GENTERRA
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ENGINEERING & ENVIRONMENTAL SERVICES

TECHNICAL MEMORANDUM

TO: Rex Wait, Vice President
The Nevada Hydro Company, Inc.

FROM: Joseph J. Kulikowski, P.E., G.E.
GENTERRA Consultants, Inc.

SUBJECT: Comments on Issues Relating to Hydrology as Identified in the DEIS
Lake Elsinore Advanced Pumped Storage Project (LEAPS)
FERC Project No. 11858

DATE: March 31, 2006

This Technical Memorandum presents the results of a review of hydrology issues for the proposed Lake Elsinore Advanced Pumped Storage Project (LEAPS) in Riverside County, California. The review was performed by GENTERRA Consultants, Inc. (GENTERRA) for The Nevada Hydro Company, Inc. (Nevada Hydro) in accordance with the scope of work authorized on February 20, 2006.

This review was undertaken in response to the Federal Energy Regulatory Commission's (FERC) "Draft Environmental Impact Statement – Lake Elsinore Advanced Pumped Storage Project, California, FERC Project No. 11858" (DEIS), dated February 2006. At the request of Nevada Hydro, GENTERRA was asked to discuss the validity of relevant statements made in the DEIS document, as related to hydrology issues.

The two candidate upper reservoir sites are Morrell Canyon (preferred site) and Decker Canyon (alternate site). These two sites are situated at the top of the steep northeast-facing slope of the Elsinore Mountains on the west side of Lake Elsinore.

The comments presented below are identified with the related section, page number and statement from the DEIS. The statements in quotes and italics are the actual wording from the DEIS, then our comments follow each quoted statement.

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"Surface water in the upper San Juan Creek Watershed in proximity to the proposed Morrell Canyon and Decker Canyon upper reservoir sites is intermittent and directly related to precipitation. Lion Spring, a natural spring within Morrell Canyon, is a length of streambed where perched groundwater surfaces into the canyon drainage for portions of the year. Because of the natural setting, surface flows originating from the upper watershed are of good quality during the brief times there is enough to runoff; typically during winter rainy season."

Comment:
Seasonal discharge of groundwater to the surface occurs at Lion Spring in Morrell Canyon. Other groundwater seeps may be present in the subsurface at the two candidate reservoir sites. Where seeps are identified, a seepage collection system will be installed to collect the groundwater and allow for its unimpeded discharge downstream. Therefore, there will be little or no loss of the base flow originating from groundwater seeps or springs (e.g. Lion Spring). The collection system will be designed with sufficient capacity to enable all groundwater seepage to drain to the downstream side of the reservoir. During base flow conditions, the system will maintain downstream flows at approximately the same rate as would have occurred without the reservoir being present.

To protect the local groundwater quality, a reservoir liner system will be constructed that prevents Lake Elsinore water from mixing with the groundwater. To maintain this separation of reservoir water from groundwater, a double-liner system is proposed. A drainage layer will be provided in the liner system to collect and remove reservoir seepage, and to keep it separate from the local groundwater.

The degree to which Lake Elsinore water quality is inferior to water in the streams near the upper reservoir sites has not yet been established. GENTERRA collected water quality samples in the vicinity of the upper reservoir sites as part of two water-quality sampling events during the 2004-05 wet season. The data were compared with results obtained from Lake Elsinore samples (by others). The limited data collected by GENTERRA indicate that Lake Elsinore water may actually be of higher quality with respect to some water-quality constituents. For several of the constituents analyzed, concentrations were higher in the Lake Elsinore water than in the samples collected from the project sampling points in the vicinity of the upper reservoir sites. Water-quality parameters that generally had higher values in the Lake Elsinore water than in the project water samples included Magnesium, Sodium, Boron, Hardness, Total Dissolved Solids, Dissolved Oxygen, pH, and Specific Conductance. Constituents that generally had similar or lower concentrations in the Lake Elsinore water included Barium, Calcium, Total Nitrogen, and Total Suspended Solids.

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A concern was raised about the possibility of unplanned releases of Lake Elsinore water from the upper reservoir into San Juan Creek. *"The storage of low quality Lake Elsinore water in the upper reservoir within the San Juan Creek Watershed could negatively affect water quality in the San Juan Creek drainage. Spills or releases from the upper reservoir or leaks in the upper reservoir liner, membrane system, water conveyance system, or subterranean diversion structure that would allow the water from the upper reservoir to reach the San Juan Creek drainage have the potential to degrade water quality in the San Juan Creek Watershed."*

Comment:
In the unlikely event of an unplanned release from the upper reservoir, procedures identified in the Emergency Action Plan will be followed. Governmental agencies, property owners, and other interested parties will be notified as part of the response. Specific remediation measures can then be implemented as needed, depending on the extent of the damage. As noted in our previous comment (above), the degree to which Lake Elsinore water is inferior and would degrade the local groundwater quality has not yet been established.

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"The proposed Morrell Canyon site would interrupt streamflow of the headwaters of this creek, hence the need for an instream collection structure at the point where the perimeter dike would intercept Morrell Creek flows and a bypass conduit under or around the reservoir. The co-applicants also may construct a detention basin upstream of the perimeter dike. Large streamflows would likely be carrying sediment and debris, and that material would also need to be transported under or around the reservoir, resulting in the need for a very large conduit (see also section 3.3.2.2, Environmental Consequences, Water Quantity in Water Resources). The co-applicants' potential detention basin would need to be designed and constructed to ensure it would not adversely affect the downstream perimeter dike."

Comment:
The system designed to handle storm water runoff may potentially include a detention basin to be constructed at the upstream perimeter dike of the reservoir. The purpose of the detention basin would be for temporary storage of runoff in order to control flows through the storm water conduit. It would be used as needed during construction as part of the construction best management practices (BMPs) for storm water control.

During post-construction operation of the reservoir, normal flows from upstream of the reservoir dike would pass directly into the storm water conduit, without detention. Only when sediment or debris accumulation become excessive, or the capacity of the conduit is exceeded, would storm water be detained in the basin. Removal of accumulated sediment and debris would have to be part of the operation and maintenance plan for the reservoir. To accommodate very high flows during extreme events, an emergency spillway channel would be provided to divert the flow around the margin of the reservoir to the downstream side of the dam.

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A concern was expressed about the facilities needed to accommodate stormwater. *"During storm events, the co-applicants propose to route water from the upstream tributary under Morrell Canyon reservoir. It is undesirable to have uncontrolled water upstream of a dike or dam structure. The Commission normally requires that upstream water be controlled up to the probable maximum flood. Under the co-applicants' proposal controlling large hydrologic events would require either a very large pipeline (for example, to control a flow 2,500 cfs would require a 9-foot-diameter pipe if a design velocity of 40 feet per second were selected) or a modification to the upstream collection structure."*

Comment:
As noted in our previous comment (above), an emergency spillway channel will be provided to divert high flows around the margin of the reservoir to the downstream side of the dam. Therefore, if the capacity of the storm water conduit is exceeded, the spillway channel will carry the excess flow.

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A concern was raised about the loss of surface water as a result of the project. *"The effect of rainfall capture during extreme flood events such as the 100-year flood would reduce outflow at the lower end of Morrell Canyon by about 6 percent during such events. On a relative magnitude basis, the effect would be most pronounced close to the dam. For example, about 2 miles downstream of the dam, more than 50 percent of the flow would be affected, while approximately 5 miles downstream of the dam, only 10 percent of the flow would be affected. More extreme events centered over the drainage area above the reservoir could increase these percentages."*

Comment:
During rainfall events, there will be a reduction in flow volume due to the loss of rainwater that is captured within the reservoir. This will decrease the flow in the creek downstream of the dam. The remaining rainfall runoff (that does not drain into the reservoir) will be routed to the downstream side of the dam, and therefore will not be lost to the creek downstream of the dam. Furthermore, if Morrell Canyon is chosen as the upper reservoir site, the flow from the upstream drainage area will be conveyed into the creek downstream of the dam. This will be accomplished by the construction of drainage conduits to convey the upstream storm water runoff. The drainage area upstream of the Morrell Canyon site is approximately 560 acres (0.9 square miles). The runoff generated from a 100-yr rainfall event would produce a peak flow of approximately 2,200 ft^3/s (Rivertech, 1987).

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"Excavation to construct the upper reservoir dam/dike foundations, to install the seepage collection system at Lion Spring (and for other as-yet unmapped groundwater, as shown by typical "subdrain laterals" on design drawings), and to develop tunnels for the conveyance of water from the upper reservoir could encounter and release groundwater. The co-applicants propose to develop tunnels for conveyance of water from the upper reservoir to the Santa Rosa powerhouse. They also propose building an underground powerhouse.
Co-applicants' Proposal—The co-applicants propose to develop and implement an upper reservoir and water conduit monitoring program to determine effects on groundwater levels and water quality. The program would include a baseline groundwater monitoring system installed prior to site development designed to avoid any adverse effects of any groundwater on aquifers during construction. The system would include perimeter wells around the facility and a network of wells down-gradient of the perimeter wells to observe groundwater levels and facilitate collection of water quality samples.
The co-applicants propose to grout and seal observed seeps that are encountered during tunneling operations. This would be done prior to the installation of either the concrete or steel tunnel liners. The co-applicant also proposes to perform remedial grouting after construction if excessive seepage is discovered to occur."

Comment:
Groundwater levels will be monitored during construction and operation of the water conduits, including the tunnels and penstocks that convey water between the upper reservoir and the powerhouse. Instrumentation will be provided so that groundwater levels can be monitored. Grouting and sealing of seeps encountered during tunneling operations will be done, and remedial actions will be taken if groundwater monitoring indicates threshold levels have been exceeded.

Thank you for this opportunity to provide these additional comments and clarifications of hydrology issues.

Please contact me or Douglas A. Harriman, P.E., C.G.W.P., at 949-753-8766 with any questions or comments.

Respectfully Submitted,
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