to the 1970s ranged from 30,000 to 45,000 acre-feet per year.

All major groundwater users in the Phoenix AMA have been required to report annual groundwater withdrawals to the Department through the Registry of Groundwater Rights (ROGR) system since 1984. From 1984 to the present groundwater pumpage in the area near the proposed plant site has declined steadily. Since 1991 reported pumpage in Township 1 South, Range 6 West, has averaged only 3,400 acre-feet per year.

Sempra Energy has bought or has options to purchase approximately 3,000 acre of land in Township 1 South, Range 6 West. These lands include agricultural Irrigation Grandfathered Rights (IGFRs) to 15,000 acre-feet of groundwater. Conversion of these agricultural IGFRs to Type I industrial rights will give Sempra the right to withdraw about 8,000 acre-feet per year, enough to cover the 7,500 acre-feet per year needed by the proposed plant. Conversion of the agricultural IGFR to a Type I right will cause a net decrease in the allowable pumpage from the local aquifer.

Groundwater Model

I have reviewed the report, "*Evaluation of Groundwater Responses to Pumping for Proposed Power Plants in the Centennial Wash Area, Maricopa County, Arizona*"(Mock, 2000). The report details the joint groundwater modeling study conducted by Sempra Energy, Duke Energy, and Pinnacle West for the area around Centennial Wash, in western Maricopa County. The groundwater flow model was developed for use as a tool to predict how the groundwater system in the Centennial Wash study area may respond to the cumulative pumpage of the three proposed power plants.

The Department was involved in an ongoing oversight and review capacity during the construction of the model. This early involvement in technical issues during model development has helped to satisfy any concerns that the Department may have had regarding the content and accuracy of the model. The Centennial Wash Area groundwater flow model is able to reasonably simulate both current and historic measured water levels. As a result, any future projections of water level changes based on model result may be inferred to be an accurate approximation of future conditions, given that the future pumpage stresses simulated are an accurate reflection of potential future conditions.

The groundwater flow model is able to simulate water levels within an average of 15 feet of current measured water levels. This level of model accuracy is good considering the level of error on measured water levels is about 10 feet. The model is also able to reasonably simulate measured historic changes in water levels within the modeled area. The ability of the model to accurately simulate large changes in historic water levels, both declines and recovery, is a good indicator that the model reasonably simulates the groundwater system in the Centennial Wash area.

The modeling study presented five future scenarios, each representing a different set of development plans for the area around the proposed power plant. The model scenarios were developed to compare the cumulative effects of the three proposed power plants to other potential uses for the land. One scenario represented a return to full agricultural production with the maximum allowable IGFR pumpage. A second scenario assumed the three power plants would be built and utilize their full converted Type I water rights. Two scenarios were developed that had the area undergo urban developed at different population densities. A fifth scenario maintained current conditions with no future development. All the scenarios were run out thirty years into the future to compare water levels at the expected end of the power plants operational life.

Under a return to full agricultural production with pumpage totaling about 35,000 acre-feet per year, the model predicted a maximum water level decline after of 30 years of about 180 feet. Urban development for populations of 57,000 and 100,000 people will need about 14,000 and 21,200 acre-feet per year to satisfy water demands, respectively. The lower population density will cause a predicted maximum drawdown of about 15 feet. The higher population density will cause a predicted maximum water level decline of 65 feet after 30 years. If no development occurs on the property and current water uses are maintained, the model predicts water levels will continue to rise. An additional 25 feet of water level recovery is projected after 30 years. If the three proposed power plants are built the total pumpage for the plants will be about 22,600 acre-feet per year. After 30 years of operation by the three plants the maximum drawdown of the local aquifer is predicted to be about 75 feet.

Conclusions

The numerical groundwater flow model developed for the Centennial Wash area allows the cumulative affects of pumpage by the three power plants on the local aquifer to be approximated. The proposed pumpage for the three power plants will impact local water levels over the life of the plants. Water levels can be expected to decline by about 75 feet in areas near the withdrawal points. These expected water level declines will negate the recent recoveries and after 30 years of operation water levels will return to the levels of the early 1980s.