SOIL AND WATER RESOURCES
FINAL STAFF ASSESSMENT TECHNICAL REPORT

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NOTE: This section provides the complete Soil and Water Resources analysis which supplements the Soil and Water Resources Summary in the Final Staff Assessment published in April 2005.

SUMMARY

The proposed Blythe Energy Project Phase II (BEP II) is located in a desert environment which depends on groundwater to supply its industrial and domestic users. The project's proposed unmitigated consumptive use of groundwater derived from the Colorado River for cooling would result in the degradation of the water quality in nearby wells. The proposed use of Colorado River water for the power plant cooling is inconsistent with the Energy Commission's policy as adopted in the 2003 Integrated Energy Policy Report. The loss of this water is complicated by the fact that it is connected to the Colorado River and there is a complex set of state and federal laws that govern its use.

The applicant has proposed to offset its water use by fallowing surrounding agricultural lands using a Water Conservation Offset Program (WCOP), however staff believes that avoidance of the impact is preferable. Staff evaluated several alternative water supply and cooling technologies and determined that dry cooling in another location would result in no unmitigated significant impacts. Either dry cooling, or wet cooling using Rannells Drain water (part of the Palo Verde Irrigation District's irrigation return system) or equivalent, in conjunction with a verifiably effective WCOP would eliminate or mitigate the project's water supply and groundwater quality issues and are the preferred alternatives.

No significant impacts are expected during the power plant's construction phase so long as proper measures are taken to ensure that impacts from stormwater and sediment are adequately controlled. The use of an evaporation pond is an acceptable wastewater discharge method from a water quality perspective, but may cause problems in **Biological Resources** and may cause impacts to aviation safety as discussed in the **Traffic and Transportation** section of the Final Staff Assessment (FSA, CEC 2005p).

INTRODUCTION

In this section staff analyzes the potential effects of the Blythe Energy Project Phase II (BEP II) on soil and water resources. The analysis specifically focuses on the potential for the project to cause significant impacts in the following areas:

- Whether construction or operation would lead to accelerated wind or water erosion and sedimentation.

- Whether the project would exacerbate flood conditions in the vicinity of the project.
- Whether the project's demand for water would adversely affect surface or groundwater supplies.
- Whether project construction or operation would lead to degradation of surface or groundwater quality.

A determination of the conformance of the project with all applicable laws, ordinances, regulations and standards will also be made.

Where actual or potential impacts are identified, staff has recommended either elimination of the impact or mitigation measures to reduce the significance of the impact and, as appropriate, has recommended conditions of certification.

LAWS, ORDINANCES, REGULATIONS AND STANDARDS (LORS)

SOIL AND WATER RESOURCES Table 1
Laws, Ordinances, Regulations, and Standards (LORS)

Federal LORS	
Clean Water Act (33 U.S.C. Section 1257 et seq.)	The Clean Water Act (33 USC § 1257 et seq.) requires states to set standards to protect water quality, which includes regulation of storm water discharges during construction and operation of a facility. These are normally addressed through a general National Pollutant Discharge Elimination System (NPDES) permit. For BEP II, regulation of water quality is administered by the Colorado River Basin Regional Water Quality Control Board (CRBRWQCB).
Section 404 Permit to Place or Discharge Dredged or Fill Material	Section 404 of the Clean Water Act regulates the discharge of dredged or fill material into waters of the United States, including rivers, streams and wetlands. The Army Corps of Engineers (ACOE) issues site-specific or general (nationwide) permits for such discharges.
Section 401 Water Quality Certification	Section 401 of the Clean Water Act provides for state certification that federal permits allowing discharge of dredged or fill material into waters of the United States will not violate federal and state water quality standards. These certifications are issued by the RWQCBs. Proposed linear facilities can also cross ephemeral drainages that are considered waters of the United States.
Resource Conservation and Recovery Act	The Resource Conservation Recovery Act (RCRA) of 1976 (40 CFR Part 260 et seq.) seeks to prevent surface and groundwater contamination, sets guidelines for determining hazardous wastes, and identifies proper methods for handling and disposing of those wastes.
Reclamation Reform Act of 1982	Allows for the management, development, and protection of water and related resources by the Bureau of Reclamation.
State LORS	
Water Code Section 13260	Requires filing with the appropriate Regional Board a report of waste discharge that could affect the water quality of the state, unless the requirement is waived pursuant to Water Code section 13269.
Water Code Section 13552.6	Specifically identifies the use of potable domestic water for cooling towers, if the State Water Resources Control Board determines that suitable reclaimed water is available, as a waste or unreasonable use of water. The availability of reclaimed water is determined based on criteria listed in Section 13550 by the SWRCB. Those criteria include provisions that the quality and quantity of the reclaimed water are suitable for the use, the cost is reasonable, the use is not detrimental to public health, and the use will not impact downstream users or biological resources.

Title 23, California Code of Regulations, Chapter 15, Division 3	These regulations require that the RWQCB issue Waste Discharge Requirements specifying conditions for protection of water quality as applicable.
Local LORS	
Riverside County	Grading Ordinance 457 regulates grading and trenching to minimize soil erosion and ensure soil conservation.
Riverside County	Has adopted ordinances, goals, and objectives through the Riverside County General Plan related to development in productive agricultural areas. Agricultural objectives are intended to encourage agriculturally productive lands to remain in agriculture and to discourage incompatible urban development adjacent to agricultural lands.
Riverside County	Environmental Hazards and Resources goals encourage the preservation and growth of agriculture while allowing agricultural land to phase into other land uses.
City of Blythe	The City has adopted a number of policies and goals related to water resources in the City's General Plan. Water resources goals and policies are intended to promote wise utilization of the Palo Verde Valley's domestic, agricultural, and potable water sources and to encourage water conserving designs and technology to protect the valley's vital water resources.
City of Blythe	The City has also adopted water resources policies intended to protect the quality of the Valley's water resources from potential sources of contamination, as well as requiring mitigation for significant impacts to water quality and quantity.
City of Blythe	The City requires developments on the mesa to submit an erosion control and drainage plan for review and approval by the City.
Guidance Provided by State Constitution, Acts, Policies, and Orders	
California Constitution, Article X, Section 2	This section requires that the water resources of the State be put to beneficial use to the fullest extent possible and states that the waste, unreasonable use, or unreasonable method of use of water is prohibited.
Title 23, California Code of Regulations, Chapter 15, Division 3	These regulations require that the RWQCB issue Waste Discharge Requirements specifying conditions for protection of water quality as applicable.
Resolution 75-58	The SWRCB has adopted policies that provide guidelines for water quality protection. The principal policy of the SWRCB that specifically addresses the siting of energy facilities is the Water Quality Control Policy on the Use and Disposal of Inland Waters Used for Powerplant Cooling (adopted by the Board on June 19, 1975 as Resolution 75-58). This policy states that fresh inland waters should only be used for power plant cooling if other sources or other methods of cooling would be environmentally undesirable or economically unsound. This SWRCB policy requires that power plant cooling water should come from, in order of priority: wastewater being discharged to the ocean, ocean water, brackish water from natural sources or irrigation return flow, inland waste waters of low total dissolved solids, and other inland waters. This policy also includes cooling water discharge prohibitions such as land application.
SWRCB Resolution 77-1	State Water Resources Control Board Resolution 77-1 encourages and promotes reclaimed water use for non-potable purposes.
SWRCB Water Quality Order 92-08	Requires the SWRCB to regulate industrial stormwater discharge from construction projects affecting areas greater than 1 acre to protect state waters. Under Order 92-08 the Colorado River Basin RWQCB will issue NPDES permits for construction activities based upon an acceptable Storm Water Pollution Prevention Plan (SWPPP) submitted by the applicant.
California Water Code Section 100	Requires the water resources of the State be put to beneficial use to the fullest extent of which they are capable, and the waste or unreasonable use or unreasonable method of use of water be prevented, and that the conservation of such water is to be exercised with a view to the reasonable and beneficial use

	thereof in the interest of the people and for the public welfare.
California Water Code Section 100.5	Declares to be the established policy of the State that conformity of a use, method of use, or method of diversion of water with local custom shall not be solely determinative of its reasonableness, but shall be considered as one factor to be weighed in the determination of the reasonableness of the use, method of use, or method of diversion of water, within the meaning of Article X, Section 2 of the California Constitution.
California Water Code Section 1254	Specifies that the SWRCB in acting upon applications to appropriate water, shall be guided by the policy that domestic use is the highest use and irrigation is the next highest use of water.
California Water Code Section 13146	Requires that state offices, departments and boards in carrying out activities which affect water quality, shall comply with state policy for water quality control unless otherwise directed or authorized by statute, in which case they shall indicate to the State Water Resources Control Board in writing their authority for not complying with such policy.
California Water Code Section 13247	Requires that state offices, departments, and boards, in carrying out activities which may affect water quality, shall comply with water quality control plans (i.e., Basin Plans) approved or adopted by the State Water Resources Control Board unless otherwise directed or authorized by statute, in which case they shall indicate to the appropriate Regional Water Quality Control Boards in writing their authority for not complying with such plans.
Water Code Section 13552.8	States that any public agency may require the use of reclaimed water in cooling towers if reclaimed water is available, meets the requirements set forth in Section 13550, that there will be no adverse impacts to any existing water right, and that if public exposure to cooling tower mist is possible, appropriate mitigation or control is provided.
SWRCB Resolution 88-63	The Regional Water Quality Control Boards (Regional Boards) shall assure that the beneficial uses of municipal and domestic supply (MUN) are designated for protection wherever those uses are presently being attained, and assure that any changes in beneficial use designations for waters of the State are consistent with all applicable regulations adopted by the Environmental Protection Agency. Where a body of water is not currently designated as MUN but, in the opinion of a Regional Board, is presently or potentially suitable for MUN, the Regional Board shall include MUN in the beneficial use designation. All surface and groundwaters of the State are considered to be suitable, or potentially suitable, for municipal or domestic water supply and should be so designated by the Regional Boards with the exception of certain defined surface and groundwaters suitable for exception as a source of drinking water.
SWRCB Resolution 68-16	This resolution (the "Anti-Degradation Policy") declares that it is the State's policy for maintaining existing high quality waters to the maximum extent possible. The existing high water quality must be maintained until demonstrated to the State that any proposed change will be consistent with the maximum benefit to the people of the state and will not unreasonably affect present or future beneficial uses.
Recycling Act of 1991	States that retail water suppliers, reclaimed water producers, and wholesalers should promote the substitution of reclaimed water for potable and imported water in order to maximize the appropriate cost-effective use of reclaimed water in California.

ENVIRONMENTAL SETTING

The proposed project is located in the Palo Verde region of eastern Riverside County, which is part of the greater Colorado River Valley. Palo Verde can be subdivided into two sections, the current flood plain, usually referred to as the Palo Verde Valley, and

the upland terraces that flank the valley, called Palo Verde Mesa. The proposed project is located on the Palo Verde Mesa, one mile west of the mesa-valley boundary.

The Palo Verde Mesa covers approximately 280 square miles. The mesa is bounded on the north by portions of both the Little and Big Maria Mountains, on the west by the McCoy and Mule Mountains, and on the south by the Palo Verde Mountains. The Palo Verde Valley forms the eastern boundary of the mesa.
Palo Verde, located within the Sonoran Desert, has an arid climate, characterized by mild winters and hot summers. The average temperatures range from a low of 41°F in January and December to a high of 108°F in July. The average annual rainfall, measured at the Blythe Airport, is only 3.7 inches.

Precipitation is typically concentrated about equally in two periods, one in the summer and one in the winter. Summer storms cause high intensity, short-duration rainfall with rapid runoff. Winter storms bring gentle rains with little or no runoff. Precipitation in the region falls far short of the water requirement for typical (non-desert) crops and landscaping vegetation. Palo Verde's climate, characterized by high temperatures, low humidity and frequent winds, places the region in the highest evapotranspiration zone in California (ETo Zone 18). Specifically, ETo for Zone 18 is 71.6 inches. (ETo represents the average annual water requirement for grass, which is the reference crop for the ETo system.) (DWR 1999)

SOILS

Soils in the region are primarily derived from alluvial and colluvial deposits and range from coarse to moderately fine in texture. On the Palo Verde Mesa, soils tend to be well to excessively drained, coarse grained, sands, gravels and loam with relatively low erosion hazards (BEP II 2002, Section 7.14). In the Palo Verde Valley, soils tend to be finer in texture and are generally well drained fine-grained sands, silts, clays, and loam with relatively low erosion hazards.

Native vegetation in the region consists mainly of the Creosote desert scrub plant community characteristic of the Sonoran Desert. The vegetation in the area is dominated by three plant community types: creosote bush scrub associated with undeveloped desert areas; riparian plant communities associated with the channel banks of the Colorado River and its various canals and drains; and agricultural areas in active cultivation.

The soils at the site as characterized in **SOIL AND WATER RESOURCES Table 2** are primarily made up of four soil types with textures ranging from moderately fine to coarse (BEP II 2002, Table 7.14-1). The water erosion hazard is expected to be slight at the BEP site and along the transmission lines. The wind erosion potential for most of these soils is moderate to high.

SOIL AND WATER RESOURCES Table 2
Soil Types Affected & Characteristics

Project Element	Soil Name	% Slope	Depth (inches)	USDA Texture	USCS Classification (1)	Erosion Factors	Permeability (in/hr)	Drainage	Erosion Hazard Rating
Site Area	Aco	<1	0-46	Sandy Loam	SM	Low	0.0-6.3	Well Drained	Slight
			46-60	Fine Sand	SM	Low	0.3-20.0	Well Drained	Slight
Site Area	Carrizo	<2	0-37	Gravelly Sand	SW-SM	Low	6.3-20.0	Excessively Drained	Slight
			37-60	Cobbly Sandy Loam, Sand	GP-GM	Low	6.3-20.0	Excessively Drained	Slight
Site Area	Orita	<1	0-10	Gravelly Loamy Sand	SM	Low	2.0-6.3	Well Drained	Slight
			10-22	Fine Sandy Loam	SM	Low	0.63-2.0	Well Drained	Slight
			22-68	Gravelly Clay Loam	CL	Low	0.2-0.63	Well Drained	Slight
			68-80	Gravelly Fine Sandy Loam	GM	Low	0.63-2.0	Well Drained	Slight
Site Area	Rositas	<2	0-72	Fine Sand	SP-SM	Low	6.3-20.0	Excessively Drained	Slight to Moderate

(BEP II 2002, Section 7.14 & Table 7.14-1)
(1) Unified Soil Classification System based on laboratory soil grain size analysis and visual classification. CL= clay, ML = silt, etc.

The Aco sandy loam is a well drained soil derived from mixed alluvium on the terraces slightly above the flood plain. The representative profile for Aco soils is approximately five feet deep. The Aco sandy loam has a moderately rapid permeability. Lands with Aco sandy loam are classified as prime agricultural land and has a high revegetation potential. Where the soil is bare, runoff is slow and erosion hazards are slight (BEP II 2002, Section 7.14).

The Carrizo gravelly sand is an excessively drained soil containing coarse fragments, predominantly gravel, and is found in arroyos. The representative profile for Carrizo

soils is approximately five feet deep. The Carrizo gravelly sand has a rapid permeability. Lands with Carrizo gravelly sand are classified as non-prime agricultural land and have a low revegetation potential. Where the soil is bare, runoff is very slow, and there is a slight erosion hazard (BEP II 2002, Section 7.14).

The Orita gravelly fine sandy loam is a generally well-drained soil derived from alluvium deposited by the Colorado River. The soil profile is greater than five feet deep and the permeability is moderately slow. Lands with Orita soils are classified as prime agricultural land with a high revegetation potential. Where the soil is bare, there is moderate runoff and a slight erosion hazard (BEP II 2002, Section 7.14).

The Rositas fine sand is an excessively drained soil derived from alluvium deposited in the Palo Verde Valley and on the Palo Verde Mesa by the Colorado River and formed in sandy eolian material blown from recent alluvium. The soil has a representative profile greater than five feet deep and a rapid permeability. Lands with Rositas fine sand are classified as prime agricultural land and have a high revegetation potential. Where the soil is bare, runoff is very slow and erosion hazards are slight to moderate (BEP II 2002, Section 7.14).

The entire original 152 acre Blythe Energy Project (BEP) site is not known to have been utilized for agriculture and has not been previously irrigated. Prior to construction of the BEP I facility on 76 acres on the eastern portion of the BEP site, the bush-scrub community occupied approximately 74 acres of the site, while the remaining 2 acres were in agricultural or industrial use (BEP I 1999). The BEP II project will occupy approximately 52 acres of the 76-acre parcel on the western portion of the BEP site. The BEP II site is on land that has been designated as Farmland of Local Importance in the Important Farmland Inventory prepared by the California Department of Conservation (BEP II 2002, Section 7.14).

During a site visit on January 26, 2005, staff observed the overall BEP site consisting of both the developed portion for BEP I, and the undeveloped portion proposed for BEP II. The soil around the BEP I developed site was largely bare, and staff observed significant quantities of eroded sediment that had deposited in the drainage channels of the BEP I stormwater drainage system.

GROUNDWATER – REGIONAL DESCRIPTION

The groundwater system in Palo Verde is predominated by the Colorado River. The Colorado River is a primary agent in creating the groundwater system and is the only significant source of groundwater recharge in the region as described below.

Formation of the Groundwater System

The U.S. Geological Survey (USGS) has described the formation of the Colorado River Valley groundwater system (Wilson and Owen-Joyce 1994). The Colorado River, in conjunction with regional tectonic movements, is the agent that shaped the valleys and eroded, carried, and deposited the sediments to form the groundwater system of the Colorado River Valley.

The Colorado River, over time, carved a string of alluvial valleys through the bedrock mountains of southeast California, including Palo Verde. These bedrock mountains roughly parallel the river throughout the Colorado River Valley. Bedrock underlies and surrounds the valleys, defining the width, length and depth of each valley basin. This bedrock structure, which is relatively impermeable, forms the base of the Palo Verde groundwater basin.

The alluvial sediments of the Palo Verde groundwater, beneath both the Palo Verde Valley and Mesa, were deposited by the same processes. Lateral and vertical variations in permeability do occur, but all of the sediments are hydraulically connected to each other and to the Colorado River. No barriers to lateral or vertical flow have been identified within the alluvial sediments of the Palo Verde groundwater basin.

Structure and Hydrogeologic Units of the Groundwater System

The sediments that fill the valleys of the Colorado River are collectively termed the river aquifer by the USGS (Wilson and Owen-Joyce 1994). Within the Palo Verde region, the USGS identified and described the four major hydrogeologic units of the Palo Verde area, the fanglomerate, the Bouse Formation, the Older Alluvium and the Younger Alluvium (Metzger 1973).

The basal sedimentary unit in the Palo Verde region is the fanglomerate. This oldest unit is composed of poorly-sorted, cemented sandy gravel that were eroded from the surrounding mountains by the Colorado River. The fanglomerate blankets the irregular surface of the underlying bedrock with thickness that range from zero to over 4,000 feet. Owing to its composition, the fanglomerate produces relatively low water yields and is not usually tapped by the regional wells.

The Bouse Formation overlies the fanglomerate and represents a change in the depositional environment. The Bouse Formation was deposited during a tectonic shift in which the Colorado River Valley became an embayment of the Gulf of California. The embayment resulted in the deposition of a marine unit composed of limestone, clay, silt, sand and volcanic deposits and contains brackish water. Well logs indicate that the Bouse Formation is approximately 500 feet thick and is present throughout the Palo Verde region. Although sands and gravels in the upper portion of the Bouse Formation can produce water up to 15 gallons per minute (gpm) per foot of drawdown, yields are far less than the overlying river alluviums. Given its low yield and brackish water content, the Bouse Formation is typically treated as the base of the fresh-water aquifer system in the Palo Verde region.

The youngest major units in the Palo Verde region, the Older Alluvium and Younger Alluvium, were deposited by the Colorado River and are the primary water-bearing units of the local aquifer system (referred to as the groundwater system in this report). The Older and Younger Alluvium were deposited as a series of flood plain deposits.

The Older Alluvium is composed of ancestral flood-plain deposits and results from all but the most recent cycle of erosion and deposition by the Colorado River. The Older Alluvium comprises all of the groundwater system deposits of the Palo Verde Mesa and extends beneath the Palo Verde Valley, underlying the Younger Alluvium. The Older

Alluvium is much thicker than the Younger Alluvium, reaching thickness of 600 feet beneath the central portion of the valley and the mesa and pinching out along the bordering bedrock mountains. The Older Alluvium is composed of sand, silt, and clay with minor amounts of gravel. The USGS also described the composition and productivity of the Older Alluvium in the mesa. The Older Alluvium includes a narrow zone of highly productive gravel lenses, which occur within a mile from the mesa-valley boundary.

The most-recent erosional episode carved the lowest terrace of the present-day Palo Verde Mesa, as well as a trench in the central portion of these older flood-plain deposits. The Younger Alluvium fills this trench with about 100 feet of sediments and comprises the present-day flood plain deposits of the Palo Verde Valley. The Younger Alluvium is predominately sand and gravel with minor amounts of silt and clay.

Groundwater Recharge and the Hydrology of the Groundwater System

The Colorado River is the source of virtually all of the water in the Palo Verde groundwater system. Water stored in the aquifer, as well as ongoing recharge to the aquifer, is derived primarily from Colorado River water. Furthermore, most significant increases in groundwater pumping in the Palo Verde region will cause an increase in recharge from the Colorado River and a corresponding decrease in Colorado River flows below Palo Verde.

The hydrologic relationship between the groundwater and the Colorado River is analyzed and described in full by the USGS (Wilson and Owen-Joyce 1994). The 1994 publication by Wilson and Owen-Joyce is one in a series of publications that the USGS undertook to analyze the groundwater-Colorado River relationship. These studies have been conducted in response to U.S. Supreme Court decree, 1964, *Arizona v. California*, which defined underground pumping as a consumptive use of Colorado River water and, as such, required accounting.

Based on hydrologic principles and the specific groundwater and river conditions in the lower Colorado River Valley, the USGS developed the so-called USGS accounting surface method. The accounting surface represents the water table of the groundwater system that would exist if the river were the sole source of groundwater recharge. The USGS accounting surface method provides a systematic approach to identify wells that yield water recharged by Colorado River water. (For a summary of the analysis of the groundwater-Colorado relationship prepared by the USGS, see **SOIL AND WATER RESOURCES Appendix C**: USGS Water Fact Sheet: Determining The Source Of Water Pumped From Wells Along The Lower Colorado River.)

Isotopic investigations by the USGS indicate that most of the water in the river aquifer of the Colorado River Valley originated from the river (Wilson and Owen-Joyce, 1994). These investigations specifically included analyses of groundwater from wells in Palo Verde. Prior to the arrival of man, water from the Colorado River filled the valley sediments through lateral underground flow from the river channel and from vertical percolation to the groundwater system during periodic overbank flooding. Following the construction of the dams and the advent of agriculture, vertical percolation to the

groundwater system from overland flooding of the Colorado River has been replaced by vertical percolation of Colorado River water diverted to the valley and mesa for agricultural irrigation. Although the natural process of overland flooding has been replaced by diversions and irrigation, the Colorado River continues to be the only significant source of recharge to the aquifers.

In fact, irrigation with Colorado River water has raised groundwater levels in the Palo Verde Valley above historical levels (PVID 2004). The amount of groundwater recharge from irrigation has required the construction of a network of drainage ditches throughout the valley to remove percolating irrigation water that would otherwise cause groundwater levels to inundate the root zones of the crops. Irrigation with Palo Verde Irrigation District's (PVID) Colorado River diversions and its network of drainage ditches maintain constant groundwater water levels a few feet below land surface throughout the Palo Verde Valley. Under these conditions, the groundwater system is hydraulically connected to the irrigation drains, unlined canals and Colorado River in the Palo Verde Valley.

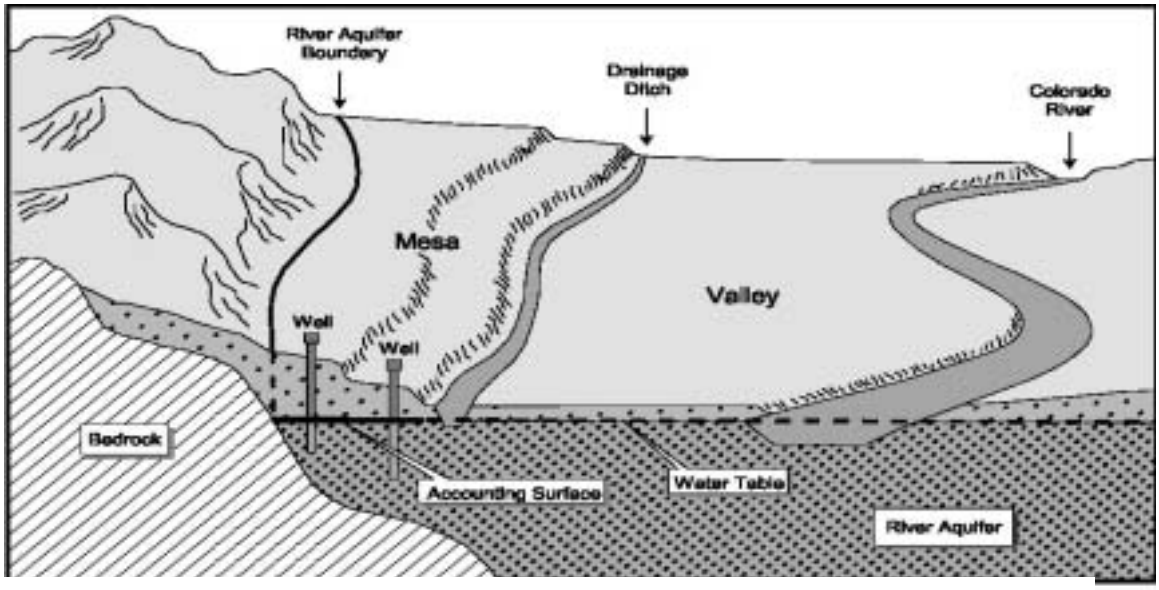
Given the constant supply of percolating irrigation water and the interconnectivity of the aquifer system, groundwater recharge increases whenever groundwater pumping increases in the Palo Verde Valley or the Palo Verde Mesa. Correspondingly, increases in groundwater recharge cause decreases in irrigation drain discharge and return flows to the Colorado River.

Groundwater pumping produces water in two ways. Groundwater pumping forms a cone of depression that radiates from each active well, creating groundwater gradients towards the well. Initially, the well produces water that is stored in the aquifer within the cone of depression. However, in the long-term, groundwater production is sustained by the lateral flow of water to the well. Drawdown stabilizes when the cone of depression intercepts a source of recharge and induces a rate of flow towards the well equal to the pumping rate. Finally, water continues to flow towards the well until the cone of depression is filled when pumping ceases.

In the Palo Verde region, irrigation water is the primary source of recharge. Groundwater pumping usually captures water that would otherwise discharge to the irrigation drains and return to the Colorado River. Furthermore, when cones of depression intercept drains and unlined canals in the valley or the Colorado River, water is transmitted from these surface-water features to the groundwater system. In this manner, pumped groundwater is replaced by water that is derived from the Colorado River. Pumping drawdown that intercepts surface-water features causes an actual decrease in the flows of the Colorado River.

Accordingly, the USGS uses the elevations of irrigation drains, unlined canals and the Colorado River to define the elevation of the accounting surface. When wells have a static water level that is at or below the elevation of the accounting surface, it can be assumed that the well will yield water that will be replaced with Colorado River water (See **SOIL AND WATER RESOURCES Figure 1**).

SOIL AND WATER RESOURCES Figure 1*
Schematic Diagram Showing the River Aquifer and Accounting Surface



Mesa wells that have a static water-level elevation equal to or below the accounting surface are presumed to yield water that will be replaced by water from the Colorado River.

Not all pumping in the Palo Verde region is assumed to be replaced by Colorado River water. A small amount of pumping in the mesa may be derived from other sources. Limited recharge from the Chuckwalla Valley and McCoy Wash may provide a minor amount of groundwater recharge to the mesa.

The Chuckwalla Valley is located to the west of the Palo Verde Mesa between the McCoy Mountains and the Mule Mountains. Local groundwater recharge occurs in the Chuckwalla Valley from rainfall percolation during infrequent large storm events. Groundwater is transmitted through a shallow, narrow trench that connects the aquifer system between Chuckwalla and the mesa. The USGS estimated that an average annual underflow of 400 acre-feet is transmitted from the Chuckwalla Valley into the Palo Verde Mesa area, based on measured groundwater levels (Metzger 1973).

The Palo Verde Mesa area may also receive a small amount of intermittent recharge through streambed seepage from the McCoy Wash, although this potential source has not been investigated or quantified. The McCoy Wash is dry, except during intense but infrequent, short-duration summer storms.

Finally, groundwater recharge from precipitation is negligible. Evapotranspiration, with an average rate of 71.6 inches per year, far exceeds rainfall, with an average rate of only 3.7 inches per year. A maximum precipitation of 6.95 inches was recorded in 1978 for the Palo Verde area. The USGS estimates that rainfall must exceed 8 inches per year to contribute directly to groundwater recharge, based on the Maxey-Eakin method (Maxey and Eakin 1950).

Groundwater Elevations and Direction of Groundwater Flow

Groundwater contours for Palo Verde, compiled by the USGS and based on 1964 water level measurements, indicates a regional pattern groundwater flow to the southwest. Groundwater contours for the mesa roughly parallel the elevations and flow direction of the aquifer beneath the valley and the Colorado River (Metzger 1973). The regional groundwater gradient is modified by irrigation, irrigation drains and groundwater pumping. Irrigation application creates groundwater mounding. Drains create corridors of drawdown and wells create cones of depression, causing localized changes in the regional direction of groundwater flow.

With limited surface-water irrigation and the absence of drainage control, groundwater levels in the Palo Verde Mesa fluctuate more than groundwater levels in the valley. Evaluation of measured groundwater levels in the Palo Verde Mesa indicate that groundwater levels are sensitive to pumping and have responded to changes in groundwater use in the mesa over the last 40 years. USGS estimated that static groundwater elevations near the project site were about 250 feet, mean sea level (MSL), in 1964 (Metzger 1973). However, groundwater development for agricultural irrigation on the Palo Verde Mesa increased significantly during the 1970's and 1980's, causing a regional decline in groundwater levels in the mesa. USGS groundwater measurement records indicate that static groundwater levels declined more than 10 feet in the mid-1980's in the vicinity of the BEP II. Recent groundwater level measurements indicate that groundwater levels in the mesa have largely recovered to 1964 levels, except near areas of significant, ongoing groundwater use. (USGS National Water Information System-NWIS; Web Data for the Nation, accessed at http://nwis.waterdata.usgs.gov/nwis). Although most farming on the mesa was discontinued by the early 1990's, groundwater levels have not fully recovered.

Groundwater Quality

Groundwater quality in the Palo Verde Mesa could be described as fair to poor. The groundwater in the Palo Verde Mesa typically has higher total dissolved solids (TDS) values than the Palo Verde Valley (BEP I 1999). The USGS reported that analyses of groundwater samples collected in the 1960's indicated that the best quality water on the mesa is found in wells within a mile or two of the valley from depths between 150 to 350 feet below land surface. Samples from these wells contained TDS ranging from 700 to 900 mg/l and chloride concentrations ranging from 150 to 250 mg/l. Samples generally indicate a gradual increase in the mineral content of groundwater with increasing depth and distance from the valley. TDS concentrations ranging from 1,000 mg/l to 4,550 mg/l were measured in deeper wells located 2 to 3 miles from the valley. The USGS anticipated that ongoing groundwater pumping in the mesa might cause an increase in mineral concentration in local groundwater (Metzger 1973).

GROUNDWATER – DESCRIPTION IN THE BEP VICINITY

Hydrogeologic and water level conditions in the vicinity of the project site are typical for the Palo Verde Mesa.

Hydrogeologic Units

The USGS has investigated the aquifer conditions in the Palo Verde region and provides general information on conditions in the vicinity of the project site (Metzger 1973). Well construction and aquifer testing for BEP I has confirmed and expanded the information described by the USGS (BEP I 2002, BEP I 2003a, and BEP I 2003b).

The project site is underlain by the Older Alluvium of the Colorado River, the Bouse Formation, and the fanglomerate. Based on a geologic cross section developed by the USGS, the Older Alluvium, which is the primary aquifer for the mesa, is over 500 feet thick in the vicinity of the project site. It is assumed that the Bouse Formation and the fanglomerate, which tend to be significantly less permeable than the Older Alluvium, are non-productive zones beneath the effective aquifer zones. Well logs for the BEP I production wells PW-1 and PW-2 confirm that the aquifer is more than 600 feet thick near the BEP II project site.

Most wells on the mesa draw water from the sand layers of the Older Alluvium; the wells completed within the zones of gravel lenses are highly productive. The BEP I production wells, PW-1 and PW-2, which are located about 1 mile from the mesa-valley boundary, both intercepted significant thickness of coarse-grained materials with minor amounts of silt and clay. PW-1 penetrated an 80-foot gravel zone, while PW-2 penetrated numerous layers of well-sorted sands.

Aquifer Parameters

Aquifer parameters include confining conditions, hydraulic conductivity and storage, which are intrinsic characteristics of the aquifer materials. Although the USGS (1973) and DWR (1978) have generally described the water-bearing properties of the mesa, no specific information on the localized aquifer parameters of the project site was included in these earlier studies. However, the recent aquifer test performed on the BEP I wells have provided data from which aquifer parameters for the local conditions can be calculated. The construction of wells and aquifer testing at BEP I have provided detailed information on the aquifer conditions adjacent to the proposed project site.

Based on aquifer tests for both production wells, BEP I has reported an average transmissivity (a measure of an aquifer's ability to transmit water through it) of about 75,000 feet^2/day and an average storativity (a measure of an aquifer's ability to store water within it) of 0.04. **SOIL AND WATER RESOURCES Table 3** summarizes the aquifer parameters calculated and presented in the BEP I final aquifer test. (BEP I 2003a and BEP I 2003b)

SOIL AND WATER RESOURCES Table 3
Blythe Energy Project Calculated Aquifer Parameters

BEP I Production Well Name	Transmissivity ($feet^2$/day)	Storage (dimensionless)
BEP I PW-1	6,9581	0.04
BEP I PW-2	7,9718	0.04
Average	7,4650	0.04

Source: BEP I 2003a and BEP I, 2003b.

Both PW-1 and PW-2 proved to be highly productive wells. Following construction, testing indicated that PW-1 has a specific capacity of 75 gpm/foot drawdown, while PW-2 has a specific capacity of over 100 gpm/foot, which is comparable to most productive wells in the valley.

The structure of the aquifer alternates between well-sorted beds, which would transmit most of the horizontal flow in the aquifer, and poorly-sorted beds that contained silts and clays, which would tend to slow the vertical transmission of water. However, no confining clay layers were encountered during well drilling. Aquifer testing provided further evidence that the aquifer is unconfined in the vicinity of the project site.

Given the proximity of BEP I to the BEP II site, it is reasonable to assume that aquifer parameters are essentially the same at both sites.

Sources of Recharge

There are no natural surface-water sources to provide steady or significant groundwater recharge on the mesa. As discussed previously, there are no nearby streams or lakes and precipitation rates are too low to contribute to groundwater recharge. The meager precipitation that does occur on the mesa is rapidly consumed by evaporation or vegetation. A minor amount of groundwater recharge may be contributed to the mesa by underflow from the Chuckwalla Valley and by storm-event percolation from infrequent runoff flows in the McCoy Wash, as discussed previously. The Chuckwalla Valley is located 5 miles west of the project site. The McCoy Wash originates 18 miles to the northwest and terminates at the mesa-valley boundary about 3 miles north of the project site. The BEP II site is not located within the McCoy Wash watershed and is outside of the Wash's 100-year floodplain (BEP II 2002, Section 7.13).

The only significant source of groundwater recharge to the BEP II wells would be water derived from the Colorado River. Project pumping would induce groundwater recharge from PVID's Rannells Drain, which is located about one mile east of the project site. In addition, PVID irrigation deliveries to about 2,000 acres of farmland on the mesa currently provides a small steady source of groundwater recharge (PVID 2004).

Groundwater Elevations

Groundwater levels at the BEP II site can be estimated from water levels and pumping activities at BEP I. Prior to the onset of groundwater testing, the BEP I reported the depth to groundwater in the monitoring and test wells ranged from 85.6 feet to 91.8 feet (BEP I, 2002); based on USGS well measuring-point surveys, static groundwater level elevations were approximately 249 feet MSL prior to testing.

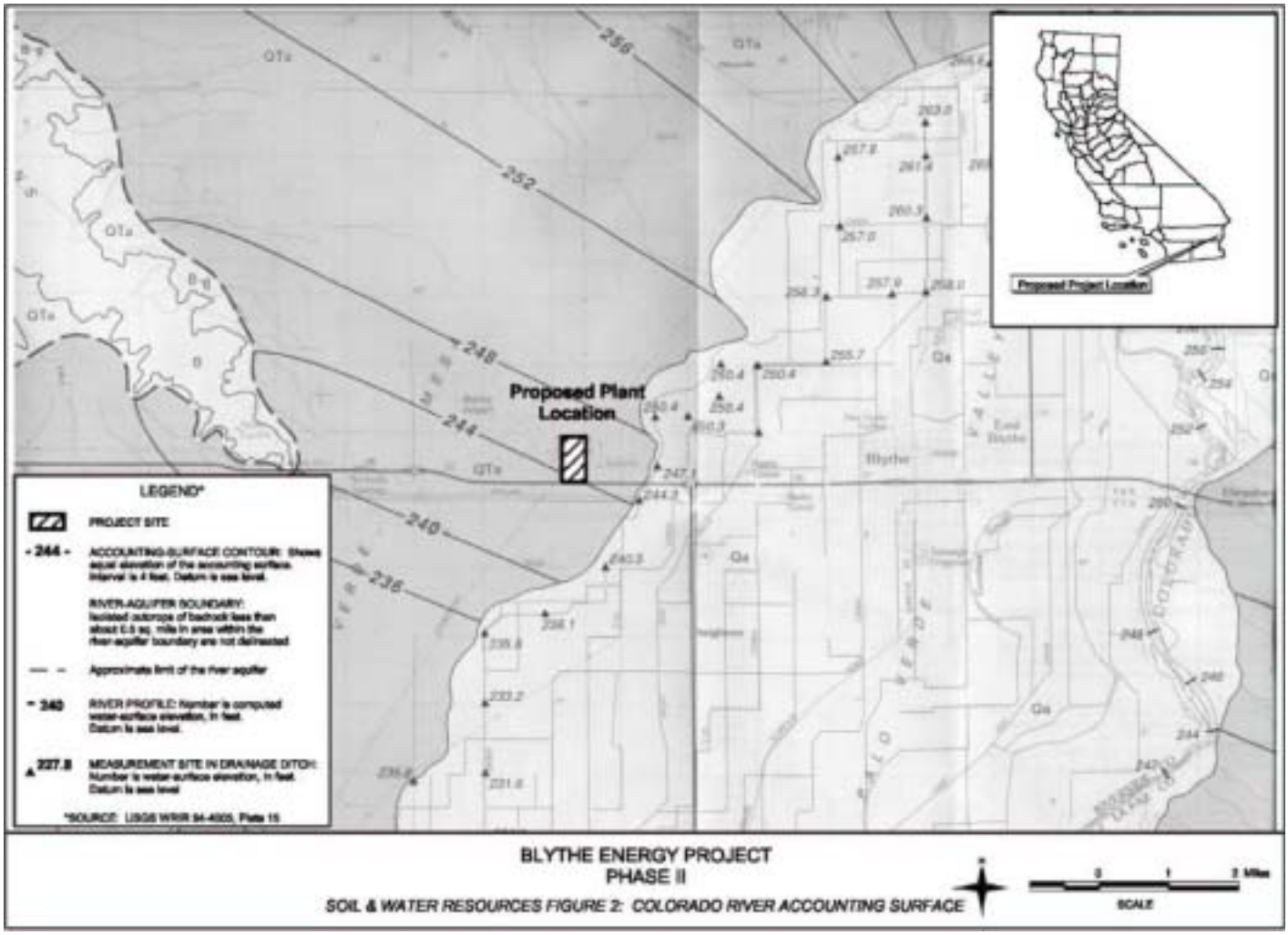
However, static groundwater levels at the BEP II site will decline as BEP I wells reach full production. BEP I has projected that the average long-term pumping rate would be approximately 2,040 gpm (3,300 acre feet/year). Based on drawdown calculations reported by BEP I, static groundwater levels at the proposed BEP II well site will decline about 4.4 feet, lowering static groundwater levels to less than 245 feet MSL at the BEP II site.

If static water levels decline below 245 feet MSL, the water levels in the BEP II wells will be below the USGS accounting surface, which indicates the BEP II wells would yield water that will be replaced with Colorado River water (**SOIL AND WATER RESOURCES Figure 2**). Confirming this USGS assessment, water levels of 245 feet MSL would also be lower than the reported water level of 247 feet MSL in PVID's Rannells drain, located about 1 mile east of the BEP II site at the toe of the mesa north of Hobsonway (PVID 2003).

Existing Groundwater Use

The applicant has identified the location of several existing industrial, agricultural, and residential wells near the project site. Industrial groundwater users include the BEP I, the Blythe Airport, and a few small businesses. The oldest well on the mesa may be the well at the Blythe Airport, which served as a military base during World War II. The largest industrial groundwater user in the vicinity of the project is the BEP I, with wells located about 1,000 feet from the proposed BEP II well sites. The applicant has also reported 3 agricultural wells located about 1 mile from the project. Other than the BEP I wells, the closest existing well to BEP II is the Thermal King shop well, located on Hobsonway, about 2,700 feet from the project well sites. In addition to agricultural and industrial wells, there are also several wells in the vicinity of the site that provide groundwater to domestic users. The largest of these wells serve the Mesa Verde community and are located 2 miles from the project site (BEP II, Data Request responses, Figure 64-1). In addition, the applicant reports 10 other domestic wells located between one half to two miles from the proposed project well sites.
Groundwater Quality

SOIL AND WATER RESOURCES Figure 2
Colorado River Accounting Surface



Source: USGS

The native chemical composition of groundwater near the project site is best described as either a sodium-sulfate or sodium-chloride water. Groundwater sampling of wells conducted by BEP I (2004 and 2005) provides a profile of most physical and chemical characteristics of groundwater. BEP I's sample analyses indicate that concentrations of a few constituents are near the maximum contaminant limits of Drinking Water Standards. Fluoride is the only constituent that approaches or exceeds a Primary Drinking Water Standard. Iron and turbidity are slightly above or below the Secondary Drinking Water Standard. Chloride and sulfate are at or slightly above the recommended Secondary Drinking Water Standard but well below the upper long-term limit. Specific conductance and total dissolved solids are at or slightly above the upper long-term limit for Secondary Drinking Water Standards. **SOIL AND WATER RESOURCES Table 4** provides a listing of these constituents for the three sampling

events that have been conducted on the BEP projection wells since construction in 2001.

Contaminant Source Investigations

BEP I investigated the two potential point sources closest to the BEP II project site, the Blythe Airport Dump and an old mobile home site. The dumpsite is located on the northern portion of BEP II and extends north beyond the site boundary. The old mobile home site, no longer occupied, is located on the southeast corner of the BEP I site.

The dump is associated with the former Blythe military airbase and consists of demolition debris and trash (BEP II 2002a II, response to Data Request 65) BEP I also identified elevated lead concentrations in 1 of 4 soil samples at the dumpsite.

SOIL AND WATER RESOURCES Table 4
Primary BEP Groundwater Supply Water Quality[1]

Constituent (units)	CDHS[2] Maximum Contaminant Level Primary (P) Secondary (S)	BEP I Production Well 2 8/22/2002	BEP I Production Well 1 12/16/2003	BEP I Production Well 2 12/16/2003	BEP I Monitoring Well 1 12/6/2004	BEP I Monitoring Well 2 12/6/2004	BEP I Monitoring Well 3 12/6/2004
Total Dissolved Solids (mg/L)	500,1000, and 1500 (S)[3]	990	920	980	1100	1000	1100
Specific Conductance (micromhos/cm)	900, 1600, and 2200 (S)	1700	1600	1700	1900	1700	1600
Fluoride (mg/L)	2 (P)	2.9	2.7	2.7			
Iron (mg/L)	0.30 (S)	0.17	0.52	0.50			
Chloride (mg/L)	250, 500, and 600 (S)	250	270	270	210	180	130
Sulfate (mg/L)	250, 500, and 600 (S)	280	230	260	380	370	340
Turbidity (NTU)	5 (S)	0.48	4	16			

[1] Groundwater Quality Sampling Results for BEP I Wells (BEP I, 2004 and 2005)
[2] CDHS = California Department of Health Services
[3] Multiple MCL Listings – Multiple listing indicate the following regulatory levels: the first is the recommended limit, the second is the upper limit, and the third is the short-term limit.

However, most of the organic chemicals found in the BEP I sampling program were detected in the well located near an old mobile home site, rather than in the well closest to the dumpsite. BEP I detected low concentrations of manmade chemicals, which did not exceed drinking water standards. The chemicals that were detected include volatile organics, semi-volatile organics, pesticides and elevated concentrations of nitrate (BEP I, 2000a). BEP I reported detecting the following concentrations of volatile organics and semi-volatile organics:

- Styrene (8.1 µg/L, method detection limit (MDL) of 0.5 µg/L)
- Ethylbenzene (0.5 µg/L, MDL of 0.5 µg/L)
- Toluene (2.7 µg/L, MDL of 0.5 µg/L)
- Total Xylenes (2.0 µg/L, MDL of 0.5 µg/L)
- Methylene Chloride (0.5 and 2.2 µg/L, MDL of 0.5 µg/L)
- 1,4 Dichlorobenzene (1.5 µg/L, MDL of 0.5 µg/L)
- Di (2 Ethyl Hexyl) Phthalate (3.4 µg/L, MDL of 3.0 µg/L)

BEP I performed on-site investigation, but no source for these chemicals were detected. In addition, BEP I's annual groundwater quality sampling conducted in December 2004 did not detect any volatile and semi-volatile organic compounds, including the compounds previously detected.

The applicant also performed a Phase I Environmental Site Assessment process in conjunction with its AFC, as well as a more extensive search for potential sources of contamination within a 3-mile radius of the proposed project site. This assessment included a review of federal, State of California and local documents for sites using hazardous material or sites with historical or current contamination issues (BEP II 2002a, response to Data Request 65). Eighty-three (83) potential sites for contamination within three miles of BEP II were identified by the initial search (some duplicate listing may be included). From the 83 initially identified sites, the applicant identified 8 sites because these sites are located up-gradient from the BEP II site or could be affected by project pumping. Of these 8 potential sites for contamination near BEP II, 6 sites reported that only soils were affected or that spills were remediated within 24 hours. The remaining 2 sites are the Blythe Airport Dump, which is listed in the State Landfill database, and the Blythe Lemon Ranch No. 41 and No. 69, which is listed in the LUST, ERNS and CORTESE databases.

The State Landfill database presumably lists all landfills in the state. However, other than the elevated lead concentrations in one soil sample from the Blythe Airport Dump, no leaks have been reported and no other chemicals in concentrations that constitute contamination have been reported at the dumpsite.

The only other notable contamination event, listed in the LUST, ERNS and CORTESE databases, was numerous reports of gasoline leaks at the Blythe Lemon Ranch in October 1991, located about 1,300 feet east of the proposed project site. In addition, no final cleanup was reported. However, the Colorado River Regional Water Quality Control Board has clarified that only one leak occurred at a single site at Lemon Ranch (but was reported repeatedly) and that the spill was cleaned up and the case closed in 1997 (CEC/RWQCB 2004).

With the exception of elevated nitrate concentrations, which are likely caused by agricultural fertilizers and mobilized by irrigation, no new information provided by the applicant indicates the source or distribution of the manmade chemicals detected during initial sampling at the BEP I site. In addition, the applicant's investigation did not identify any other significant contamination sites near the project.

SURFACE HYDROLOGY

Surface hydrology in Palo Verde is predominated by the Colorado River, which is the only significant body of water in the region. The river flows on the east side of the valley, about 9 miles to the east of the proposed project site. The average annual flows of the Colorado River, measured at the Palo Verde Dam, are 7,594,000 acre-feet per year (Metzger 1973). Numerous dry washes cross the upland areas and provide infrequent and short-duration flows during intense rainstorms, flowing generally southeast across the mesa to the valley. However, the contribution to surface water

flows from the dry washes in the Palo Verde area is negligible compared to the flow of the river. The USGS estimated runoff to the valley from the McCoy Wash, the only large wash on the Palo Verde Mesa, averages only 800 acre-feet per year (Metzger 1973).

There are numerous irrigation canals and drains in the region, located in the Palo Verde Valley. The drain located closest to the proposed site is the Rannells Drain, approximately 1 mile to the east of the site at the foot of the mesa. Drain flows are primarily derived from groundwater drainage and operational spills. These return flows are discharged to the Colorado River and are included in the PVID's computation of total Colorado River water use based on diversion less return flows.

There are no significant surface water bodies in the vicinity of the site. Drainage on the Palo Verde Mesa in the vicinity of the site generally flows to the southeast toward the Palo Verde Valley and the Colorado River. Likewise, the existing topography at the BEP site is relatively flat with gradient towards the southeast. Drainage at the BEP site has been modified to accommodate the BEP II facilities. The drainage plans for the BEP II facilities are intended to prevent the flow of runoff onto the project site from upgradient land. Runoff from upgradient of the project site is captured in a network of drainage channels and routed to the retention basin at the southern portion of the BEP site. Runoff generated on-site will also be routed to the retention basin. The retention basin is intended to capture and percolate all runoff generated by a 100-year 24-hour event and to prevent potential storm water drainage impacts (BEP II 2002, Section 7.13). Runoff caused by major rainfall events will convey eroded soil to the BEP retention basin, where the eroded soil would be trapped.

WATER RESOURCES AND INFRASTRUCTURE

Water Supply and Use in PVID's Service Area

The primary water resources in the Palo Verde area are derived from the Colorado River through surface diversions and groundwater pumping. Surface diversions are used primarily to supply water to agriculture in the valley and to a limited extent in the mesa. Groundwater pumping is used for local water supply by City of Blythe, by the Mesa Verde community, and by individual property owners, particularly in the mesa, where the surface-water delivery infrastructure is limited.

The Palo Verde Irrigation District (PVID) is the sole entity in Palo Verde with rights to divert and use Colorado River water. PVID annually provides irrigation water to approximately 90,000 acres of farmland, primarily in the valley, with water diverted from the Colorado River. PVID has Priority 1 rights to irrigate up to 104,500 acres in the Palo Verde Valley, Priority 3 rights to irrigate 16,000 acres on the Palo Verde Mesa and Priority 6 rights to irrigate an additional 12,000 acres on the mesa. PVID annually delivers surface water to approximately 90,000 acres of farmland, primarily in the valley, with water diverted from the Colorado River.

PVID has delivered surface water to approximately 1,250 acres of farmland on the mesa annually since 1980 (PVID 2004). A major portion of the water that PVID diverts is consumed by the crops it irrigates. However, to irrigate crops effectively, the amount

of applied irrigation water must exceed the crop-water requirements. The portion of the applied water that is not consumed by crops percolates past the root zone to recharge the underlying aquifer. However, when groundwater levels rise to the elevation of irrigation drains, it discharges to the drains and is returned to the Colorado River.

The PVID service area contains 131,228 acres along the Colorado River in southeastern Riverside and northeastern Imperial counties. The PVID diverts water from Colorado River for irrigation through a series of diversion canals originating at the Palo Verde Diversion Dam and returns water to the Colorado River through PVID drains. The PVID's diversion system includes approximately 244 miles of main and lateral irrigation canals and approximately 141 miles of open drainage canals carrying groundwater drainage and canal operational spill flows (PVID 2002). This network of irrigation and drainage canals throughout the Palo Verde Valley carries Colorado River water to and from agricultural users and is essentially an extension of the Colorado River system.

During the 10-year period including 1987 to 1999 (excluding 1992 through 1994), the PVID's average annual diversion was approximately 913,000 acre-feet and the average annual return was approximately 513,000 acre-feet, resulting in a net average annual use of approximately 400,000 acre-feet. Given the total flows diverted and returned, the PVID's annual diversions and return flows from the Colorado River represent approximately 11.5 percent and 5.1 percent, respectively, of the river's annual flow volume (PVID 2002).

The PVID also plans to provide Colorado River water to the Metropolitan Water District of Southern California (MWD). MWD delivers water to 26 city, county, and municipal water agencies that serve more than 17 million people in Los Angeles, Orange, San Diego, San Bernardino and Ventura counties. Water sources for MWD include the Colorado River and State Water Project. On the Colorado River, MWD has Priority 4 and Priority 5 water rights totaling 1.1 million acre-feet. To supplement its allocation of Colorado River water, MWD is working with the PVID to implement a water conservation program within the PVID that will enable the PVID to provide MWD up to an additional 111,000 acre-feet of Colorado River water per year.

MWD's proposed water conservation program involves rotationally fallowing farmland through voluntary agreements with an estimated 60 to 70 land contracts (PVID 2002). Water saved by the proposed water conservation program would be made available to MWD for its use within its service area. The proposed water conservation program includes limits on the amount of land fallowed within the PVID and within any individual participant's agricultural fields, land management measures, monitoring and verification measures, reporting, and payments to assist in stabilizing the farm economy within the Palo Verde Valley. The proposed water conservation program includes comprehensive measures to ensure that the program results in real and documented reductions in PVID water use such that water saved within the PVID can be transferred to MWD.

Groundwater primarily supplies municipal water users in the valley and most water users on the mesa. In the valley, the largest groundwater producer, the City of Blythe, delivers groundwater to a population of about 12,200, who live within a 6-mile radius. Agriculture is currently the largest user of groundwater on the mesa. Based on PVID's

earliest records, farmland irrigated with groundwater on the mesa has declined from over 3000 acres in the early 1970's to less than 1000 acres presently. In 2003, PVID reports that 544 acres within their service area and an estimated 300 acres outside their service area irrigate with groundwater on the mesa (PVID 2004). The existing BEP I is the second largest user of groundwater on the mesa, with an estimated average annual production of 3,300 acre-feet during normal operations. Also located on the mesa, the Blythe Airport and the Mesa Verde community, as well as small commercial and private homes use groundwater.

Most groundwater consumption is included in the calculation of PVID Colorado River water consumption. As pumping drawdown radiating from wells intercepts nearby irrigation drains and unlined canals in the valley, groundwater recharge from these surface-water features increase. Correspondingly, return flows to the Colorado River decrease.

Plant Water Use

The proposed raw water supply for all plant uses would be from two 3,000 gpm groundwater wells to be constructed on the BEP II site. These wells would be in addition to the two wells constructed for BEP I. The applicant has proposed to interconnect the water delivery system of the BEP II with BEP I to provide operational flexibility. Each of the project wells on both sites is designed to independently meet the project water requirements. The BEP I and BEP II project's combined groundwater use would be 6,600 acre-feet/year. The second well on each site is designed to provide backup to the first well. However, during emergencies, both wells on a single site could provide the entire water supply to both projects because the systems would be interconnected and all wells would have similar capacities as the BEP I. The applicant states that BEP II would limit emergency pumping to a few days. (BEP II, 2004).

The minimum, average and maximum rates of water usage for BEP II when operating at full generating capacity are estimated to be about 1,670, 2,200 and 3,000 gallons per minute (gpm) respectively. Annual consumption of water is expected not to exceed 3,300 acre-feet per year. Water use requirements include makeup for the cooling tower, gas turbine inlet cooling (GTIC), makeup for the brine discharge to the evaporation pond, demineralized water for the steam system and potable water.

BEP II water use for these purposes is expressed as a range based on conditions that are approximately the coolest and warmest expected in the Blythe area, as summarized in **SOIL AND WATER RESOURCES Tables 5 and 6**. The equivalent daily use for these two extremes is 7.4 and 13.1 acre-feet per day (AF/day) respectively.

SOIL AND WATER RESOURCES Table 5
BEP II Daily Water Consumption
59º F Ambient Temperature, 60% Relative Humidity, Chilling to 50º F,
No Duct Burning, 7 Cycles of Concentration

Description	Instantaneous Demand (gallons per minute)	Daily Demand (gallons per day)
Main Cooling Tower Evaporation	1,490	2,145,600
Inlet Air Chiller Cooling Tower Evaporation	154	221,760
Brine to Evaporation Pond	10	14,400
Miscellaneous Losses	10	14,400
Potable Water	10	14,400
Total	**1,674**	**2,410,560**

(BEP II. 2004, Figure 2.0-18A)

SOIL AND WATER RESOURCES Table 6
BEP II Daily Water Consumption
110º F Ambient Temperature, 5% Relative Humidity, Inlet Chilling to 50º F,
Duct Burning, 7 Cycles of Concentration

Description	Instantaneous Demand (gallons per minute)	Daily Demand (gallons per day)
Main Cooling Tower Evaporation	2,610	3,758,400
Inlet Air Chiller Cooling Tower Evaporation	307	442,100
Brine to Evaporation Pond	18	25,900
Miscellaneous Losses	10	14,400
Potable Water	10	14,400
Total	**2,955**	**4,255,200**

(BEP II. 2004, Figure 2.0-19C)

Actual water use will vary with power output, ambient temperature, duct firing, use of gas turbine inlet air-cooling, and humidity. Maximum water consumption coincides with maximum generator output and is achieved in a combined cycle plant when auxiliary burners are operated – "fired". Auxiliary burners, or duct burners, are natural gas fueled burners located in the duct work between the gas turbine exhaust and the corresponding entrance to the heat recovery steam generators (HRSG). These burners are fired in order to raise the temperature of the flue gas entering the HRSG's, thereby increasing steam production from the HRSG's. The increased steam generation is used in the steam plant portion of the combined cycle plant.

The other primary variable in plant water use is the operation of the Gas Turbine Inlet Cooling (GTIC) system. Gas turbines operate at maximum capacity and efficiency when using the coolest temperature air at the inlet of the turbine – at the compressor inlet. For that reason it is typical to cool the gas turbine inlet air in high ambient temperature locations. The initial heat balances indicated that water would be sprayed

into the incoming air to cool it by direct evaporation, although in the January 26, 2005 PSA Workshop, the applicant stated they wanted to maintain design flexibility to use either evaporative or mechanical cooling for the GTIC at this time.

As shown in the previous section, **SOIL AND WATER RESOURCES Table 4** characterizes the quality of the proposed water supply consisting of Colorado River water withdrawn as groundwater. The greatest portion of project water use (about 90 - 95% of the total) will serve as makeup water to the cooling tower and will accommodate use of the groundwater without treatment. Water used for GTIC, steam production, miscellaneous plant use, and potable supply (about 5 - 10% of the total) will need to be treated before use. The project's water treatment plant will consist of an evaporator (brine concentrator) for concentrating the cooling tower blowdown, a reverse osmosis (RO) unit to purify water for potable water use, and an RO unit and an electrodeionization (EDI) unit for producing demineralized water for the steam production and GTIC.

PROCESS AND SANITARY WASTEWATER

The wastewater system is shown schematically on the water balance diagrams. More detailed flow diagrams are not available. The raw water from the on-site wells is directed to three places: a minor amount to in-plant utility uses, on the order of 5 percent is directed to the gas turbine inlet air cooling system, and the remainder to the steam turbine condenser cooling system (cooling tower). The two larger uses are for evaporation in cooling towers of 7 cycles of concentration. The blowdown/wastewater from the cooling towers is sent to a brine concentrator system. In this equipment approximately 95 percent of the water is flashed off in a vacuum system as pure water, the remaining 5 percent, containing essentially all the dissolved solids, is sent to an evaporation pond. The pure water is then directed to the makeup system for the plant steam process and through the demineralizer system as needed, with the rest of the pure water returned to the main cooling tower.

The wastewater sent to the evaporation ponds can accurately be described as brine, and is actually far "saltier" than ocean water (see also **Biological Resources** in the **FSA** [CEC 2005p]). This brine is left exposed to the sun and wind so that the water will evaporate, and in due course (years) all the water will be removed and only the chemical solids that were initially brought in with the well water and any non-volatile power plant water treatment chemicals, will remain. These solids will eventually be removed to a suitable solids disposal site. The wastewater has the following chemical characteristics:

SOIL AND WATER RESOURCES Table 7
Estimated Constituent Concentrations in Brine Discharged to Evaporation Ponds

Constituents	Estimated Concentration (mg/l)
Dissolved Silica	4,236
Dissolved Iron	6.7
Calcium	8305
Magnesium	1,333
Sodium	46,485
Potassium	735
Sulfate	57,603
Chloride	44,503
Fluoride	315
Nitrite	5,902
Boron	105
Phosphorous	<7.5
Total Dissolved Solids	169,808
Aluminum	17.5
Arsenic	0.75
Lead	<0.005
Selenium	1.8
Strontium	163
Zinc	12.6

Source: BEP II 2002, Section 7.13, AFC Table 7.13-7; BEP II Revision to Information in Support of a Report of Waste Discharge, February 2004, Table 3; and Staff Analysis.
mg/l – milligrams/liter

Blowdown from the HRSG's, the demineralizer system rinses, and in-plant process wastes are all directed to the main cooling tower, to eventually join the wastewater stream that is directed to the brine concentrator. The other wastewater streams are sanitary waste, which is discharged to leach fields, and storm water, which is conveyed to a retention basin and is discussed in the following Stormwater section. Further discussion of the wastewater system is described in the **Waste Management** section of the FSA (CEC 2005p).
Wastewater streams from BEP II circulating water processes will be discharged to the BEP II evaporation pond after being concentrated in the brine concentration unit. The concentrated brine will have elevated concentrations of total dissolved solids (TDS) and other non-hazardous constituents; estimated constituent concentrations for the brine discharged to the evaporation ponds are presented in **SOIL AND WATER RESOURCES Table 7** (BEP II 2002, Section 7.13; BEP II 2004, Table 3). Wastewater streams from the oil water separator will also be discharged to the evaporation pond (BEP II 2002a, Data Response 68).

The BEP II evaporation pond is designed as a 2-cell pond with a total evaporative area of approximately 6.07 acres and a total storage capacity of approximately 62 acre-feet at the maximum operating level 13 feet above pond bottom including 2 feet of freeboard (BEP II 2002, May 2002; BEP II, February 2004). The evaporation pond design

includes two 60-mil HDPE liners placed on a geosynthetic clay mat with a leak detection system (BEP II 2002).

STORM WATER

The relatively flat topography at the site naturally drains towards the southeast. The BEP (I and II) site intercepts storm water runoff from a contributing upgradient watershed of approximately 1,134 acres, which will be routed in drainage channels to the retention basin in the southern portion of the BEP site. All non-contact runoff generated on the 152 acre BEP site will be routed by a network of drainage channels and culverts to the retention basin. Contact runoff from plant process areas will be routed to the oil water separator and then to the evaporation pond. The retention basin is intended to capture and percolate all runoff generated by a 100-year 24-hour event and to prevent potential storm water drainage impacts (BEP II 2002). Retention basin design plans submitted by BEP were reviewed and approved by the City of Blythe, the Blythe Chief Building Officer (CBO), and the Energy Commission during licensing phase of BEP I. Staff reviewed the drainage channel and culvert designs and found them to be acceptable.

Storm water drainage from plant process areas will be routed through an oil-water separator and pumped to the evaporation pond. The oil-water separator will receive flows from:

- Combustion Turbine Transformer areas
- Steam Turbine areas
- HRSG drains
- Chemical Storage areas
- Boiler Feedwater pumphouse floor drains
- Ammonia Unloading area drains
- Fire Pumphouse floor drains
- Maintenance Shop and Warehouse floor drains
- Water Treatment area drain sump (BEP II 2002a, Data Response 68)

ANALYSIS OF PROJECT RELATED IMPACTS

The analysis of impacts is conducted pursuant to CEQA, the Warren-Alquist Act, and the Energy Commission siting regulations.

DIRECT AND INDIRECT IMPACTS

Soils

Linear Facilities

In the AFC, the applicant indicated that the BEP II facility would be connected to Buck Boulevard Substation constructed as part of the neighboring BEP I facility and that

additional transmission lines off-site will not be necessary (BEP II 2002, Section 6). Also, natural gas would be supplied by the pipeline constructed as part of the BEP I facility, and construction of additional off-site natural gas pipelines will not be necessary (BEP II 2002, Section 6). However, in response to Data Requests, the applicant indicated that either an additional 500-kV single circuit transmission line or an additional 230-kV double circuit transmission line would be required to interconnect the Buck Boulevard Substation to either the Devers Substation or the Midway Substation (BEP II 2003a, Data Responses 195–197 and 227-232).

The applicant did not provide the discussion of the final routes, construction methods, environmental setting, environmental impacts, and mitigation measures specifically requested by staff (BEP II 2003a, Data Responses 203). In comments to the PSA, the applicant indicates that BEP II linears will be contained on the BEP site (BEP II, April 2004) because all linear transmission and natural gas lines were constructed as part of the BEP I. As noted in the **Transmission System Engineering** section of the FSA (CEC 2005p), it is not clear how BEP II will connect to the grid. Therefore, this analysis is limited to the project as described in the AFC and off-site linears were not analyzed.

Water Conservation Offset Plan

The BEP II project includes a Water Conservation Offset Plan (WCOP) intended to offset the project's water use by fallowing agricultural lands within the PVID.
The proposed WCOP for BEP II includes the following elements:

1. BEP II would construct up to three wells at the site for pumping groundwater derived from the Colorado River, and would install recording meters to maintain records of its water use.
2. BEP II would acquire, through purchase or lease, lands on the mesa or the Palo Verde Valley within PVID that have been actively irrigated within the past 5 years. These lands would be rotationally fallowed or retired from all uses that depend on Colorado River water.
3. A consumptive use volume of 4.2 acre-feet water per acre would be used as the accounting basis for the offset.
4. BEPII would report water use and acreage of land retired from irrigation to US Bureau of Reclamation (USBR) and PVID annually. Reports would be sent by January 31st of the following year. If the land retired or fallowed was previously served by surface water, BEP II's report will include records from PVID's database showing that no water was delivered to the particular fields. For land previously irrigated using groundwater, or sharing a point of water delivery with a field continuing to be irrigated, photographic evidence would be provided.
5. The WCOP would be implemented concurrent with commercial operation of BEP II, and would remain in effect for the life of the project (BEP II 2002, App. 7.13-F).

Staff's concerns with the proposed WCOP stem from inadequacies in erosion control measures and the inability to accomplish water conservation as proposed. Soils in the valley are generally classified as silty fine to medium grained sandy soils with relatively low erosion hazards. Water erosion hazards are limited in the valley by the very flat slopes and soils with high permeability and low to moderate runoff potential (BEP II

2003, Data Response 170). However, appropriate drainage, erosion and sedimentation control measures for these types of soils and topography must be maintained to ensure that significant impacts do not occur.

The applicant has indicated the fallowing program would include approximately 1,000 acres of land that will be rotationally fallowed on a 5-year cycle with 80% of the land fallowed during any given year (BEP II 2003, Data Responses 170, 171). The applicant has offered to include the following conservation measures in the WCOP (BEP II 2003, Data Responses 174,198, 225):

- Maintenance of stubble residue for fields previously planted in alfalfa, wheat, barley, or similar crops; and
- Clod tilling for non-irrigated fields without stubble residue or sod cover. Mulch or similar material would be integrated into the clods on soils classified as Highly Erodible Land (HEL) by the Natural Resource Conservation Service (NRCS).

These conservation measures could be adequate on certain soils in the Palo Verde area. However, the NRCS reviewed these measures and noted that a cover crop should be used to protect fallowed lands (NRCS, September 2003). The cover crop could require light irrigation during dry years that would need to be accounted for when determining the actual water conservation offset figure for a given plot of fallowed land. The NRCS also noted that clod plowing would not be effective on the sandy textured soils predominant on the Palo Verde Mesa and would not be effective for long-term durations (NRCS, September 2003).

Implementation of land management measures that have been reviewed and approved by the NRCS and Palo Verde Resource Conservation District (PVRCD), and included as an integral part of the WCOP would provide adequate mitigation for potentially significant erosion impacts associated with the planned fallowing program. In Data Response #80, the applicant stated that "NRCS has no LORS that apply to the project, and therefore no legal jurisdiction of any kind. There is no need, requirement or intent for the WCOP to satisfy local NRCS staff." However, during the PSA Workshop in January 2005, the applicant stated that they were willing to work with NRCS staff to ensure that adequate erosion control measures are implemented on fallowed lands. Staff notes that absent a condition requiring the applicant to implement erosion control recommendations of the NRCS, that there would not be any assurances that land fallowing would include proper BMPs for erosion control, and therefore could lead to a significant adverse impact to soil resources.

Beyond the specific concern for erosion control measures, staff believes in a broader sense that the Final WCOP submitted by the applicant has not provided sufficient detail with regard to how it would be implemented, managed, monitored, reported, and verified (BEP II, June 2002). Some of the specific inadequacies with the applicant's proposed WCOP are highlighted as follows:

1. BMPs to prevent soil erosion of the fallowed lands have not been adequately addressed in the view of NRCS and staff, particularly for lands where there is no stubble residue (other than alfalfa, wheat, barley and similar crops) and in areas

where clod plowing is not considered effective for coarse granular soil such as on the mesa.

2. Lands proposed for fallowing have not been identified, and thus cannot be verified that they have been irrigated within the past 5 years. Lands previously identified by the applicant have since been withdrawn.
3. Fallowing lands that have been irrigated as infrequently as once in the last five years would only result in 20 percent of the water conservation that is needed and necessary to be achieved, and would cause a net increase in consumptive use of Colorado River water within both the PVID and the state.
4. Water needed to prevent soil erosion such as for establishing and maintaining vegetative cover or other soil surface treatment has not been identified in the proposed accounting method which assumes water will be conserved at a flat rate of 4.2 AFY per acre of land fallowed, regardless of the water that could be required for erosion control BMPs.
5. Management of the proposed WCOP does not include providing any historical or current records of irrigation to lands proposed for fallowing to verify the basis that water will be effectively conserved. During implementation of the WCOP it may be necessary to distinguish water conserved by the WCOP from other independent water conservation activities occurring within PVID's service area for which the WCOP could claim credit.
6. Monitoring, reporting, and annual verification of the results of the WCOP for demonstrating actual water conservation equivalent to BEP II's proposed annual use of 3,300 acre-feet per year has not been addressed. Although the applicant has proposed to provide an annual accounting to USBR and PVID, it is not clear that these agencies will serve to verify results, or will have any authority to enforce compliance. Adequate oversight will ensure the success of the BEP II's WCOP and will avoid the problems that BEP I's WCOP has experienced.

Although staff believes the proposed BEP II WCOP in its current form is inadequate with respect to erosion control measures and its ability to accomplish water conservation, the USBR has indicated its acceptance of the BEP II WCOP (USBR. 2002). We also note that USBR has previously reversed its position of acceptance with respect to the WCOP for BEP I, as indicated in their letter to the BEP I project owner dated July 18, 2003 (USBR 2003). In their letter, USBR questioned the validity and legality of BEP I's existing use of Colorado River water derived from groundwater due to its concerns that the BEP I WCOP is not acceptable, a position that reflects staff's view of the of BEP I WCOP and that proposed for BEP II. The USBR's concern for BEP I stems from the realization that the offset lands claimed by BEP I did not have a recent history of irrigation. USBR further requested BEP I to identify its plans for the source of water that will be used at BEP I, and the legal basis to use that water (USBR.2003).

Although the applicant indicated during the January 26, 2005 PSA Workshop for BEP II that this matter for BEP I had been resolved, staff has not received evidence to this effect. As for other agencies that have expressed concern for the BEP II WCOP, the

Colorado River Board of California (CRB) has provided several comments stating that agency's position on the use of a WCOP by BEP II (CRB 2003):

> *A water conservation offset program could be used to mitigate impacts of unauthorized use on the condition that it be acceptable to Reclamation and junior water right holders. Such an offset program must not be illusory, such as an agreement to fallow land which has not been irrigated for decades.*
>
> *For a water conservation offset program to be acceptable mitigation, actual water conservation would be necessary in an amount sufficient to offset the BEP II water use. Verification would be necessary to ensure that the amount of water unused for other reasons in the service area is not being credited against the water conservation offset program.*

Unauthorized use results from Colorado River water derived from either the mainstream or pumped as groundwater being used in the absence of either a water delivery contract with the USBR (Secretary of the Interior) in accordance with Section 5 of the Boulder Canyon Project Act, or those with pre-1928 present perfected rights resulting from the Supreme Court Supplemental Decree of 1979 and a water delivery contract with the Department of Interior (CRB 2003, Enclosure 6). CRB also notes that while PVID takes the position BEP II would not be an unauthorized water user since the project is located with the District's service area, and that the District's water right would cover service to the Project, Coachella Valley Water District (CVWD) disagrees with PVID's position (CRB 2003).

Staff and the applicant have the benefit of referring to two relatively recent model WCOPs as examples to help resolve inadequacies in the current BEP II WCOP. These include WCOPs associated with water transfer agreements from PVID to MWD, and from Imperial Irrigation District (IID) to San Diego County Water Agency (SDCWA). In the event the Commission desires a Condition of Certification addressing the BEP II WCOP, staff has included Condition of Certification **SOIL and WATER 7** that address the inadequacies to the existing WCOP and prevent an unnecessary net increase in the consumptive use of Colorado River water within the PVID. Without a complete and verifiably effective WCOP, neither mitigation of potentially significant erosion related impacts or its effectiveness as a water conservation plan can be demonstrated.

Surface Water Hydrology

The BEP II site is not located near any natural surface water features and is not within a 100-year floodplain. The BEP II site will be graded to direct surface water runoff to an on-site retention basin designed to accommodate a 100-year storm and prevent runoff from leaving the site. Staff will recommend revisions to the retention basin operational plans to address the need for mitigation of potentially significant adverse flood related impacts.

Groundwater

Groundwater pumping for BEP II may cause two potentially significant impacts: well interference impacts to nearby existing wells and water quality impacts.

Well Interference Impacts

Significant well interference impacts occur when a project's pumping causes substantial and unacceptable declines in groundwater levels in existing nearby wells. Power plants are water-intensive operations when water is used for cooling. When groundwater is used for cooling, pumping for power plants cause drawdown that is greater than drawdown for agriculture or residents, relative to the land-use acreage.

The magnitude of well interference is defined by the drawdown of groundwater levels, which radiates from the pumping well forming a cone of influence. The radial influence and depth of drawdown are determined by five factors: (1) the rate of pumping, (2) the duration of pumping, (3) the depth of the well screens (well construction specifications), (4) the local aquifer parameters and (5) aquifer boundary conditions.

Aquifer parameters, storativity and hydraulic conductivity, are determined by the layering and thickness of coarse-grained materials, gravel and sand, and fine-grained materials, clay and silt. The composition of aquifers varies widely throughout an aquifer. To accurately determine the impact of pumping specific to the project, calculations of well interference must be based on the aquifer conditions within the vicinity of the pumping wells. Aquifer parameters are best determined by aquifer field tests.

Aquifer field testing has been conducted in the vicinity of the proposed site at BEP I. BEP I conducted aquifer tests on both of the plant's production wells. The construction of monitoring wells, supply wells and irrigation wells and aquifer testing and retesting at the BEP I have provided detailed information on the aquifer conditions adjacent to the proposed project site. The results of these two tests are presented in two final reports, "Results of the Aquifer Test on Blythe Production Well PW-1, Final Report" (6/18/2003) and "Final Results of the Aquifer Retest on Blythe Production Well PW-2" (5/2003). This testing provides the necessary data to evaluate well interference for BEP II.

Applicant's Analysis of Well Interference Impacts

The applicant provided an initial analysis in the AFC that evaluates well interference impacts that would be caused by project pumping. The applicant stated that analysis included an evaluation of the impact of BEP II's pumping at average long-term pumping rates and short-term maximum pumping 4-month summer-peak demand rates. The applicant based its analysis on the results of BEP I's first aquifer test for project well PW-2 (BEP I 2002). Using a significance threshold of 5 feet drawdown on existing wells, the applicant concluded that well interference caused by BEP II would have no significant adverse impact on nearby existing wells under long-term pumping conditions and short-term maximum pumping conditions. The nearest well identified by the applicant, the Sun World well, would only experience 2.2 feet of drawdown, according to the applicant's analysis. **SOIL AND WATER RESOURCES Table 8** summarizes the applicant's well interference findings for long-term average pumping rates. The applicant states that drawdown under short-term maximum pumping conditions would be negligible.

SOIL AND WATER RESOURCES Table 8
Results of Applicant's Well Interference Analysis
for Blythe Energy Project Phase 2 [1]

	1,000 feet	Sun World Well (4,140 feet) [2]
Long-Term Average Pumping Rate (40 years) Drawdown (feet) [2]	Approx. 3	2.2

[1] Drawdown data for BEP II impacts: AFC, Section 7.13.1.4.5.
[2] Sun World Well – Identified by applicant as nearest known well, located 4,140 feet northeast of the project well field (approximate well coordinate T6SR22ES28G) (BEP II. 2002a, Figure 64-1).

Staff has determined that the applicant's well interference analysis is in error for two reasons. First, the basis of applicant's analysis, the BEP I's initial PW-2 aquifer test, contained errors and was subsequently rejected by the Energy Commission. Staff determined the test was improperly conducted and the analysis based on these results contained conceptual errors. The BEP I project developer eventually performed successful tests on both its project wells, performed the analyses, and submitted reports that have been accepted by the Energy Commission.

The second error in the applicant's analysis is the evaluation of short-term maximum-rate pumping impacts. The applicant evaluated maximum short-term pumping rate drawdown assuming an initial pumping rate of zero; initial zero pumping rate will only occur at the beginning of the project's operations and not during continuous and extended operation. Maximum short-term pumping could occur during any summer during the life of the project and must be evaluated accordingly. Worst case conditions would occur if maximum pumping was required during the latter years of the project. The applicant has declined to submit a revised well interference analysis for BEP II based on BEP I's approved test results.

Staff Analysis of Well Interference Impacts

In evaluating the significance of the impact of project pumping on nearby existing wells, it is important to recognize that all pumping causes drawdown and some degree of well interference. However, BEP II project pumping would cause drawdown that is greater than drawdown from agricultural or residential water use for comparable land use acreage. The water use-land use ratio for BEP II will be disproportionately higher than other existing water users on the Palo Verde Mesa, and, correspondingly, well interference from the BEP II would be disproportionately large. Currently, groundwater use in the mesa is very limited and well interference between existing wells would be very small.

Based on average weather conditions in the Blythe area, the 52 acre project site, planted in citrus would consume about 223 acre-feet of water per year, based on the average evapotranspiration for citrus of 4.3 feet per year (DWR 1986, Snyder 1999). In contrast, BEP II will occupy only 52 acres and will consume an average of 3,300 acre-feet of water per year. This rate of consumption is equal to about 63 acre-feet of water per acre. This means that the BEP II will consume about 15 times more water per acre than equivalent acreage planted in citrus. Therefore, drawdown from the project wells and the corresponding well interference will be much greater than drawdown for water

requirements for typical land uses, so the significant project pumping impacts on nearby groundwater users should be carefully evaluated. Private residential wells may be particularly vulnerable to the impacts of well interference because they tend to be smaller and shallower than agricultural or municipal production wells.

Given the location of the proposed project, the location of existing wells that have been identified, and the results of the BEP I aquifer tests, there are three adverse impacts that may occur either alone or in combination, as a result of well interference caused by the BEP II groundwater use.

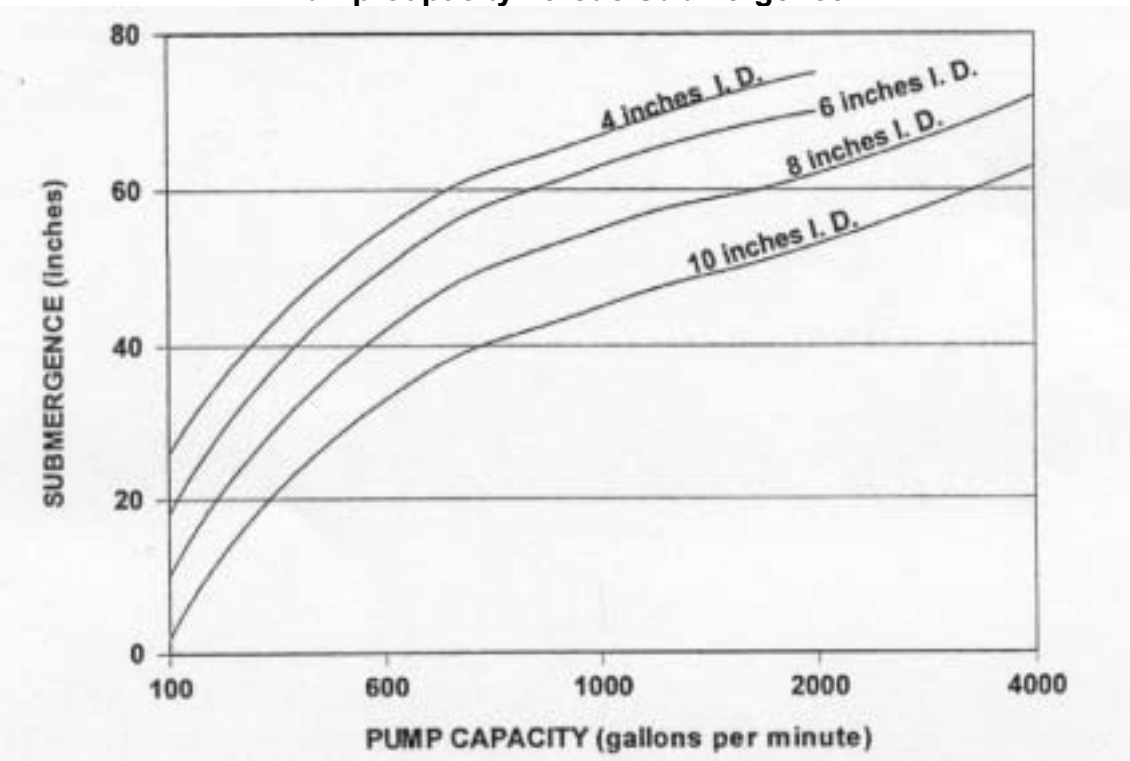
1. Well interference could cause a sufficient decline in the groundwater level in nearby wells that lowering well bowls (pump intake devices) would be required to maintain efficient operation and to prevent damage to pumps.
2. The productivity of affected wells could significantly decrease if the declines in groundwater levels significantly reduced the saturated interval from which the wells draw water.
3. Well interference would increase the pumping lift and the corresponding energy costs in nearby wells.

It should be noted that project well interference will only affect wells on the mesa. Water levels in wells located in the Palo Verde Valley would not be affected because drawdown from the BEP II wells would not extend past the PVID drains and unlined canals located at the toe of the mesa. These drains and canals would provide groundwater recharge to maintain groundwater levels within valley wells.

Pump Damage

To establish a significance criterion for a well-interference threshold that would exceed bowl submergence standards, staff has referred to “Irrigation Pumping Plants,” published by University of California at Davis (Hanson 2000) and Driscoll’s “Groundwater and Wells” (1986), which are standards in the well and pump installation industry. Hanson provides a plot showing recommended values of submergence for various pipe diameters and flow rate; likely submergence values range from about 2 feet for small diameter, low capacity wells to 5 feet for large diameter, high capacity wells (**SOIL AND WATER RESOURCES Figure 3**). Driscoll recommends that pump intakes be submerged 3 feet below the maximum operating depth of a well. However, local well drilling firms indicate that it is their practice to place well intakes 40 to 100 feet below pumping depths (McCalla 2003) or to place them relative to the depth of the well, avoiding elevations that contain fine-grained sediment (Vickery 2003). Staff also considered the 5 feet threshold adopted in the BEP I Final Decision. Based on these factors, staff determined that a submergence threshold of 5 feet would be sufficient and appropriate criterion for BEP II.

SOIL AND WATER RESOURCES Figure 3
Pump Capacity versus Submergence



To establish a significance criterion for increased cost of pump lift caused by project well interference, staff compared project well interference for long-term average pumping to well interference that would be generated by providing water to agriculture with a comparable acreage.

Based on an average of the finalized aquifer parameter values calculated by BEP I and a simple Theis nonequilibrium equation method, staff calculated the well interference impacts that would be caused by BEP II pumping (1) for average long-term (40 years) drawdown and (2) for the maximum pumping rate drawdown. **SOIL AND WATER RESOURCES Table 9** provides a summary of the results of the staff well interference analysis.

SOIL AND WATER RESOURCES Table 9
Results of Staff Well Interference Analysis for Blythe Energy Project Phase 2 [1]

	1,000 feet	BEP I Wells (1,330 feet) [2]	2,000 feet	Thermal King Well (2,700 feet) [3]	1 mile (5,280 feet)	2 miles (10,560 feet)
Long-Term Average Pumping Rate [1] (40 years) Drawdown (feet)	4.6	4.4	4.1	3.8	3.2	2.7
Short-Term Maximum Pumping Rate [1] (4 months) Drawdown (feet)	5.7	5.4	4.9	4.5	3.8	2.9

[1] BEP II - Average Pumping Rate = 2,050 gpm (3,300 acre fee/year); maximum pumping rate for any four-month period = 2,898 gpm; BEP I average of the finalized aquifer parameter values: transmissivity = 74,650 feet^2/day, specific yield = 0.04 (dimensionless).
[2] BEP I Wells – Averaged distance between BEP II production wells and BEP I productions wells.
[3]Thermal King Shop well – Identified by staff as nearest known pre-existing well (excluding the BEP I wells). The Thermal King Shop well is located on Hobsonway, about 2,700 feet southwest of proposed project wells (2,575 feet from BEP II PW-1 and 2,800 from BEP II PW-2). Distances are based on manual map measurements of Figure 64-1, BEP II response to Round 3 Data Request 64.

Owing to the use of the finalized aquifer values and a correct formulation of maximum rate calculation, staff has determined that well interference caused by project pumping would be larger than the applicant's determination of well interference. Nevertheless, well interference at the Thermal King shop well, the nearest known well to the project excluding the BEP I wells would be less that the submergence threshold of 5 feet. The calculated well interference caused by project pumping would average 3.8 feet, increasing to 4.5 feet during maximum-rate pumping. Therefore, staff concludes that direct impacts caused by BEP II project pumping alone would not produce sufficient well interference to damage pumps in any known, pre-existing wells (excluding the BEP I wells). BEP II pumping would produce about 4.4 feet of drawdown on the BEP I wells, increasing to about 5.4 feet during maximum-rate pumping.

Decline in Well Productivity

Existing wells could also experience declines in groundwater levels caused by project well interference that could significantly reduce the saturated interval from which the well draws water and would decrease the productivity of the well. However, the saturated interval of most wells in the Palo Verde Mesa have been reported to be greater than 100 feet (Metzger 1973). Therefore, the decline in water levels caused by the project would cause less than a 5 percent decline in production rate, under worst-case conditions. Furthermore, wells would be able to compensate for small declines in the saturated interval by a correspondingly small increase in pumping rate or pumping duration.

Staff concludes that the BEP II well interference would cause no significant adverse impact to well productivity to nearby groundwater users in the Palo Verde Mesa.

Increase in Pumping Lift Costs

To evaluate the increased cost for pumping lift that would occur for existing wells, staff compared project water use to water consumption for citrus irrigation. Although the actual pumping rate would be equal to the applied water rate, this analysis assumes that any water that is not consumed by evapotranspiration recharges the aquifer through deep percolation on-site. The following table (**SOIL AND WATER RESOURCES Table 10**) shows the estimated drawdown impacts of pumping if the project site was to be planted with a citrus orchard and irrigated with groundwater compared to the range of drawdown that is likely to occur owing to pumping for the BEP II.

SOIL AND WATER RESOURCES Table 10
Net Drawdown Impact to Nearby Existing Wells (feet)[1]

Annual Water Consumption	1,000 feet	2,000 feet	1 mile (5,280 feet)	2 miles (10,560 feet)
BEP II 3,300 acre-feet/year	4.6	4.1	3.2	2.7
Orchard 223 acre-feet/year	0.3	0.3	0.2	0.2
Difference	4.3	3.8	3.0	2.5

[1] Average annual water consumption for irrigation of 52 acres of citrus compared to BEP II water consumption.

This comparison clearly indicates that drawdown and pumping lift caused by groundwater consumption for a typical land use would be minimal as compared to the estimated impact of the groundwater consumption by BEP II.

The increase in energy costs to existing wells caused by project pumping can be calculated with the following formula, which was adopted in the BEP I Final Decision:

$$\text{KWhr/year} = \frac{(\text{gallons pumped/year})^{(1)} \times H^{(2)}}{162{,}162^{(3)}}$$

(1) Gallons pumped/year by existing well
(2) Change in head (drawdown) in feet
(3) This factor was derived by combining the following two formulas

$$\text{KW input to motor} = \frac{\text{pump bhp} \times 0.7457}{\text{motor efficiency}}$$

$$\text{pump bhp} = \frac{\text{gpm x H(in feet) x sp.gr.}}{\text{3960 x pump efficiency}}$$

where: bhp = brake horsepower
gpm = gallons per minute
sp.gr. = specific gravity (water = 1)
H = hydraulic head
Typical pump efficiency = 60%
Typical motor efficiency = 85%

Staff determined that increased costs to residential water users would be nominal; assuming that a household of four uses 1 acre-foot of water annually (about 300,000 gallons/year) and electrical rate of $0.12/KWhr. Entities that pump large quantities of water annually, such as agriculture, would experience a correspondingly larger increase in pumping lift costs. For example, pumping 1,000 acre-feet annually with a 2 ½ - foot increase in pumping lift would cost an additional $600/year. However, staff has not been informed of any community concern regarding increases in cost for pumping lift on the mesa caused by the existing or proposed power project.

Staff concludes that if the significance criteria of 5-feet drawdown that was adopted for BEP I is applied to BEP II, the BEP II well interference would cause an increase in the cost of pumping lift to nearby groundwater users in the Palo Verde Mesa that would be adverse but not significant.

Water Quality Impacts

Staff identified three potential adverse impacts related to groundwater quality that could be caused by the proposed project. First, impacts may be produced from chemical constituents in groundwater that would be concentrated and volatilized during the cooling process. Second, project groundwater pumping could mobilize hazardous chemicals in the subsurface causing the occurrence of chemical concentrations in the project wells or in existing private wells. Third, project pumping might cause upwelling or transport of groundwater with higher concentrations of naturally occurring minerals, causing degradation of aquifer quality.

Organic Chemicals Detected in Groundwater

The first potential impact, caused by the presence of hazardous chemicals in cooling water, would be air emission problems resulting in worker safety issues or in exposure issues for downwind receptors. As reported, low levels of ethylebenzene, toluene, total zylenes, and 1,4-dichlorobenzene, methylene chloride, styrene, and di-2-ethylhexyl-phthalate were detected in the old mobile home well on the BEP I property (BEP I, 2004). BEP I calculated that air emission release rates would be below OSHA exposure levels for ethylebenzene, toluene, total zylenes, and 1,4-dichlorobenzene but would exceed the maximum daily exposure level for methylene chloride, styrene, and di-2-ethylhexyl-phthalate if groundwater produced by project wells contained the same concentration of chemicals detected in the mobile home well.

Based on the detection of these chemicals and the potential for air emission problems, the BEP I Final Decision adopted a condition requiring annual groundwater sampling,

including organic chemicals. BEP I has completed the first round of annual water quality sampling in December 2004 and did not detect any volatile or non-volatile organic compounds, including the chemicals previously detected (BEP I, 2005). However, five years of annual sampling for the BEP I wells are required to verify that there is not a significant source of groundwater contamination on site.

Staff concluded that the potential for significant adverse impacts posed by the hazardous chemicals previously detected in groundwater on the BEP I property would also apply to BEP II, given the proximity of the project wells to BEP I.

Unmitigated Contaminant Sources

The second potential impact would be the introduction of one or more chemical concentration in project wells or in existing private wells caused by the mobilization of pre-existing chemical spills to the aquifer by project pumping. The potential impact that could result from the transport of chemicals in the subsurface is related to source and concentration issues.

However, the applicant's contaminant investigation did not identify any significant unmitigated contamination sites near the project. Staff concludes there is no evidence of an unmitigated source of groundwater contamination that could be affected by project pumping. Therefore, staff concludes that there is not a potential for significant adverse impact.

Groundwater Degradation

The third potential impact is the degradation of the local groundwater supply caused by project pumping. The aquifer serves both municipal and agricultural beneficial uses on the mesa. Although groundwater concentrations approach and, in some cases, exceed the upper limits for secondary drinking water standards for TDS, specific conductance and chloride, it is the only source of drinking water available in the Palo Verde Mesa. The aquifer is a source of drinking water, and it does serve both municipal and agricultural beneficial uses. As such, staff does not classify the alluvial aquifer in the mesa as brackish or unsuitable to serve municipal beneficial use. Considering the lack of an alternative supply for drinking water and the already elevated mineral concentrations of the groundwater, any additional degradation of the aquifer would be a potentially significant impact.

The mesa aquifer is particularly vulnerable to degradation through groundwater pumping. The depositional history of the groundwater system, combined with the hydrologic conditions of the mesa, produce stratified water quality conditions. Based on the compilation of groundwater sampling performed prior to the 1970's, the USGS reports that total dissolved solids (TDS), which is a measure of salinity, in groundwater wells in the mesa increases with depth and distance from the Palo Verde Valley. Groundwater in the mesa is usually fresher near the valley because of pre-development flooding of the ancestral Colorado River and present-day irrigation with Colorado River water. The primary reason salinity increases with depth is because the mesa aquifer, composed of Older Alluvium, is directly underlain by the Bouse Formation, which consists of marine sediments containing brackish water. Brackish water from the Bouse

Formation has slowly diffused into the fresh water of the mesa aquifer over time. However, groundwater pumping in the aquifer accelerates this mixing process.

In the 1973 Metzger report, the USGS cautions that increases in groundwater pumping in the mesa would likely cause upwelling or transport of lower quality water into the fresh-water aquifer. This process commonly occurs in deep wells constructed in alluvial systems underlain by marine or brackish formations. Although most water flows horizontally through an aquifer system to pumping wells, pumping also causes vertical flow. Upward vertical flow to a well is commonly called upwelling.

The rate of upwelling would increase as wells approach or penetrate the Bouse formation. Higher pumping rates would also increase the rate of vertical flow. In other words, deep, high-rate production wells would be most likely to increase the draw-up of brackish water from the Bouse Formation and cause degradation of the fresh-water aquifer. Upwelling would decrease with distance from the project production well but could occur anywhere within the cone of depression, which extends miles beyond the project site boundaries. Existing wells located in the vicinity of the project site would likely be affected by increases in salinity caused by project pumping.

Furthermore, wells usually act as vertical conduits for groundwater to be transmitted rapidly between lower and upper aquifer zones. A deep well could transmit brackish water entering the bottom well screen to any upper zone of the fresh-water aquifer that is screened or gravel-packed. In addition, alternating pumping of the two BEP II wells and interaction with the BEP I wells would cause groundwater mixing in the upper zones within the well field of the two power plants. Although upper-zone degradation may remain localized during plant operation, degraded groundwater would migrate towards other wells operating nearby after plant closure.

Underlying saline formations function as extensive, non-point sources for groundwater degradation. It is important to note that once degradation has occurred, it is infeasible to restore the water quality of an aquifer.

No regional elevation maps or salinity concentration maps of the Bouse Formation have been published. However, based on well log data and cross-section analyses, the USGS estimates that Bouse Formation occurs at an approximate depth 600 to 700 feet below land surface on the mesa in the vicinity of the BEP II. Although most mesa wells described by the USGS are completed to depths of less than 400 feet, the deeper wells surveyed by the USGS provide an indication of the potential salinity of the Bouse Formation. The three wells that were completed to a depth of 600 feet yielded water containing a TDS concentrations ranging from 2,160 to 3,020 mg/L. One deeper well, screened between 700 and 900 feet and reportedly completed in the originally fresh-water formation beneath the Bouse Formation, yielded water containing a TDS concentration of 4,550 mg/L. Only one deep well (572 feet deep), which is located adjacent to the McCoy Wash, yielded water containing a TDS concentration of less than 1,000 mg/L (752 mg/L) (Metzger 1973).

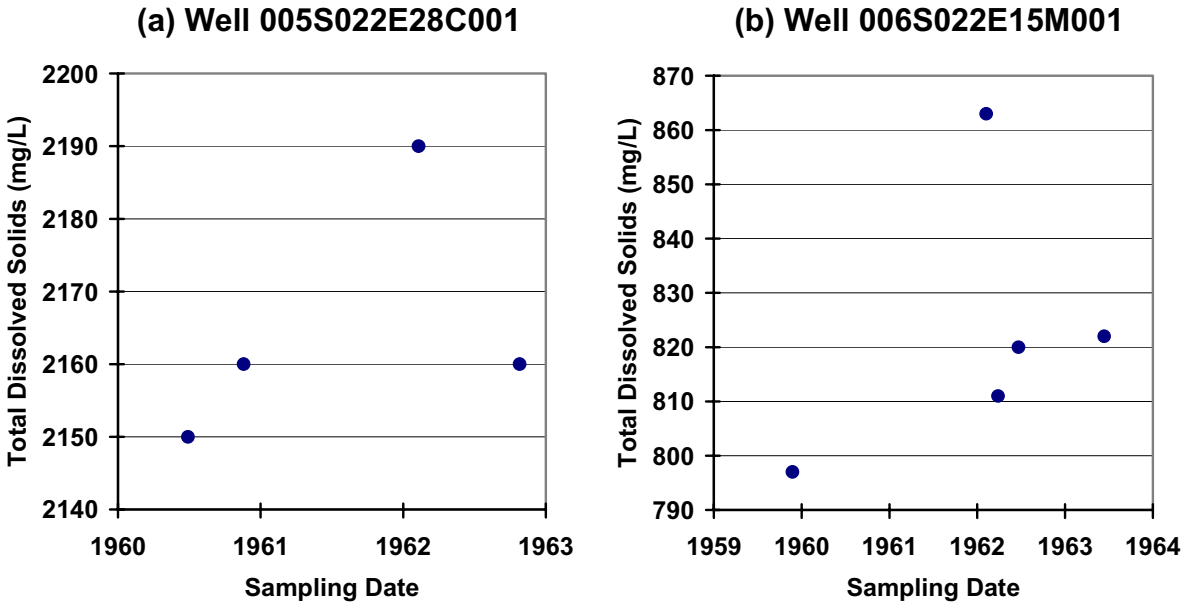
There are very limited data available to evaluate the potential for change over time in the salinity in the Palo Verde Mesa aquifer. However, based on the data available in 1973, the USGS notes that a slow increase in salinity was already occurring in the

mesa. The current USGS water quality data base provides TDS data from four wells in the Palo Verde Mesa that have been sampled more that three times over a period of years (NWISWeb, http://nwis.waterdata.usgs.gov). All four wells clearly exhibit an increase in TDS with time (Figures 4 and 5).

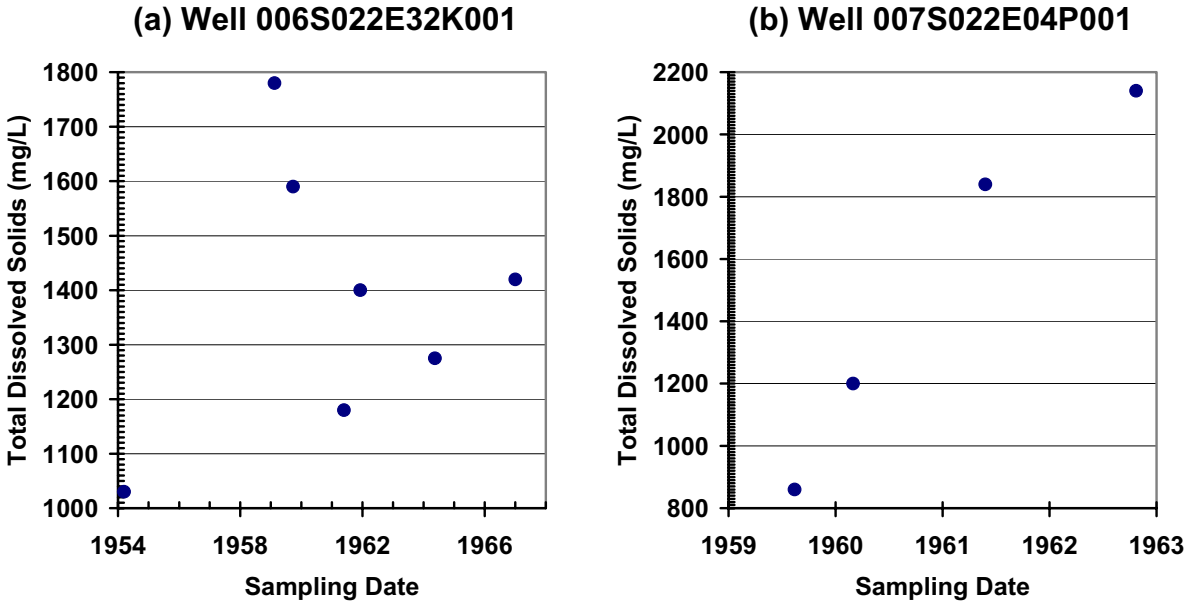
The first two wells, which are located in the McCoy Wash, indicate a small, gradual increase in salinity (Figures 4a and 4b). Well 5S22E28C01 is located about 4 ½ miles from the valley and is screened from 270 feet to 601 feet below land surface (Figure 4a). The second well is located closer to the valley and is much shallower. Well 6S22E15M01 is located about 2 miles from the valley and is screened from 170 feet to 315 feet below land surface (Figure 4b). TDS increased less than 100 mg/L in 3 to 5 years in these two wells. It is likely that the periodic fresh-water flood flows through the McCoy Wash have flushed the more permeable upper portion of the Bouse, reducing the salinity of the formation's water.

In contrast, the second two wells, located south of the McCoy Wash and closer to the proposed BEP II wells, exhibit a much more rapid increase in TDS with time (Figures 5a and 5b). Well 6S22E32K001, located less than mile southwest of the BEP II site, about 1 ½ miles from the valley. This well is screened from 112 feet to 464 feet below land surface (Figure 5a). The TDS in Well 6S22E32K001 increased from about 1,000 mg/L to over 1,400 mg/L within 14 years. The second well, Well 7S22E04P001, is located about 1.5 miles southeast of the BEP II site on the edge of the mesa, adjacent to the valley. This well is quite shallow, screened from 118 feet to 136 feet below land surface (Figure 5b). Well 7S22E04P001 experienced an increase in TDS from 860 mg/L to over 2,100 mg/L in less than 4 years. Although there are other processes that contribute to increasing groundwater salinity, upwelling of brackish water from the Bouse Formation caused by pumping from deep wells is the most likely the major cause of rapid increases in salinity observed in the Palo Verde Mesa aquifer.

SOIL AND WATER RESOURCES FIGURE 4
Water Quality Sampling
Change in Concentration of Total Dissolved Solids with Time
Mesa Wells Located in McCoy Wash (North of BEP II Project Site)



SOIL AND WATER RESOURCES FIGURE 5
Water Quality Sampling
Change in Concentration of Total Dissolved Solids with Time
Mesa Wells Located Near BEP II Project Site



Based on water quality sampling in the BEP I wells, some degree of groundwater degradation may have already occurred in the vicinity of the proposed project from prior groundwater production for BEP I. TDS concentrations appear to be elevated in the shallow portion of the aquifer. The BEP I monitoring wells, which are only 120 feet in depth and located on the mesa about a mile from the valley, produce water with TDS concentrations that range from 1,000 mg/L to 1,100 mg/L (BEP I 2005). The USGS reports that deeper wells (150 to 350 feet in depth) located on the mesa about 1 to 2 miles from the valley that were sampled in the 1960's produced water with TDS concentrations ranging from 640 mg/l to 900 mg/l. In addition, TDS concentrations in the much-deeper BEP I production wells are equivalent to TDS concentrations of the monitoring wells, which could also indicate the groundwater mixing.

Given the depth, capacity and location of the proposed BEP II wells, pumping for the project is likely to cause upwelling of saline waters from the Bouse Formation and significant increases in groundwater salinity over the life of the project. Given the vulnerability of the aquifer system to degradation, the irreversibility of the process and the lack of an existing alternative water supply system on the mesa, staff concludes that the proposed project groundwater pumping is likely to produce direct significant adverse impacts to groundwater quality.

WATER RESOURCES AND INFRASTRUCTURE

Water Supply and Use in PVID's Service Area

Groundwater pumping within the PVID service area is accounted for as part of PVID's reported Colorado River consumption, based on the "Diversion Less Return" accounting system. Groundwater pumping within the PVID service area draws water from canals, drains and excess irrigation derived from PVID's Colorado River diversions. Within the PVID service area, water from canals, drains and excess irrigation percolates to the groundwater table. High groundwater levels in the valley are maintained by this percolation of irrigation water provided by PVID.

PVID's service area includes both the Valley, and the mesa where BEP II is located. Groundwater pumping on the mesa consumes both water derived from canals and drains in the Valley as well as excess irrigation water delivered by PVID to the mesa for agriculture. Groundwater pumping on the mesa forms cones of depression that captures excess irrigation water percolating from locally irrigated fields and causes groundwater underflow from the Valley. Groundwater flow to the mesa from the Valley decreases the amount of water in the canals and drains, which in turn, decreases PVID's return flows to the Colorado River.

Staff and PVID agree that any groundwater withdrawn by BEP II would reduce PVID's returns, would be accounted in PVID's Colorado River consumption and would be a utilization of PVID's Priority 3 water. Both PVID and staff recognize the effects of the proposed BEP II's utilization of PVID's Priority 3 water, and PVID supports the proposed use of this water within the PVID by BEP II. PVID has also acknowledged the Energy Commission's requirements to consider alternative water supplies and cooling methods in its review of power plant applications such as BEP II with respect to direct/cumulative impacts and LORS applicable to power plant water use.

Groundwater pumping on the Palo Verde mesa produces a chain of responses through the groundwater and surface water systems, which are hydrologically connected in the Palo Verde region. Beginning at the project site, BEP II groundwater pumping would produce a cone of depression, producing water that is stored in the aquifer. However, the cone of depression would continue to expand, extending from the well until it intercepts a source of recharge. All of the drains and unlined canals located on the west side of the valley provide a potential constant-head source of groundwater recharge to the mesa. The PVID Rannells drain, located about 1 mile east of the project, is the nearest source of potential recharge to the project. Staff has calculated that BEP II drawdown would intercept the Rannells drain in less than a week, based on an average of the finalized aquifer parameter values calculated by BEP I, the average anticipated rate and a simple Theis nonequilibrium equation method.

When project drawdown intercepts the Rannells drain, pumping would begin to induce recharge from the drain. The drawdown gradient and the rate of groundwater recharge would increase until recharge from the Rannells drain equals the project pumping rate. Once recharge from the drain equals the rate of BEP II pumping, drawdown from the BEP II wells would stabilize. The rate of groundwater recharge would remain constant until plant closure. When project pumping ceases at time of plant closure, recharge from the drain would continue until the pumping cone of depression refilled and groundwater recovered to static levels.

The increase in groundwater recharge from the Rannells Drain caused by BEP II pumping would correspondingly decrease the irrigation return flows to the Colorado River. The total decrease in return flows to the river would equal the total amount of water pumped by BEP II over the life of the project.

This relationship between the increase in groundwater consumption and the decrease of Colorado River supply is the physical basis of the U.S. Supreme Court decree, 1964, *Arizona v. California* regarding underground pumping, as well as the USGS accounting surface method. A summary of the analysis of the groundwater-Colorado relationship prepared by the USGS is provided in **SOIL AND WATER RESOURCES Appendix C** (Wilson and Owen-Joyce 1973).

PVID's Board recently adopted an industrial water rate, which at this time has neither been assessed to any new customers nor charged to any existing industrial customers. The new industrial rate as applied in the future, could potentially pertain to water it delivers from either Colorado River surface water supplies or Colorado River water withdrawn as groundwater from within its service area, which is included in PVID's annual reported consumption of Colorado River water, based on the "Diversion Less Return" accounting method. The adopted rate is $85/acre-foot. While PVID indicated that it would clarify its position as to whether a water supply agreement or some other mechanism for serving industrial water supply to BEP II is necessary, as of the January 26, 2005 PSA Workshop, PVID did not offer any further clarification (CEC/PVID 2004).

Plant Water Use

The applicant has provided minimum, average and maximum rates of BEP II water usage when operating at full generating capacity, estimated to be about 1,670, 2,200

and 3,000 gpm respectively. Annual consumption of water is expected not to exceed 3,300 AF/year. Water use requirements include makeup for the cooling tower, gas turbine inlet cooling (GTIC), makeup for the brine discharge to the evaporation pond, demineralized water for the steam system and potable water.

In order to investigate and confirm the water use numbers, staff prepared water balances using heat balance information. Since the heat balances did not specify the main cooling system water consumption, derivation required analysis from the steam turbine exhaust conditions using engineering procedures and judgment typically used by staff for such investigations. The Revised Project Description – AFC Section 2.0 (BEP II 2004) provides better information to derive actual cooling water consumption at certain ambient temperature conditions. Staff notes that the latest project description indicates auxiliary firing has been apparently increased.

In studying the applicant's Revised Project Description as provided in April 2004, staff observed the following plant design information affecting water use.

- "Chiller" cooling of gas turbine inlet air flow rather than spray water. No details are provided to indicate the ultimate heat sink of the GTIC system, whether the main condenser, separate cooling tower, or air cooling.
- Duct firing in amounts raising the duct temperatures by 21.1 to 75.3 °F.
- Maximum generator output of 538.91 MW, some 17 MW greater than shown in the previous heat balances (BEP II 2004, Heat Balance Figures 2.0-A through F).

The applicant has not advised staff how it will operate the plant in regard to the amount of auxiliary firing; whether it will operate at 522 MW or 538 MW maximum capacity, and what will be the expected pattern of BEP II water use. Without knowing the specifics of how the operator intends to operate the plant with regard to the use of auxiliary firing of the duct burners, it is not possible to exactly determine the water consumption. Much of the information in the Heat Balances (AFC Figures 2.0-6A through D) does not appear to be in agreement with the operator's intended use of the plant.

However, using the heat balance data for steam turbine exhaust only, making adjustments as needed, and with the addition of cooling towers for gas turbine inlet cooling, staff has calculated that for the average year the plant would consume approximately 3,262 acre-feet (2,022 gpm). This is in very close agreement with the applicant's expressed average as stated in their response to Data Request #202. The applicant now intends to use mechanical refrigeration system (chiller) for GTIC, and states that this makes little difference in total water consumption. Therefore, staff's estimate of 3,262 AF/year is sufficiently consistent with the applicant's stated expectation of 3,300 AF/year.

Staff has taken it on face value that the applicant will build a Siemens V84.3A, two on one combined cycle power plant, but notes that Siemens usually does not normally provide the V84.3A gas turbines in the US, but instead supplies the Westinghouse 501F.

After consideration of all factors and despite some inconsistencies in the applicant's data, staff believes it is appropriate to use the volumes given by the applicant and repeated in **SOIL AND WATER RESOURCES Table 11** for expected total water demand. The "Derived" values represent calculations by staff for the conditions noted corresponding with the conditions assumed in the applicant's estimate (AFC/DR), and are in reasonable agreement.

SOIL AND WATER REOSURCES Table 11
Verification of Estimated Total Annual Water Demand
(Acre-feet)

	AFC/DR	Derived
"Average" Annual Consumption of water	3,300	3,262
Annual Use based on Peak 4 month Consumption (91 ºF average ambient temperature)	4,320	4,130
Annual Use based on Lowest Water Consumption (59 ºF average ambient temperature)	2,550	2,500

Lacking further detailed information, and based on both the latest heat balance data and staff's derivation of water requirements, the estimated annual maximum water use of 3,300 AF/year is a reasonable estimate for the proposed project. To the extent that the power plant is operated in combined cycle mode – without auxiliary firing – or ambient temperature is below expectations, or operation is less than 100% of the year, then less water should be consumed.

While staff has attempted to understand which GTIC method the applicant proposes and the corresponding water use effects, the applicant has suggested staff accept its willingness to commit to not exceed an annual water use of 3,300 AF/year. In the event the Commission desires a Condition of Certification addressing water use for the proposed project, staff has included **SOIL and WATER 9 and 10.**

PROCESS AND SANITARY WASTEWATER

Wastewater disposal can lead to soil, surface water, and groundwater degradation and impairment of beneficial uses. Wastewater streams from BEP II circulating water processes, oil water separator, and the reverse osmosis unit will be concentrated in a brine concentration unit and discharged to the BEP II evaporation pond. The concentrated brine will have elevated concentrations of total dissolved solids (TDS) and other non-hazardous constituents as presented in **SOIL AND WATER RESOURCES Table 8** (BEP II 2002, Section 7.13; BEP II, February 2004, Table 3). Leaks in the evaporation pond liner system or overtopping could lead to impacts to soil and water quality.

The BEP II will be required to secure Waste Discharge Requirements (WDRs) from the RWQCB before discharging wastewater streams to the evaporation ponds. BEP II must

comply with WDRs that regulate evaporation pond capacity, wastewater discharge limitations, monitoring, and reporting for industrial (operational) activities. The applicant submitted a Waste Discharge Permit Application for BEP II to the RWQCB in May 2002. Neal Krull of the RWQCB indicated that the Waste Discharge Permit Application contained the information required to apply for Waste Discharge Requirements in a May 14, 2002 letter. In response to issues raised by staff in the PSA and the RWQCB, BEP II submitted a Revision to Information in Support of a Report of Waste Discharge to the RWQCB in February 2004.

Upon initial review, the proposed BEP II evaporation pond area and capacity for a 6.07-acre two-cell evaporation pond appears inadequate compared to the two (2), 8-acre evaporation ponds constructed for BEP I. In response to this concern, the applicant submitted a Revision to Information in Support of a Report of Waste Discharge (BEP II, February 2004), clarifying the BEP II evaporation pond is designed with storage capacity to provide:

- Sufficient depth for storage of discharge water and brine sludge for several years of operation.
- Sufficient additional depth for variations in water level due to variations in plant inflow, rainfall, and evaporation rates.
- Sufficient additional depth for an increase in water level due to the evaporation rate falling to 90 percent of the mean evaporation rate for two consecutive years.
- Sufficient additional depth to provide limited storage capacity (0 to 4 days depending on operating level) for increased inflow when the brine concentrator is inoperable.
- Sufficient additional depth to provide for increased water level for pond maintenance.
- Sufficient additional depth to account for the 100-year rainfall on top of the maximum water level.
- Sufficient freeboard above the maximum water level to provide the maximum of either 24-inches or the height of wind wave run-up plus 12-inches.

In response to RWQCB comments, the applicant identified maximum operating levels for brine sludge storage and pond water levels (BEP II, March 2004). The applicant proposed that::

- When both cells are operable, the maximum solids storage depth will be 9 feet above pond bottom (leaving 4 feet of operational depth above the stored brine sludge).
- When only one cell is operable, the maximum solids storage depth will be 10 feet above pond bottom (leaving 3 feet of operational depth above the stored brine sludge).
- When either one or both cells are operating, the maximum pond water level will be 13 feet above pond bottom (leaving no operational depth above the maximum pond water level).

Staff contacted the RWQCB and discussed the BEP II evaporation pond capacity requirements and the maximum operating levels identified by the applicant

(Communication with Michelle Ochs, June 10, 2004). It was acknowledged that the maximum solids storage depths allowed only limited excess capacity to contain the increased inflow for a brine concentrator shutdown and/or to deal with pond maintenance. Also, the maximum operational water level identified by the applicant did not provide any additional capacity to contain the 100-year rainfall on top of the maximum water level or for additional inflow in the event of an extended shutdown of the brine concentrator, contrary to its design objectives.

The RWQCB issued Draft Waste Discharge Requirements (DWDRs) for BEP II on July 9, 2004 (RWQCB, July 2004). The DWDRs included requirements for leak detection and evaporation pond capacity that reflected the project design presented in the revised Report of Waste Discharge (BEP II, February 2004). The RWQCB also issued a Monitoring and Reporting Program with the DWDRs that outlined requirements for groundwater, unsaturated (vadose zone), and leak detection monitoring and reporting to ensure that potential leaks are identified and repaired before leading to significant impacts to soil or water quality (RWQCB, July 2004). In support of staff's concerns for the adequacy of area and storage capacity in the Evaporation Pond , the Energy Commission submitted comments on the DWDRs in January 2005 requesting that regular monitoring of solids storage depth and water levels be added to the Monitoring and Reporting Program to ensure that maximum operating levels are not exceeded (CEC, January 2005).

Absent the significant adverse effects to wildlife that would result from the Evaporation Pond (see **Biological Resources Section** of the **FSA** [CEC 2005p]), staff would also specify this recommended monitoring requirement for solids storage depth and water levels in a Condition of Certification, addressing the WDRs and reporting requirements to the RWQCB and Energy Commission. In addition to monitoring with the leak detection system, the applicant has proposed quarterly groundwater and vadose zone monitoring to identify potential leaks before significantly impacting soil or groundwater resources.

Staff anticipates that if BEP II operates the evaporation ponds in accordance with the Final WDRs issued by the RWQCB, there would be no significant impacts to soil or groundwater resources due to leaks in the pond liner, and staff has proposed Condition of Certification **SOIL and WATER 5** to address the use of evaporation ponds for wastewater disposal. If the significant impacts to wildlife can only be mitigated with elimination of the Evaporation Pond (see **Biological Resources Section** of the **FSA** [CEC 2005p]), and instead staff recommends implementation of a Zero Liquid Discharge (ZLD) System, and proposes Condition of Certification **SOIL and WATER 6** to address the ZLD system.

Sanitary wastewater will be managed and discharged via an on-site septic system and drain field to be designed according to applicable City and County laws. With the implementation of proposed mitigation (refer to the **Mitigation** discussion for more information) and compliance with the proposed Condition of Certification **SOIL and WATER 4**, no water quality impacts are expected from operation of the drain field.

STORM WATER

Storm water drainage at the BEP (I and II) site will be managed through a network of drains, pipes, channels, and culverts. Non-contact runoff from the project site and upgradient land is routed to the existing retention basin in the southeast corner of the site. Contact runoff from plant process areas will be routed to the oil water separator and then to the evaporation pond. The drainage channels and culverts were designed to convey 100-year peak flows, and to keep contact runoff separate from non-contact runoff. The drainage channel and culvert designs were reviewed and approved by City of Blythe building officials and the BEP I CBO. Staff reviewed the drainage channel and culvert designs and found them to be acceptable.

The Applicant submitted the BEP (I and II) drainage and retention basin design plans for Staff review in Data Response #164 (BEP II 2003). A set of supplementary storm drainage calculations was provided by Rob Holt on behalf of BEP I following the PSA workshop in February 2005 (BEP I 2003). The area of the contributing watershed was identified as 1,273 acres including the BEP (I and II) sites and upgradient land. The 100-year 24-hour rainfall was identified for the Blythe area as 3.79 inches. The Soil Conservation Service Curve Number approach was used to estimate the runoff volume for a 100-year 24-hour event, 96.6 acre-feet (0.91 inches from 1273 acres). The retention basin design presented in the storm drainage calculations (DR #164, BEP II, 2003) indicated that a 55 acre-feet retention basin would have adequate capacity to contain the 96.6 acre-feet design storm. In addition, the supplementary storm drainage calculations (BEP 1 2003) indicated that the retention basin could store up to 3.5 feet (24.25 acre-feet) of eroded sediment.

The constructed BEP (I and II) retention basin provides 89.63 acre-feet of storage volume at elevation 333 feet with 2 feet of freeboard and a maximum capacity of 104.11 acre-feet at elevation 335 feet, which is the spill crest for the basin (BEP I 2003). In response to Data Request #66, the Applicant identified a percolation rate (peak outflow discharge) of 6.3 cubic feet per second or 12.6 acre-feet per day based on a site-specific pump test.

Staff's analysis of flood routing indicates that for the retention basin to retain the 96.6 acre-feet design storm runoff volume and maintain 2 feet of freeboard, 7.0 acre-feet of runoff would need to percolate to the subsurface over the 24-hour design storm duration. Given the measured percolation rate of 12.6 acre-feet per day, the required minimum percolation rate of 7.0 acre-feet per day provides a safety factor of 1.8, which is below the normal acceptable range (2 to 10) for an infiltration basin as specified in the California Best Management Practice Handbook (SQTF 1993).

Based on our analysis of flood routing, the retention basin has limited storage capacity and does not have sufficient excess storage capacity to store accumulated sediment without decreasing the storage available for the design storm. If BEP allows 3.5 feet of eroded sediment (24.25 acre-feet) to accumulate at the base of the retention basin as planned in the supplementary storm drainage calculations (BEP I 2003), there will not be sufficient capacity available to store the runoff produced in the 100-year design storm. Staff discussed this issue with Rob Holt, a consultant for BEP I (per. com. Feb 11, 2005). Staff and Mr. Holt, agreed that this issue should be addressed by a

Condition of Certification requiring more frequent removal of accumulated sediment than called for in the Supplementary Storm Drainage Calculations (BEP II, February 2005).

Based on Staff's own analysis, Staff believes that the proposed retention basin has sufficient capacity to handle the 100-year 24-hour design storm identified by City of Blythe requirements provided that percolation rates can be maintained at the rates measured during the pumping/percolation tests. Ideally, the storage volume provided in the retention basin would be sufficient to provide a higher safety factor within the 2 to 10 range, but a safety factor of 1.8 approaches the acceptable range.

Given the limited capacity of the retention basin, sediment should be removed from the retention basin when a maximum of 0.5 feet (2.12 acre-feet at elevation 317.5 feet) of deposited sediment accumulates at the base of the retention basin. Staff anticipates that no significant adverse impacts will result from an extreme storm event, provided that sediment is not allowed to accumulate above elevation 317.5 feet. Although design of the retention basin is fully the responsibility of the Applicant, Staff recommends that the Applicant consider employing sediment forebays at culvert discharge locations within the retention basin as detailed in the California Storm Water Best Management Practice Handbook (SWQTF 1993). Sediment forebays would provide a location where sand and heavier silt particles would deposit and would help to limit the area required to remove accumulated sediment.

A small outlet/overflow structure on the retention basin would limit the potential for significant adverse impacts related to uncontrolled discharges or over topping during extreme events. The BEP I retention basin has an 18-inch culvert that would allow discharge of overflows from the basin. In addition along the northern portion of the retention basin where the drainage channels enter the basin, there is a low point in the containment berm that would serve as an outlet to prevent overtopping during an extreme event. Any discharges from the retention basin during extreme events would be negligible as compared to the pre-construction discharges from the BEP site including the upgradient, contributing watershed. Staff anticipates that no significant adverse impacts would result from discharges during an extreme event and no mitigation is required.

A properly designed and maintained stormwater drainage system is essential to prevent potentially significant impacts to soil and water resources. Staff has yet to receive recognition by the Applicant of the as-built capacity of its retention basin and the limited ability to accumulate sediment without compromising needed water storage capacity. Therefore, staff is recommending in its Condition of Certification **SOIL & WATER 2** that the Applicant accurately represent its comprehensive plans for permanent stormwater facilities, maintenance and monitoring in the Drainage, Erosion and Sediment Control (DESCP) Plan.

Staff has recommended several Conditions of Certification to prevent impacts to soil and water resources associated with managing stormwater as follows:

SOIL and WATER 1 – Requires the project owner to operate under the General NPDES Permit for Discharges of Storm Water Associated with Construction Activity,

and to prepare and implement a SWPPP for Construction in accordance with the SWRCB's standards;

SOIL & WATER 2 – Requires the project owner to prepare and implement a Drainage, Erosion and Sedimentation Control Plan for both the construction and operation phases of the project in accordance with the Energy Commission's standards;

SOIL & WATER 3 – Requires the project owner to operate under the General NPDES Permit for Discharges of Storm Water Associated with Industrial Activity, and to prepare and implement a SWPPP for Operations in accordance with the SWRCB's standards.

CUMULATIVE IMPACTS

Groundwater Derived From The Colorado River

Hydrologic Assessment of Groundwater Use Impacts to Colorado River Supply

Groundwater pumping for BEP II would reduce flows in the Colorado River in an amount equal to the amount of water pumped by the project. The canals and drains of the Palo Verde Valley transmit Colorado River water diverted by PVID for irrigation. The drains and unlined canals located on the west side of the valley provide a potential constant-head source of groundwater recharge to the mesa. Groundwater pumping for BEP II would yield water that would be replaced by Colorado River water from these drains and canals. See the **Water Supply and Use in PVID's Service Area** in the **Direct and Indirect Impacts** section of this **Technical Report** for a detailed discussion of the effects the project's groundwater pumping would have on the aquifer system.

Pumping and drawdown from the BEP I wells has had a similar effect on PVID. Groundwater consumption by BEP I and BEP II would be additive. In the absence of a verifiably effective WCOP, groundwater use by BEP I and BEP II would cause an average increase of 6,600 acre-feet/year in PVID's and California's consumptive use of Colorado River water. Over the 30-year life of the two projects, BEP I's and BEP II's unmitigated groundwater use would cause a cumulative increase of about 200,000 acre/feet in PVID's consumptive use of Colorado River water.

The relationship between the increase in groundwater consumption and the decrease of Colorado River supply, described in the above assessment of BEP II pumping impacts, is the physical basis of the U.S. Supreme Court decree, 1964, *Arizona v. California* regarding underground pumping, as well as the USGS accounting surface method defining the Colorado River aquifer. A summary of the analysis of the groundwater-Colorado River relationship prepared by the USGS is provided in **SOIL AND WATER RESOURCES Appendix C** (Wilson and Owen-Joyce 1973). It is also the physical change in the environment that requires an assessment of significant impact.

California's Water Supply

California is currently experiencing a statewide shortage of fresh surface water, and ground water is also being extracted from many aquifers at a rate greater than the aquifers are being recharged, i.e., they are in overdraft condition. These conditions will

continue for the foreseeable future as demand continues to exceed supply. Because of this water shortage the state has been using Colorado River water in excess of its entitlement, often exceeding it by up to 1 million acre-feet per year (MAFY). The normal year amount of Colorado River water that California receives will eventually be reduced by approximately 1 million to 800,000 AFY (or by about 20 percent) to California's legal entitlement of 4.4 MAFY by 2016.

The project's proposed use of fresh water would add approximately 3,300 acre-feet per year of new demand on California's fresh water resources, particularly those provided by the Colorado River. This is in addition to the existing BEP I project's use of the same amount of fresh water. If a 30-year operational life is assumed for BEP II, the project will consume through evaporation approximately 100,000 acre-feet of Colorado River water withdrawn as groundwater over its lifetime.

Staff believes the unmitigated use of Colorado River derived groundwater for evaporative cooling is an unnecessary and avoidable contribution by the BEP II project to a potentially significant adverse cumulative impact to the Colorado River water supply and its users. This significant cumulative impact can be mitigated through the use of either dry cooling or wet cooling using Rannells drain water in conjunction with a verifiably effective WCOP (see **SOIL AND WATER RESOURCES Appendix A**). Further discussion of the state's serious water supply issues can be found in **SOIL AND WATER RESOURCES Appendix B- California's Water Supply Outlook**.

Cumulative Impacts to the State's Colorado River Water Supply

To appreciate California's long-established dependency for Colorado River water in excess of its normal 4.4 MAF annual allocation (surplus water), the state's historical pattern of annual water use as tallied by USBR is summarized in **SOIL AND WATER RESOURCES Table 16**. The shaded values of the table indicate the years that California used surplus water in excess of its allocated 4.4 MAFY.

SOIL AND WATER RESOURCES Table 16
California's Annual Use of Colorado River Water during 1914 – 1999 (Acre-Feet)

Year	Use	Year	Use	Year	Use
		1941	2,844,230	1971	5,216,192
		1942	2,819,685	1972	5,230,635
		1943	2,743,293	1973	5,317,547
1914	1,704,204	1944	2,834,049	1974	5,414,040
1915	1,783,896	1945	2,888,661	1975	4,983,705
1916	2,009,700	1946	3,167,417	1976	4,706,594
1917	2,088,396	1947	3,258,444	1977	5,097,343
1918	2,386,500	1948	3,352,589	1978	4,503,340
1919	2,334,300	1949	3,644,345	1979	4,788,423
1920	2,495,196	1950	4,040,767	1980	4,732,879
1921	2,128,596	1951	4,324,682	1981	4,788,470
1922	2,465,400	1952	4,395,144	1982	4,299,799
1923	2,836,103	1953	4,602,321	1983	4,245,082
1924	2,692,897	1954	4,587,303	1984	4,671,080

1925	2,704,801	1955	4,537,651	1985	4,778,748
1926	2,670,409	1956	4,622,275	1986	4,804,802
1927	2,771,603	1957	4,495,640	1987	4,891,961
1928	2,834,593	1958	4,401,444	1988	5,039,679
1929	3,050,292	1959	4,689,012	1989	5,144,417
1930	3,092,400	1960	4,983,885	1990	5,217,626
1931	2,609,807	1961	5,200,747	1991	5,003,784
1932	2,568,407	1962	5,212,989	1992	4,544,068
1933	2,591,808	1963	5,227,934	1993	4,835,018
1934	1,822,920	1964	5,064,733	1994	5,234,089
1935	2,492,555	1965	4,899,987	1995	4,925,480
1936	2,885,944	1966	5,096,907	1996	5,322,655
1937	3,159,651	1967	4,886,715	1997	5,250,120
1938	2,977,409	1968	5,072,514	1998	5,045,230
1939	3,000,626	1969	4,896,527	1999	5,194,380
1940	2,985,062	1970	5,015,018		

Source: www.usbr.gov/lc/region (USBR. 2005)

To appreciate the effects of further reductions caused by consumptive use by power plants on California's limited supply of Colorado River water, staff has summarized in **SOIL AND WATER RESOURCES Table 17** the actual use during 2000 – 2004 and deliveries projected for 2005 as allocated by USBR for California's authorized users of Colorado River water. Water used for the existing BEP I power plant and if used for the proposed BEP II Project would be accounted for as part of PVID's annual use, and would directly decrease the amount of water available to other authorized users in the state.

SOIL AND WATER RESOURCES Table 17
Annual Water Use of Colorado River Water in California during 2000 - 2004 & Forecasted for 2005 (Acre-Feet)

Entity	2000 Actual	2001 Actual	2002 Actual	2003 Actual	2004 Actual	2005 Forecasted
MWD	1,300,014	1,250,502	1,237,994	683,786	750,031	529,330
PVID	511,947	492,634	540,786	379,650	412,700	479,419
IID	3,112,770	3,085,531	3,152,984	2,978,223	2,757,120	2,918,387
CVWD	342,871	329,478	331,107	296,808	319,385	352,900
Others	91,630	96,575	102,738	70,330	46,728	81,963
CA Total	**5,359,232**	**5,254,720**	**5,365,609**	**4,408,797**	**4,285,964**	**4,361,999**

Source: www.usbr.gov/lc/region (USBR. 2005)
Notes: MWD – Metropolitan Water District
IID – Imperial Irrigation District
CVWD – Coachella Valley Water District

Beginning in 2003, California's limitation to an annual allocation of 4.4 MAF from the Colorado River stems from USBR immediately enforcing state allocations under the Boulder Canyon Project Act of 1928 and as further interpreted under the 1964 U.S. Supreme Court Decree in *Arizona v. California* in response to an unresolved dispute

related to how California's Colorado River water supply would be divided up among the state's authorized users. In reviewing USBR's tally of the long-term historical use pattern of California's annual Colorado River water supply since 1914 as shown in **SOIL AND WATER RESOURCES Table 16**, and the recent history of use among California beneficiaries since 2000 as shown in **SOIL AND WATER RESOURCES Table 17**, the following is observed:

1. California's long-established dependency for more than its share of Colorado River water is evident by noting it has used an annual volume in excess of its current annual allocation of 4.4 million acre-feet (MAF) in every year between 1953 – 2003 (see shaded values), except in 1982 and 1983, which represents 49 of 51 years, or 96% of the time over the last half century.
2. During 2000, California used almost 1 MAF in excess of its 4.4 MAF annual allocation, equivalent to 22% above its entitlement.
3. One million AF is enough water to annually supply about 2 million average households, which could meet the consumptive needs of about 6.4 million people.
4. Beginning in 2003, California experienced the immediate loss of about 0.8 – 1.0 MAF annually in its historic allocation and use of Colorado River water in order to assure that other states receive their lawful entitlements and that California does not exceed its normal allocation of 4.4 MAF per year.
5. In California, MWD has incurred the most significant reduction of Colorado River water supply as a result of the state having to operate within its 4.4 MAF annual allocation and MWD having a lower priority Colorado River water right among most California entities. Therefore, MWD has experienced a reduction in its own direct allocation during 2003 – 2005 to about half of its typical 1.2 MAF/year it received prior to 2003.

It is clear the state is facing both immediate and long-term effects of a diminishing supply of Colorado River water and rapidly increasing demands for water in the state as a whole, and particularly in the greater Los Angeles and San Diego region which the Colorado River serves. The BEP II project's unmitigated use of 3,300 acre-feet/year (or total BEP I and II combined use of 6,600 acre-feet/year) of Colorado River water will result in a contribution to a significant adverse cumulative impact to state's Colorado River water supply and the users dependent on it.

The Colorado River's status during 2003 and beyond is best described by excerpts from the CRB's letter (CRB 2003):

> "The current status of the Colorado River water supply is a bleak one. Generally, the Colorado River basin is experiencing a fourth year of drought and little, if any, surplus water is anticipated in the near future. For example, the Coachella Valley Water District's (Coachella) supply was reduced on April 28th of this year from 338,820 acre-feet to 238,500 acre-feet for this calendar year (Enclosure 1). The Metropolitan Water District of Southern California (Metropolitan) requested 1,250,000 acre-feet for this calendar year. Metropolitan's supply was reduced to 713,500 acre-

> feet on January 1st and to 592,500 acre-feet on April 28th for this calendar year (Enclosure 2)."
>
> "Coachella has had to execute leases with farmers in the Palo Verde Valley, served by the Palo Verde Irrigation District, this year for a six-month period, beginning June 20th, in return for compensation of $750 per acre (Enclosure 4)."
>
> Note: The enclosures referenced in the excerpts above refer to information contained in the CRB's submittal.

Additional detail on California's Colorado River water supply issues can be found in **SOIL AND WATER RESOURCES Appendix B – Status of the Colorado River**.

Absent a water delivery contract with PVID, neither CRB, CVWD, nor staff recognizes BEP II's proposed consumptive use of Colorado River water derived from groundwater pumping as an authorized water use under any entitlement to use this water. The CRB and MWD are in agreement with staff that if wet cooling is used, the applicant should implement a verifiably effective WCOP that results in no net increase in Colorado River water use within the PVID to mitigate the project's contribution to a significant cumulative impact to the Colorado River water supply and its users.

Conservation of agricultural water through fallowing or other programs and subsequent transfer for urban use is a central tenet of California's Colorado River Water Use Plan (CRB 2000). The necessity for water transfers from irrigation to urban uses accomplished through agricultural land fallowing is evident by existing water conservation fallowing programs and contracts transferring substantial amounts of agricultural water from PVID to MWD, and from Imperial Irrigation District (IID) to San Diego County Water Authority (SDCWA), encompassing the eventual fallowing of a total of about 45,000 acres of agricultural land. Additional detail on the challenges faced by urban water agencies can be found in **SOIL AND WATER RESOURCES Appendix B – Effects on Other Colorado River Water Users**.

Staff has demonstrated that power plant cooling can be accomplished without a significant use of groundwater and can instead limit annual use to about 100 – 150 acre-feet/year using dry cooling and a zero-liquid-discharge to solids wastewater treatment system (see **SOIL AND WATER RESOURCES Appendix A**). Staff's conclusion is in consideration that the project could be sited in an alternative location where dry cooling and a zero-liquid discharge to solids system could be employed to achieve maximum conservation of water, or by using wet cooling with degraded agricultural drain water from Rannells Drain in conjunction with a verifiably effective WCOP to mitigate the project's contribution to a significant cumulative impact to the Colorado River water supply and its users. An alternative site could avoid significant adverse impacts to aviation safety which exists for both wet and dry cooling project designs. (See **Executive Summary** in the **FSA** [CEC 2005p]).

Groundwater - Cumulative Well Interference Impacts

Cumulative well interference impacts have been evaluated in terms of the effect of the proposed BEP II and BEP I, which is operational. The water supply demand of the two

projects and the well interference of the two projects is additive and is, therefore, roughly double the impact of BEP II alone.

Applicant's Analysis of Cumulative Well Interference Impacts

The applicant provided an analysis in the AFC that evaluates cumulative well interference impacts that would be caused by groundwater pumping for BEP II and BEP I combined (**SOIL AND WATER RESOURCES Table 13**). However, the applicant based this analysis on the results of BEP I's first aquifer test for project well PW-2 (BEP I 2002). The applicant's analysis included an evaluation of the impact of pumping for BEP II and BEP I at average long-term pumping rates and short-term maximum pumping 4-month summer-peak demand rates.

SOIL AND WATER RESOURCES Table 13
Results of Applicant's Well Interference Analysis of Combined Pumping for BEP II and BEP (1)

	1,000 feet	2,000 feet	Sun World Well (4,140 feet) (2)	1 mile (5,280 feet)
Long-Term Average Pumping Rate (40 years) Drawdown (feet)	5.9	5	4.2	3.8
Short-Term Maximum Pumping Rate (4 months) Drawdown (feet)	4.2	3.4	1.8	1.4

(1) Drawdown data for BEP II plus BEP I impacts: AFC, Section 7.13.2.3 and Figure
(2) Sun World Well – Identified by applicant as nearest known well.

Using a significance threshold of 5 feet drawdown on existing wells, the applicant concluded that well interference caused by BEP II and BEP I combined would have no significant adverse impact on nearby existing wells under long-term pumping conditions or short-term maximum pumping conditions.

Staff Analysis of Cumulative Well Interference Impacts

Groundwater pumping for BEP II, in addition to pumping for BEP I, would double new well interference impacts to the Palo Verde Mesa. The combined drawdown increases the potential for the project to cause damage to nearby existing well pumps. The significance criteria for pump damage caused by well interference would be the same for evaluating cumulative impacts as it would for direct impacts. Well interference from project pumping that exceeded 5 feet would cause the following three adverse impacts:

1. Under short-term maximum pumping conditions, declines in affected wells would be likely to damage pumps in existing wells near the project if these pumps have been configured to industry standards. (Even brief periods of dewatering can cause damage to water well pumps.)
2. Under average long-term pumping conditions, the productivity of affected wells would significantly decrease if the declines in groundwater levels significantly reduced the saturated interval from which the wells draw water.

3. Under average long-term pumping conditions, declines in groundwater levels in affected wells would increase the pumping lift and would correspondingly increase energy costs.

Staff evaluated the potential cumulative well interference impacts that would be caused by groundwater pumping for BEP II and BEP I combined, based on the aquifer parameters calculated by BEP I from the data from the production well aquifer field tests. Again, given the proximity of BEP I to the BEP II site, it is reasonable to assume that aquifer parameters are essentially the same at both sites. For the cumulative analysis staff considered the location of both the existing BEP I well sites and the proposed BEP II well sites. The distance from both sets of wells is listed in **SOIL AND WATER RESOURCES Table 14**, below.

SOIL AND WATER RESOURCES Table 14
Distance From BEP II and BEP I Production Wells
and Nearest Known Existing Well

Production Well	Approximate Distance from Thermal King Shop Well (feet)
BEP II PW-2	2800 (1)
BEP II PW-1	2575 (1)
BEP I PW-2	4002 (2)
BEP I PW-1	3315 (2)

(1) Based on manual map measurements using BEP II response to Round 3 Data Request 64, Figure 64-1.
(2) Based on distance given in BEP I reports, "Results of the Aquifer Test on Blythe Production Well PW-1" (6/2003) and "Results of the Aquifer Retest on Blythe Production Well PW-2" (5/2003)

Using the average of the aquifer parameters calculated by BEP I and a simple Theis equation method, staff had calculated the well interference impacts that would be caused by BEP II and BEP I pumping (1) for average long-term (40 years) drawdown and (2) for the maximum pumping rate drawdown (**SOIL AND WATER RESOURCES Table 15**).

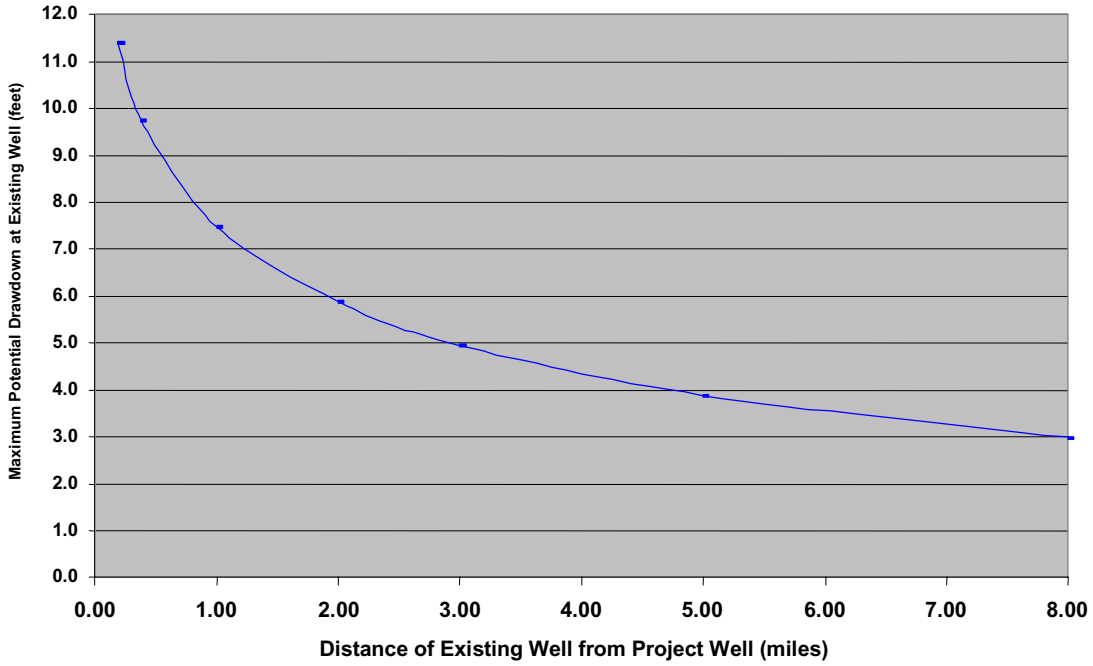
SOIL AND WATER RESOURCES Table 15
Results of Staff Well Interference Analysis
Combined Well Interference Impact of BEP II and BEP I Pumping (1)

	1000 feet	2000 feet	Thermal King Well (3170 feet) (2)	1 mile	2 miles	3 miles	8 miles
Long-Term Average Pumping Rate (40 years) Drawdown (feet)	9.2	8.1	7.3	6.5	5.3	4.6	3.0
Short-Term Maximum Pumping Rate (4 months) Drawdown (feet)	11.4	9.8	8.7	7.5	5.9	5.0	3.0

(1) BEP II - Average Pumping Rate = 2,050 gpm (3300 acre fee/year); maximum pumping rate for any four-month period = 2,898 gpm; BEP I - Average Pumping Rate = 2,040 gpm (3290 acre feet/year); maximum pumping rate for any four-month period = 2,882 gpm
(2) Thermal King Shop well – Identified by staff as nearest known existing well, located on Hobsonway, southwest of proposed project wells. The Thermal King well is about 3170 feet from the combined BEP I-BEP II well field.

SOIL AND WATER RESOURCES Figure 9

Maximum Cumulative Well Interference from BEP II and BEP I



Pump Damage

Using a significance threshold of 5 feet drawdown on existing wells, staff concludes that the BEP II project pumping would cause significant adverse impacts to wells within about 3 miles from the project site on the Palo Verde Mesa, based on a significance criterion for well interference of 5 feet drawdown.

However, wells located in the Palo Verde Valley would be excluded from this finding. Water levels in wells located in the Palo Verde Valley would not be affected because drawdown from the BEP II wells would not extend past the PVID drains and unlined canals located at the toe of the mesa. Because these drains and canals intercept groundwater, they would also provide groundwater recharge to maintain groundwater levels within valley wells.

Decline in Well Productivity

Reduction in the saturated interval from which the well draws water would also decrease the productivity of the well. However, as discussed under direct impacts, the saturated interval of most wells in the Palo Verde Mesa have been reported to be greater than 100 feet (Metzger 1973). Therefore, the decline in water levels caused by the project would cause approximately a 7-percent decline in well production rate, under worst-case conditions. For most wells, the decline in well production would be much less. Furthermore, wells would be able to compensate for small declines in the

saturated interval by a correspondingly small increase in pumping rate or pumping duration.

Therefore, staff concludes that the cumulative well interference caused by BEP II and BEP I would cause no significant adverse impact to well productivity to nearby groundwater users on the Palo Verde Mesa.

Increase in Pumping Lift Costs

As discussed under direct impacts, declines in groundwater levels caused by project well interference would cause an increase in pumping lift costs. The cost increase caused by BEP I pumping would be compounded by the construction of the addition of groundwater pumping for BEP II. The costs would be additive. The cost for small groundwater wells would remain nominal. The cost for large groundwater producers would be comparable to the addition of any large water producer on the mesa.

Therefore, staff concludes that the cumulative well interference would cause an increase in the cost of pumping lift to nearby groundwater users in the Palo Verde Mesa that would be adverse but not significant.

MITIGATION

APPLICANT PROPOSED MITIGATION

Soils

The applicant proposes to incorporate standard BMPs into the project design for construction and operation to mitigate erosion and sedimentation impacts. See additional description under Stormwater. An adequate SWPPP and DESCP will ensure that impacts are less than significant.

Groundwater

Applicant's Well Interference Mitigation Measures

The applicant has proposed an agreement to accept the Conditions of Certification Soil and Water 6 and 7 that were required for BEP I, which is related to well interference impacts (BEP II 2003, Response to Data Request 199). The applicant stated their support for conditions that included on-site aquifer testing on project production wells, calculation of well interference from the aquifer test results and reimbursement of existing well owners for impacts. Staff has proposed **SOIL and WATER 11** to ensure that well interference impacts remain less than significant.

Groundwater Quality Mitigation

The applicant has recommended the adoption of the BEP I Condition of Certification **SOIL and WATER 10**, which requires annual analyses of groundwater samples from on-site wells and reassessment of treatment requirements if significant changes in groundwater quality occur to ensure impacts remain less than significant.

Surface Water Hydrology

All non-process storm water runoff will be routed to the retention basin where it will percolate into the subsurface. An adequate SWPPP and DESCP, as required by **SOIL and WATER 1-3,** will ensure that impacts are less than significant.

Process and Sanitary Wastewater

The applicant has submitted a Waste Discharge Permit Application and a Revised Report of Waste Discharge to the Regional Water Quality Control Board (Regional Board) that generally addresses wastewater disposal. Wastewater from the proposed BEP II facility will be discharged to the project's evaporation ponds as concentrated brine un the Regional Board Waste Discharge Requirements (WDRs) permit. The evaporation ponds are designed with double containment and leak detection to limit the potential for impacts to soil and groundwater resources. Maintaining compliance with the WDRs will ensure that significant impacts to water and soil quality do not occur. See **Biological Resources Section** of the **FSA** [CEC 2005p] for a discussion of impacts to wildlife related to the use of evaporation ponds.

Stormwater

The applicant has submitted a draft construction SWPPP that generally addresses BMPs that may be used at BEP II. More site specific BMPs that will reduce erosion and sedimentation impacts and their possible impacts to surface water quality will be required in the project design for construction and operation. Measures established within the operational SWPPP regarding spill control would also protect surface water resources. Areas where there is a possibility for runoff to encounter contaminants will be collected in drains and sumps. The runoff from these portions of the site will be routed through an oil/water separator and discharged to the evaporation ponds, eliminating this potential source of polluted runoff. The applicant will be required to meet general storm water requirements of the NPDES permit.

The applicant has not provided a draft Storm Water Pollution Prevention Plan (SWPPP) or a Drainage, Erosion and Sedimentation Control Plan (DESCP) for industrial operation at the BEP II facility. However, the applicant has indicated that drains and sumps will be utilized for spill prevention and control, and that storm water runoff from process areas will be routed through an oil-water separator and discharged to the evaporation ponds (BEP II 2002a, Data Request 68). These measures are intended to minimize the potential for ground water contamination. Compliance with an adequate SWPPP and DESCP will ensure that impacts are less than significant.

STAFF PROPOSED MITIGATION

Soils

BEP II Site and Linears

Staff recommends that the applicant be required to meet general storm water requirements of the NPDES permit. As required by Colorado River Basin Regional Board Order 99-08-DWQ (Storm water during construction) and Order 5-00-175 (discharge of short duration or low threat), a Storm Water Pollution Prevention Plan

(SWPPP) would be implemented to minimize erosion from construction and operation activities (See Conditions of Certification **SOIL and WATER 1 and 3** respectively). In addition, the applicant must develop and implement a site specific Drainage, Erosion and Sedimentation Control Plan for the entire project (including ancillary facilities) that addresses standard erosion runoff and sedimentation impacts for construction, post-construction, and operational phases (See Condition of Certification **SOIL and WATER 2**). The applicant should provide a complete, site-specific Drainage, Erosion and Sedimentation Control Plan, and a complete SWPPP that includes the BEP I and II site and addresses all staff's and other agencies' concerns. The applicant must revise the draft plans to provide the following amendments and additions to the plans for the entire proposed BEP II project. The plans should include:

- The topographic features of the proposed project including areas involving all proposed pipeline construction, laydown (staging) area, transmission upgrades, and stockpile location(s). The mapping scale shall be at least 1"= 100' (1"=50' recommended). Include not less than 1000 feet of the surrounding area of the sites (topography and existing features) on the drawings.
- A construction schedule that addresses all BMP installation, maintenance and removal sequences of events from initial site mobilization to final stabilization (i.e. vegetation/asphalt) and plant operation.
- Proposed contours shall be shown tying in with existing ones. All proposed utilities including storm water facilities should be shown on the plan drawings. All erosion and sedimentation control facilities should be shown on the drawings. The drawings should contain a complete mapping symbols legend that identifies all existing and proposed features including the soil boundary and a limit of construction. The limit of construction boundary should include the project facility, pipeline areas, stockpile areas, laydown areas, and any off-site staging areas. The limit of construction boundaries ensures all work is confined to the proposed BEP II project in order to protect all surrounding areas not involved in construction or operation of the proposed project.
- Silt fencing and sandbags shall be used to trap sediment, and not as runoff conveyance facilities. Earthen berms or channels can be substituted to intercept sediment-laden runoff and direct it into the sediment retention basin/trap. A sediment trap should be used for drainage areas less than five acres and a sediment basin should be used for drainage areas greater than five acres.
- All excavated material shall be kept away from active flows. Site specific BMPs shall be included in narrative and drawing portions of the erosion and sediment control plan. The soil shall be covered via a liner or anchored mulch. Areas disturbed during construction shall be stabilized via permanent vegetation upon completion of the process.
- Appropriate Best Management Practices (BMPs) shall be employed for all project-related construction including, but not limited, to access roads, directional drilling / tunneling, linear facilities, and any off-site staging areas. All BMPs shall be shown on legible drawings of appropriate scale.
- Revegetated or landscaped areas and a description of revegetation procedures shall be included on the drawings.

- Soil stockpile management BMPs shall be included for water and wind erosion control.
- Maintenance and monitoring protocol for erosion/storm water control shall be clearly described.

Compliance with **SOIL and WATER 1, 2,** and **3** requiring an adequate SWPPP and DESCP for both construction and operational phases of the project will ensure that impacts remain less than significant.

Water Conservation Offset Plan

In the event the Commission requires a Condition of Certification addressing the BEP II WCOP, staff has included **SOIL and WATER 7** that could address the inadequacies of the proposed WCOP. Staff believes that the proposed project's contribution to a significant cumulative impact to the Colorado River water supply and its users, and potentially significant impacts related to erosion and sedimentation from the fallowed lands can be mitigated with either dry cooling, or with wet cooling using Rannells Drain water and a verifiably effective WCOP.

Groundwater

Water Conservation Offset Plan

In the event the Commission requires a Condition of Certification addressing the BEP II WCOP, staff has included **SOIL and WATER 7** that could address the inadequacies of the proposed WCOP. Staff believes that the proposed project's contribution to a significant cumulative impact to the Colorado River water supply and its users, and potentially significant impacts related to erosion and sedimentation from the fallowed lands can be mitigated with either dry cooling, or with wet cooling using Rannells Drain water and a verifiably effective WCOP.

Groundwater Quality Mitigation

Adoption of the proposed project's use of groundwater would potentially cause two significant adverse water quality impacts that can only partially be mitigated. The first is an increase in groundwater salinity from underlying brackish deposits and the second is mobilization of existing on-site groundwater contamination.

The first water quality impact, potential upwelling of brackish water from the deeper Bouse Formation into the shallower fresh water zones caused by the project's proposed use of deep, high-capacity wells, cannot be mitigated once it has occurred. If the project uses groundwater, staff does recommend that annual water quality analyses include TDS, chloride, sulfate and specific conductance, which would document changes in salinity in the immediate vicinity of the project well field. If an increase in salinity occurs, staff recommends termination of groundwater pumping, which would arrest the progression of upwelling. However, groundwater degradation that had already occurred would likely affect a large area, extending beyond the project site boundaries, and could not be reversed.

Second, to mitigate impacts causeD by groundwater contamination likely caused by dumping or spills that occurred previously near the site, staff recommends the adoption of Condition of Certification **SOIL and WATER 12** (similar to BEP I SOIL AND WATER 10), which requires annual analyses of groundwater samples from on-site wells and reassessment of treatment requirements if significant changes in groundwater quality occur. Mitigation would become necessary If any annual analysis indicates that the concentration of any contaminant found in groundwater is above its Environmental Screening Level (ESL; Table D for sites with depth to groundwater >5 meters and not a potential source of drinking water), a level determined by the San Francisco Bay Regional Water Quality Control Board to pose an insignificant risk if used or ingested (SFBRWQCB 2005).

Should ESLs be exceeded, the project would be required to either (a) prepare a human health risk assessment demonstrating that the increased level(s) of groundwater contaminant(s) pose an insignificant risk to on-site workers and the off-site public or (b) cease groundwater pumping and obtain an alternative water supply or cooling method or (c) pre-treat the groundwater sufficient to maintain contaminate levels below the ESL. Staff has proposed **SOIL and WATER 12** to provide monitoring, reporting, and mitigation of potentially impacts caused by existing on-site contamination. However, **SOIL and WATER 12** would identify but not mitigate potential impacts caused by increases in salinity to the aquifer.

To avoid both potential significant adverse impacts caused by contamination and salinity degradation to groundwater, staff recommends the use of dry cooling or the use of agricultural drain return water from PVID's Rannells Drain for wet cooling. Use of agricultural drain water for wet cooling would require an agreement with PVID to provide water to the project, which is addressed in Condition of Certification **SOIL and WATER 8.** PVID has repeatedly expressed a willingness to provide the project with water. If either dry cooling or wet cooling with agricultural drain water and a verifiably effective WCOP are adopted, no significant adverse impacts to groundwater quality would occur.

Surface Hydrology and Stormwater

As proposed, all runoff originating on the BEP II site and land upgradient of the BEP II site will be routed to the project's retention basin where it will percolate into the subsurface. A revised SWPPP/DESCP that accurately represents the storage volume required to contain the runoff produced in a 100-year design event and the sediment storage volume available in the retention basin should be submitted to the City of Blythe for review and comment and to the Energy Commission for review and approval.

The revised SWPPP/DESCP should identify sediment removal procedures including monitoring deposition within the basin and identifying appropriate sediment storage levels at which sediment removal activities would be implemented to protect the required runoff storage volume. The revised SWPPP/DESCP could include implementation of sediment forebays recommended by staff to help manage sediment removal activities at BEP II.

BEP II must comply with the general NPDES permit requirements that regulate storm water discharges. These requirements regulate storm water by establishing effluent

limitations and monitoring and reporting requirements for construction activities storm water, low-threat or short duration discharge, and the industrial activities (operational) dictated by the storm water general permit. The draft SWPPP should be revised to be site specific and comply with the guidelines provided in RWQCB's Water Quality Order 99-08-DWQ and 97-03-DWQ.

BEP II should supply all information required by the Regional Water Quality Control Board (RWQCB) and Energy Commission staff to determine compliance with the NPDES requirements for storm water discharge. This includes preparing and implementing the required construction and operational SWPPPs. Compliance with staff's recommended mitigation addressing the construction and operation phases specified under Conditions of Certification **SOIL and WATER 1, 2** and **3** respectively, and implementing proper maintenance protocols including removal of accumulated sediment and activities to maintain the percolation rates will ensure that any significant surface hydrology impacts are less than significant.

Water Resources and Infrastructure

Use of Colorado River Water

The applicant's proposed use of an evaporative cooling system will result in the consumption of approximately 3,300 acre-feet per year of Colorado River water withdrawn as groundwater. Staff has concluded that this use of water is a contribution to a significant cumulative impact to the state's Colorado River water supply and to the users dependent on it.

Water Use by Power Plants in the State

The necessity for implementing power plant water conservation measures is indicative by several trends in water use and wastewater discharge over the last decade, even predating the Energy Commission's adoption of its water use policy in 2003. Since 1996, an increasing number of new power plants have been sited in areas with limited fresh water supplies. As a result, use of limited fresh water for power plant cooling is increasing. Although water use for power plant cooling is relatively small on a statewide basis, it can cause significant impacts to local and regional water supplies. See **SOIL AND WATER RESOURCES Appendix B** for further discussion of the state's water supply issues.

Degraded surface and groundwater can be used for power plant cooling. When sufficient quantities are available, reclaimed water is a commercially viable cooling medium. Of the 7,054 MW of new cogeneration or combined cycle generated capacity permitted by the Energy Commission and brought on line in California between 1996 and December 2004, more than 1,622 MW or 23 percent is cooled using recycled water. Alternative cooling options, such as dry cooling, are also available and commercially viable, and can reduce or eliminate the need for fresh water. Two projects using dry or air cooling became operational in 1996 and 2001. A third project, Otay Mesa, using dry cooling and located in a hot and arid region in southeast San Diego County, has been permitted by the Energy Commission and is under construction.

Water quality impacts to surface water bodies, groundwater and land from waste water discharges are being increasingly controlled through use of technologies such as zero liquid discharge systems in order to meet the state's water quality standards. Of the 7,554 MW of new cogeneration or combined-cycle generating capacity permitted by the Energy Commission and brought on line in California between 1996 and March 2005, 35 percent used zero liquid discharge. More than 46 percent of the projects now under licensing review or under construction will use this technology.

Possible Alternatives to the Proposed Water Supply

In order to consider options for mitigating the significant cumulative impacts to the water supply and other users of this resource and in consideration of state water policy, staff analyzed the following water supply and cooling alternatives in detail in comparison to the proposed project as presented in Water Supply and Cooling Options Study (**SOIL AND WATER RESOURCES Appendix A**).

The Proposed Project – Use of Colorado River Water Withdrawn as Groundwater with Wet Cooling;

Alternative 1 – Reclaimed Water from City of Blythe's WWTP with Wet Cooling;

Alternative 2 – Irrigation Return Water from PVID with Wet Cooling;

Alternative 3 –Irrigation Return Water from PVID with Hybrid Cooling (1/3 Wet and 2/3 Dry);

Alternative 4 – Dry Cooling; and

Alternative 5 – Dry Cooling with a 50 MW Peaker.

Water conservation, environmental and engineering measures developed to compare the results of the alternative water supply and cooling schemes for the proposed project and site are shown in **SOIL AND WATER RESOURCES Appendix A** - **Table 8**. The following summarizes these results.

From a water conservation standpoint and in consideration of state water policy, including the Energy Commission's, dry cooling would accomplish the highest conservation of Colorado River water pumped as groundwater, reducing average annual water use from about 3,300 AFY to about 100 - 150 AFY. No new water supply infrastructure (wells, pumps or off-site pipelines) would be needed, as the minimal water supply needed to support dry cooling could be made available using the existing BEP I infrastructure.

From an environmental view, the proposed project and all alternative water supply and cooling schemes at the proposed site would result in at least one common significant adverse impact, in regard to aviation safety. (See **Executive Summary** in the **FSA** [CEC 2005p].) Staff is not further distinguishing the water supply and cooling alternatives by any other environmental measures. If the project could be sited at an alternative location, it is likely that dry cooling and a zero-liquid discharge to solids

system could be employed to achieve maximum conservation of water and avoid contributing to a significant cumulative environmental impact with regard to Colorado River water supplies and other users.

From a financial perspective, dry cooling is an economical alternative that is reasonably comparable in cost to the proposed project. When accounting for financial elements other than lost power effects from hybrid or dry cooling, all alternatives are equivalent in cost to the proposed project. Even when accounting for effects in power production, dry cooling would only result in a 0.5 – 3.5% increase in the total cost of production compared to the proposed project, which staff believes would not affect the overall economics of the project or the ability for the applicant to market its power at competitive rates.

The other option that could be used to mitigate the project's significant impacts, albeit with much less actual water conservation, is wet cooling using agricultural drain water from Rannells Drain in conjunction with a verifiably effective WCOP. Any WCOP must demonstrate in a verifiable manner the ability to conserve the same amount of water the BEP II project consumes and have no significant erosion and sedimentation impacts to the fallowed lands.

Either of these options would address significant impacts in the Soil and Water Resources technical area. However, staff cannot recommend the use of either dry or wet cooling due to aircraft safety issues associated with dry or wet cooling at the proposed project site.

Process and Sanitary Wastewater

Process Wastewater

The proposed evaporation pond design includes a double contained pond liner system with leak detection to limit the potential for impacts to soil and groundwater resources. The Regional Board issued Draft Waste Discharge Requirements for the wastewater discharge at BEP II. The Final Waste Discharge Requirements should include monitoring of solids storage levels and water storage levels in the evaporation pond, and staff has made this recommendation to the Regional Board by letter.

The applicant has proposed no back-up for the brine concentrator system. The project must be operated in a manner consistent with the Regional Board's WDRs for the evaporation pond that require that the required freeboard not be exceeded. The proposed evaporation pond has associated wildlife concerns, as discussed in the **Biological Resources Section** of the **FSA** (CEC 2005p). Staff finds that the project's compliance with both proposed **SOIL and WATER 5** and the Regional Board's WDRs will prevent significant impacts to soil, surface water, and groundwater resources related to the evaporation ponds.

Sanitary Septic System

The on-site septic system and drainfield must be designed according to applicable city and county laws in order to prevent any significant impacts to water quality. The Energy Commission CPM must receive comments from the City of Blythe's building officials on

approval of the plans. CPM approval is needed prior to the start of septic system construction activities. With compliance maintained with recommended **SOIL AND WATER 4**, no significant impacts are expected.

COMPLIANCE WITH LORS

RWQCB WDRS FOR WASTE DISCHARGE TO EVAPORATION PONDS

Draft WDRs were issued by the RWQCB based on the evaporation pond design presented in the applicant's Revised Report of Waste Discharge. The RWQCB left open the issue of compliance with State Water Resource Policy 75-58 regarding the use of groundwater from onsite wells in Finding No. 3 on page 1 of the Draft WDRs (RWQCB, 2004). Operation of the evaporation ponds in accordance with the RWQCB's WDR's are required for compliance with applicable LORS. The Condition of Certification **SOIL and WATER 5** addressing compliance with the Final WDRs for the Evaporation Pond is subject to resolution of the impact to wildlife discussed in **Biological Resources Section** of the **FSA** [CEC 2005p].

STORM WATER NPDES PERMIT

Staff does not agree with the applicant's analysis used to calculate the capacity and plan operation of the storm water retention basin. Staff will need to confirm that correct design calculations for the basin are provided to staff and to the City of Blythe for review and approval, and used in the SWPPPs required by the RWQCB and the DESCP required by the Energy Commission. The BEP II will be required to secure a Construction and General Industrial Storm Water NPDES permit from the RWQCB before beginning construction of the power plant or any related component. BEP II must comply with the NPDES requirements that regulate storm water effluent limitations, monitoring, and reporting for construction activities and for industrial (operational) activities. BEP II must supply a Notice of Intent to the SWRCB to operate under both General NPDES Storm Water Permits for Construction and Industrial Activities. The applicant must submit copies of the accepted notices for construction and operational storm water discharge prior to site mobilization and prior to operation, as specified in Conditions of Certification **SOIL and WATER 1 and 3,** respectively.

COLORADO RIVER – LAW OF THE RIVER AND THE USBR WATERMASTER AUTHORITY.

The USBR has provided several letters regarding use of Colorado River derived groundwater (USBR 2000, 2000a, 2001, 2002, 2003), and has stated that while they do have jurisdiction over this water and while they have a legal responsibility to account for it and regulate its use under the "Law of the River" discussed generally below, they were not currently doing so in a general manner, although they intend to do so in the future. At this time the USBR is not regulating other groundwater users pumping Colorado River derived groundwater either on the Palo Verde Mesa or in the valley and/or within the PVID service area, nor does it appear to have established any generally applicable contract or permit process to do so (USBR 2000a).

The Law of the River

The Colorado River is managed and operated under numerous compacts, federal laws, court decisions and decrees, contracts, and regulatory guidelines collectively known as the "Law of the River." This collection of documents apportions the water and regulates the use and management of the Colorado River among the seven basin states and Mexico. While a complex legal discussion of these laws is beyond the scope of this technical report, the principal documents comprising the Law of the River are briefly summarized below:

- **The Colorado River Compact, 1922**. The cornerstone of the "Law of the River", this Compact was negotiated by the seven Colorado River Basin states and the federal government in 1922. It defined the relationship between the upper basin states, where most of the river's water supply originates, and the lower basin states, where most of the water demands were developing. At the time, the upper basin states were concerned that plans for Hoover Dam and other water development projects in the lower basin would, under the Western water law doctrine of prior appropriation, deprive them of their ability to use the river's flows in the future. The basin was divided into an upper and lower half, with each basin having the right to develop and use 7.5 million acre-feet (MAF) of river water annually.
- **The Boulder Canyon Project Act, 1928.** This act: (1) ratified the 1922 Compact; (2) authorized the construction of Hoover Dam and related irrigation facilities in the lower Basin; (3) apportioned the lower basin's 7.5 MAF among the states of Arizona (2.8 MAF), California (4.4 MAF) and Nevada (0.3 MAF); and (4) authorized and directed the Secretary of the Interior to function as the sole contracting authority for Colorado River water use in the lower basin.
- **The Seven Party Agreement, 1931.** This agreement helped settle the long-standing conflict between California agricultural and municipal interests over Colorado River water priorities. The seven principal claimants - Palo Verde Irrigation District, Yuma Project, Imperial Irrigation District, Coachella Valley Irrigation District, Metropolitan Water District, and the City and County of San Diego - reached consensus in the amounts of water to be allocated on an annual basis to each entity. Although the agreement did not resolve all priority issues, these regulations were also incorporated in the major California water delivery contracts.
- **Treaty with Mexico, 1944.** Committed 1.5 MAF of the river's annual flow to Mexico.
- **Upper Colorado River Basin Compact of 1948.** Created the Upper Colorado River Commission and apportioned the Upper Basin's 7.5 MAF among Colorado (51.75 percent), New Mexico (11.25 percent), Utah (23 percent), and Wyoming (14 percent); the portion of Arizona that lies within the Upper Colorado Basin was also apportioned 50,000 acre-feet annually.
- **Colorado River Storage Project of 1956**. Provided a comprehensive Upper Basin-wide water resource development plan and authorized the construction of Glen Canyon, Flaming Gorge, Navajo and Curecanti dams for river

regulation and power production, as well as several projects for irrigation and other uses.

- **The Arizona v. California U.S. Supreme Court Decision of 1964.** In 1963, the Supreme Court issued a decision settling a 25-year-old dispute between Arizona and California. The dispute stemmed from Arizona's desire to build the Central Arizona Project so it could use its full Colorado River apportionment. California objected and argued that Arizona's use of water from the Gila River, a Colorado River tributary, constituted use of its Colorado River apportionment, and that it had developed a historical use of some of Arizona's apportionment, which, under the doctrine of prior appropriation, precluded Arizona from developing the project.
- **The Colorado River Basin Project Act of 1968**. This Act authorized construction of a number of water development projects in both the upper and lower basins, including the Central Arizona Project (CAP). It also made the priority of the CAP water supply subordinate to California's apportionment in times of shortage, and directed the Secretary to prepare, in consultation with the Colorado River Basin states, long-range operating criteria for the Colorado River reservoir system.

Staff believes that reasonable beneficial use of Colorado River derived groundwater can be obtained with consideration of the positions taken by the CRB, the PVID and the USBR in this matter, and in a manner consistent with both state law and water policy, and federal law. However, from the perspective of the staff representing the Energy Commission, staff has determined that the unmitigated use of any Colorado River derived groundwater will reduce the amount of water available for all junior authorized users of Colorado River water in the state, particularly MWD (including SDCWA) and CVWD, and contribute to a significant adverse cumulative impact.

It is important to recognize and to distinguish the regulations and state water policy for which the Energy Commission is responsible to review for consistency, including water conservation policies, from the somewhat unique regulations that other agencies, such as the USBR are responsible for enforcing. In this regard, it is understandable why USBR can take a position generally supporting the proposed project and the associated WCOP from the perspective of conformance with the Law of the River. Whereas, the Energy Commission is charged with making its own independent determination in a manner consistent with CEQA and applicable state and federal regulations and state water policy, including those providing guidance with respect to the beneficial use and conservation of water in the state. Therefore, staff acknowledges and respects the relative and sometimes differing positions of other parties, including the USBR, the PVID, and the CRB and the differences between state and federal law in this proceeding.

Unauthorized Use of Colorado River Water

The issue of unauthorized use of Colorado River water has been raised in both the BEP I and in the current BEP II proceedings. Unauthorized use results from Colorado River

water derived from either the mainstream or pumped as groundwater being used in the absence of either a water delivery contract with the USBR (Secretary of the Interior) in accordance with Section 5 of the Boulder Canyon Project Act, or those with pre-1928 present perfected rights resulting from the Supreme Court Supplemental Decree of 1979 and a water delivery contract with the Department of Interior (CRB 2003, Enclosure 6).

The issue of unauthorized use of Colorado River water has been an ongoing concern to the state, the CRB, and the Colorado River water rights holders it represents. In a letter to Robert Johnson of the USBR from Gerald Zimmerman of the CRB dated July, 9 2003 (CRB 2003, Enclosure 6), the CRB frames the issue as stated in excerpts from this letter as follows:

> "In this "Era of Limits", as your staff has eloquently outlined at your public workshop, and with the current water supply conditions within the Basin, the water use by valid Section 5 water contract holders is being limited. As a result, it is imperative that unauthorized uses of mainstream water within the Lower Basin be terminated. A review of the record shows that a draft Regulation for Administering Entitlements to Colorado River Water in the Lower Basin was set to be published in the *Federal Register* in November 1991."
>
> "Twelve years has now passed since the original draft Rule was proposed and it appears Reclamation is no further along in terminating these unauthorized uses of Colorado River water through issuance of a rule."
>
> "Without such a rule being in place, entities in California who hold valid Section 5 contracts to use Colorado River water are being required to limit their water use while the unauthorized users are allowed to continue their use."
>
> "This places an extreme hardship on the valid users of Colorado River water while unauthorized users are able to operate in violation of the U.S. Supreme Court decree in Arizona v. California. The legal entitlement holders should not suffer for Reclamation's lack of regulating the unauthorized use of water. To be equitable, such unauthorized use of Colorado River water should not be charged against California's annual apportionment until Reclamation has a rule in place to terminate such users and is enforcing it."

Considering the complexities of the Law of the River, the USBR's stated interpretation of its own authority and responsibilities as watermaster of the Colorado River, and the legal and water resource supply issues for both the state and its Colorado River water rights holders, staff believes the USBR has clear jurisdiction over enforcement to prevent unauthorized use of Colorado River water. However, the USBR has not generally regulated unauthorized use in the

past or currently, and does not presently have a schedule for when it will have a regulation-based enforcement procedure to apply in the future. Aside from there not being an enforcement procedure currently in place to reduce unauthorized use of the Colorado River, the USBR has stated that its LORS apply to this project, that it intends to eventually enforce the LORS, and that the applicant's proposed WCOP would be sufficient to ensure project conformance with its LORS.

The USBR, CRB, and Energy Commission staff agree that if the BEP II project uses wet cooling a WCOP is necessary to allow for authorized use and to prevent any net increase in Colorado River water use within the PVID. However, the CRB and staff require that the WCOP be verifiably effective at conserving the same amount of water the project will consume. In contrast, the USBR has somewhat less stringent requirements for the WCOP, particularly with regard to verifiable water conservation and mitigation of potentially significant erosion related impacts.

In this regard, staff believes a more stringently enforced and verifiably effective WCOP will meet the requirements of the USBR, the CRB, and Energy Commission staff. Any WCOP must be reviewed by the USBR, CRB, NRCS, PVID, staff, and approved by the Energy Commission Compliance Project Manger (CPM) prior to acceptance and implementation (see **SOIL and WATER 7**).

STATE WATER POLICY

Due to the complexity of the state and federal legal issues involved, a detailed legal analysis of the state and federal law or state water policy guiding water use in the state and its relationship to the federal Law of the River is beyond the scope of this technical report, and only a general discussion is provided below.

Article X, section 2 of the California Constitution and the state regulations derived from it, an example being Water Code Section 100, direct that the water resources of the state be put to beneficial use to the fullest extent possible and states that the waste, unreasonable use, or unreasonable method of use of water is prohibited. The State Water Resources Control Board (State Board) passed a resolution based on this direction provided by the Constitution and Water Code, that states as their policy that fresh inland waters should only be used for power plant cooling if other sources or other methods of cooling would be environmentally undesirable or economically unsound (SWRCB Resolution 75-58).

In May 2002, the Chairman of the State Board provided a letter to the Energy Commission's Siting Committee providing clarification of one important aspect of the policy, stating that "the basic principles of the policy are sound. The policy requires that the lowest quality cooling water reasonably available from both a technical and economic standpoint should be utilized as the source water for any evaporative cooling process . . ." (SWRCB 2002). The Board further states as a matter of principle, "Where the Board has jurisdiction, use of fresh inland waters for power plant cooling will be

approved by the Board only when it is demonstrated that the use of other water supply sources or other methods of cooling would be environmentally undesirable or economically unsound." This interpretation of the Board's policy by its Chairman provides a very good example of how one of the principal water agencies in the state views policy to address water use by power plants in the state.

The Warren-Alquist Act provides direction to staff, and reiterates state water policy whose intent is to conserve fresh water and use alternative sources of water:

> *"It is further the policy of the State and the intent of the Legislature to promote all feasible means of energy and water conservation and all feasible uses of alternative energy and water supply sources."*

This policy is also reflected in the Energy Commission's 2003 Integrated Energy Policy Report which states when considering the siting of power plants, that :

> *Consistent with the Board policy and the Warren-Alquist Act, the Energy Commission will approve the use of fresh water for cooling purposes by power plants which it licenses only where alternative water supply sources and alternative cooling technologies are shown to be "environmentally undesirable" or "economically unsound." Additionally, as a way to reduce the use of fresh water and to avoid discharges in keeping with the Board's policy, the Energy Commission will require zero-liquid discharge technologies unless such technologies are shown to be "environmentally undesirable" or "economically unsound." The Commission interprets "environmentally undesirable" to mean the same as having a "significant adverse environmental impact" and "economically unsound" to mean the same as "economically or otherwise infeasible."*

Thus, it is clearly the policy of the state to conserve water to the extent feasible and to promote alternative cooling options or use of degraded water sources for power plants that propose using only fresh water for cooling. When considered together, the California Constitution, regulations and policies summarized in **SOIL and WATER Table 1** provide a regulatory framework guiding water use in the state that applies to all water resources of the state, whether they are derived from surface water, groundwater, or imported water such as the Colorado River. Allowing a project to use fresh inland water simply because it is sited on a particular parcel that precludes the otherwise feasible use of dry cooling is not consistent with the intent of the State's policies on water use, especially where there are other sites that would meet the project objectives and allow the project to avoid using fresh water.

Proposed Use of Colorado River Derived Groundwater

In a manner similar to the Colorado River "Law of the River", California's surface and groundwater water laws have evolved in the courts, and the statutory body of law is not particularly extensive (Schneider 1977). The three legal classes of groundwater recognized in the state are (CERES 2004):

- Underflow of a surface stream
- Definite underground streams

- Percolating waters

Surface water rights are applied to the first two categories of groundwater, while distinct groundwater laws are applied to percolating waters which include water in underground water basins and groundwater that has escaped from streams (CERES 2004). The project's water supply is derived principally from the Colorado River surface water through pumping of groundwater from wells penetrating the Colorado River aquifer. The BEP II project groundwater cannot be classified as underflow of a surface stream or as groundwater in a known and definite underground stream, therefore it is classified as percolating waters. Although groundwater on the mesa receives virtually no recharge from percolating waters, this is the default classification when the categories under state law are considered.

Staff strongly disagrees with the applicant's contention that the USBR as watermaster of the Colorado River is the sole agency determining how and under what circumstances Colorado River water may be used in the state. All water use in the state whether derived from surface water, groundwater, or imported water such as that obtained from the Colorado River is subject to state law and policy that requires reasonable and beneficial use without waste or unreasonable use. In contrast, the USBR operating under the Law of the River has no authority to approve or allow energy projects and/or their consumptive water use that are subject to state/Energy Commission jurisdiction and/or that cause or allow unmitigated significant impacts or the waste or unreasonable use of the state's water resources in manner that conflicts with state law and policy.

Sources of Drinking Water

The groundwater derived from the Colorado River beneath the Palo Verde Mesa near the BEP II site has a TDS marginally (i.e., 920 - 1100 ppm TDS) greater than the 1000 ppm TDS categorized as "brackish" by the policy. The applicant has argued that the policy recommends this groundwater be used to cool power plants. The 1000 ppm TDS level is equivalent to the state's secondary maximum Contaminant Level (MCL) for drinking water, exceedance of which does not render such water unfit for use as drinking water or any other beneficial use. Secondary MCLs are aesthetics-based, water quality standards that are applicable to public water systems, and are set to protect odor, taste, and appearance. They do not prevent this water from being used as a source of drinking water or to satisfy other beneficial uses, which it does for those users dependent on it and who have no other source of water.

This groundwater is used for, and meets the beneficial use requirements for the definition of "Fresh Inland Waters" with regard to domestic, municipal, and agricultural water supply beneficial uses. This groundwater aquifer is a "source of drinking water" under the more recent State Board Policy 88-63, the "Sources of Drinking Water" policy for the state, and is widely used in the area for just that purpose. This groundwater is of substantially higher quality and greatly exceeds <u>any</u> of the requirements of Policy 88-63 that would qualify it to be exempted as a source of drinking water, which include:

1. Surface and ground waters where:

a. The total dissolved solids (TDS) exceed 3,000 mg/L (5,000 uS/cm, electrical conductivity) and it is not reasonably expected by Regional Boards to supply a public water system, or

b. There is contamination, either by natural processes or by human activity (unrelated to the specific pollution incident), that cannot reasonably be treated for domestic use using either Best Management Practices or best economically achievable treatment practices, or

c. The water source does not provide sufficient water to supply a single well capable of producing an average, sustained yield of 200 gallons per day.

2. Surface Waters where:

   a. The water is in systems designed or modified to collect or treat municipal or industrial wastewaters, process waters, mining wastewaters, or storm water runoff, provided that the discharge from such systems is monitored to assure compliance with all relevant water quality objectives as required by the Regional Boards; or,

   b. The water is in systems designed or modified for the primary purpose of conveying or holding agricultural drainage waters, provided that the discharge from such systems is monitored to assure compliance with all relevant water quality objectives as required by the Regional Boards.

3. Ground water where:

   a. The aquifer is regulated as a geothermal energy producing source or has been exempted administratively pursuant to 40 Code of Federal Regulations, Section 146.4 for the purpose of underground injection of fluids associated with the production of hydrocarbon or geothermal energy, provided that these fluids do not constitute a hazardous waste under 40 CFR, Section 261.3.

Staff strongly disagrees with the applicant's assertion that there is any support provided by state water policy for recommending that a source of drinking water be preferentially used for evaporative cooling of power plants, particularly when degraded agricultural drain water is readily available.

Summary

As discussed in staff's Water Supply and Cooling Option Study (**SOIL AND WATER RESOURCES Appendix A**), the use of this groundwater would clearly be inconsistent with state water policy that directs the use of lowest quality cooling water reasonably available from both a technical and economic standpoint to be used as the source water for any evaporative cooling process. Staff concludes there is adequate and much lower quality agricultural drain water available in close proximity to the project location. However, without a verifiably effective WCOP, the Colorado River water supply-related impacts associated with the use of agricultural drain water are similar to those of Colorado River water withdrawn as groundwater since they both would result in a net increase in the use of Colorado River water within the PVID.

An alternative site could avoid significant adverse impacts to aviation safety common to both dry cooling and wet cooling/Rannnells Drain/WCOP alternatives. (See **Executive Summary** of the **FSA** [CEC 2005p]).

FACILITY CLOSURE

The BEP II project is expected to operate for a minimum of 30 years. Closure options range from "mothballing," with the intent of a restart at some time, to the removal of all equipment and facilities.

The decommissioning plan will be submitted to the Energy Commission for approval prior to decommissioning. Compliance with all applicable LORS, and any local and/or regional plans will be required. The plan will address all concerns in regard to potential erosion and impacts on water quality.

RESPONSE TO COMMENTS

APPLICANT'S PSA COMMENTS

Staff has prepared the following responses to the applicant's comments to the PSA as transmitted in their letter dated April 15, 2004:

Comment 1: Water Quality Testing. Caithness Blythe II, LLC (applicant) asked staff to contact BEP I to obtain BEP I water quality testing results.

> **Staff Response:** BEP I subsequently submitted its 2003 water quality report to Energy Commission on February 16, 2004 and 2004 report to Energy Commission on February 7, 2005. Staff summarizes the results in the Water Quality subsection under Vicinity and Site Description/Groundwater.

Comment 2: Gas interconnection. Applicant clarifies that the natural gas interconnection for BEP II would be on the BEP I site, and not off-site.

> **Staff Response:** Staff has corrected its discussion of the natural gas pipeline in the Soils – Linear Facilities Section of the Analysis of Direct and Indirect Impacts.

Comment 3: Site acreage for the BEP site overall and BEP II. Applicant clarifies that the BEP site overall consists of 152 acres, and BEP II would occupy about 52 acres.

> **Staff Response:** Staff has corrected its description of the site acreage accordingly in the Soils Section of Environmental Setting.

Comment 4: Heat balances. Applicant notes the source of heat balance data is from Siemens Westinghouse, and agrees with staff that the negative temperature rise across the duct burner is not possible.

> **Staff Response:** Comment noted**;** No response necessary.

Comment 5: Water Balances and Duct Firing. In response to staff's request, applicant clarifies the duct firing capacity applicable for a typical summer condition.

> **Staff Response:** Comment noted; No response necessary.

Comment 6: Project water requirements. Applicant does not believe the main cooling tower evaporation rates are accurate as shown in PSA SOIL and WATER Resources Tables 4 and 5 in the column titled Heat Balance.

> **Staff Response:** Staff has updated the water use projections based on the applicant's revised Project Description as provided in April 2004, and as shown under the section titled Plant Water Use – Environmental Setting (BEP II, 2004).

Comment 7: Water flow data discrepancies. Applicant acknowledges discrepancies and questions how staff derives an estimate for evaporation rate.

> **Staff Response:** Staff has been able to reasonably present plant water use as shown in the section titled Plant Water Use – Environmental Setting (BEP II, 2004).

Comment 8: Number of wells, interconnection and use. Applicant clarifies that (a) the project will have 2 production wells, rather than one, and (b) that the BEP II water delivery system will be interconnected to the existing BEP water deliver system. The applicant also states that BEP II would use water from the BEP wells (and vice versus) only during emergencies and would limit use to a few days.

> **Staff Response:** Staff has revised its description of the proposed well use and interconnection between BEP I and BEP II wells in the section titled Plant Water Use – Environmental Setting.

Comment 9: Well Use. Applicant states that each project (BEP I and BEP II) will operate their own well, except in cases of emergency, which are anticipated to be a few days in duration, at most.

> **Staff Response:** Staff has revised its description of the proposed well use in the section titled Plant Water Use – Environmental Setting.

Comment 10: Routing of waste streams. Applicant clarifies that wastewater streams from the reverse osmosis unit of the water treatment plant and effluent from the oil-water separator are routed to the cooling tower.

> **Staff Response:** Staff has reflected this in the section titled Process and Sanitary Wastewater – Environmental Setting.

Comment 11: Evaporation pond design. Applicant clarifies the evaporation pond has a surface area of 6.07 acres when full and includes 2 feet of freeboard.

> **Staff Response:** Staff has reflected these dimensions of the evaporation pond in the section titled Process and Sanitary Wastewater – Environmental Setting.

Comment 12: Basis for design of the Evaporation Pond. Applicant states the chronology of correspondence with the RWQCB as to how the design and operating limits were developed for the Evaporation Pond.

Staff Response: Staff has portrayed the design development of the Evaporation Pond consistent with the applicant's description as shown in the section titled Process and Sanitary Wastewater – Analysis of Direct and Indirect Impacts.

Comment 13: Storm water drainage design. Applicant clarifies the existing stormwater retention basin collects runoff from the entire BEP site and the chronology for its design approval under BEP I.

Staff Response: Staff has described the drainage area and chronology of BEP I design approval consistent with the applicant's description as shown it the section titled Stormwater – Environmental Setting.

Comment 14: Typo. Applicant notes that division signs in the pumping lift equations were omitted.

Staff Response: Staff has corrected the pumping lift equations in the section titled Analysis of Well Interference Impacts - Analysis of Direct and Indirect Impacts.

Comment 15: Stormwater drainage area and retention basin location. Applicant clarifies the stormwater drainage area description and that the location of the retention basin is in the southern portion of the site.

Staff Response: Staff has reflected this in the section titled Stormwater – Environmental Setting.

Comment 16: Retention basin capacity. Applicant disagrees with staff's assertion that the retention basin does not have adequate capacity.

Staff Response: Staff has discussed the basis for applicant's retention basin design, the reason the basin capacity was estimated improperly by applicant, and staff's independent analysis of basin capacity and adequacy to accept the 100-year 24-hour design storm as shown in the section titled Stormwater – Analysis of Direct and Indirect Impacts. After analysis by staff, the retention basin does have adequate capacity so long as it is maintained.

Comment 17: Analysis of transmission line impacts. Applicant states there is no need to evaluate potential erosion impacts of the transmission line, because it is limited to development within the BEP site.

Staff Response: Staff will not be evaluating potential erosion impacts associated with the transmission line for BEP II, since a definitive transmission line corridor is not currently part of the project. However, staff understands that the BEP II Project as proposed does not have adequate transmission capacity. In addition, staff is addressing potential erosion and drainage impacts associated with the BEP I Transmission Line in a separate proceeding at the Energy Commission. Any transmission line(s) associated with BEP II must be fully addressed in the construction and operational SWPPPs and DESCPs, as required by proposed Conditions of Certification **SOIL and WATER 1, 2,** and **3** to ensure significant impacts do not occur.

Comment 18: SWPPP for Industrial Activity. Applicant states that they do not believe the project needs to prepare a SWPPP for Industrial Activity because it does not plan to discharge stormwater off-site.

> **Staff Response:** Staff disagrees, as the SWPPP is needed to avoid erosion and drainage impacts both on-site at BEP II, and to assure there are no impacts off-site. A SWPPP is also required to operate under the General NPDES Permits for Discharge of Stormwater. Staff also noted inadequate maintenance practices for cleanout of the stormwater collection channels and treatment of the bare ground at the BEP I site recently during its January 26, 2005 site visit, which points to the potential for significant impacts resulting from the lack of a SWPPP for Industrial Activity currently. If the BEP II Project is to be approved, staff has recommended the applicant prepare and implement a Construction SWPPP, a DESCP, and an Operational SWPPP as specified in Conditions of Certification **SOIL and WATER 1, 2** and **3,** respectively.

Comment 19: Water Supply Analysis. Applicant disagrees with staff's characterization of the project water supply and legal analysis of water law. Discussion of specific disagreements was provided in Attachment 4 to Soil and Water Comments summarized as follows:

> **Attachment 4 to Soil and Water Comments:** This discussion is subdivided into 3 sections, each containing a number of comments.
>
> Comments in Section 1 address the following issues.
>
> - **California water law and USBR policy.** The applicant asserts that staff fails to recognize California water law pertaining to groundwater and misunderstands USBR policy regarding regional use.
>
> **Staff response:** Staff addresses the applicant's position and clarifies staff's position regarding California water law and USBR policy under Cumulative impacts to the extent possible in this Technical Report.
>
> Comments in Section 2 address the following issues.
>
> - **Colorado River groundwater.** The applicant objects to the term "Colorado River groundwater."
>
> **Staff response:** Although staff defined its use of this term in the PSA consistent with the Law of the River, depending on the discussion, various terms such as "Colorado River water withdrawn as groundwater" and "Colorado River derived groundwater" may be used interchangeably.
>
> - **River depletion and groundwater drawdown.** The applicant states "the PSA Soil and Water Resources analysis prepared by staff is inaccurate as it is based upon …assertion in one section that all pumped water will directly deplete the

surface waters in the Colorado River, while claiming in another section that pumping will draw groundwater levels down."

Staff response: Staff explains the hydrologic process by which project pumping would cause groundwater drawdown and depletion in the flows of the Colorado River in the sections titled Groundwater and Water Resources and Infrastructure under both Environmental Setting and Analysis of Direct and Indirect Impacts.

- **Confusion regarding staff's description of groundwater conditions.** The applicant expresses confusion in the statement, "staff also explains irrigation waste in the valley flows west to recharge the aquifer wile simultaneously the aquifer flows east to recharge the surface water drains, and despite all this movement and implied direct connectivity, the groundwater aquifer has not fully recovered more than a decade later from agricultural groundwater pumping on the mesa that occurred in the 1970's and 1980's."

  Staff response:

  (a) Staff clarifies the factors that determine the direction of groundwater flow in the Groundwater Elevations and Direction of Groundwater Flow subsection under Environmental Setting/Groundwater Regional Description and Groundwater Description in the BEP Vicinity. This subsection explains how wells and drains cause localized changes in the regional direction of groundwater flow.

  (b) Staff clarifies that the aquifer system beneath the Palo Verde Valley and Mesa is most definitely hydrologically continuous and provides references to USGS investigations that describe the system in subsections Formation of the Groundwater System, Structure and Hydrogeologic Units of the Groundwater System, and Groundwater Recharge and the Hydrology of the Groundwater System under Environmental Setting/Groundwater Regional Description.

  (c) Staff researched the question of groundwater recovery on the mesa and has determined that recent groundwater level measurements indicate that groundwater levels in the mesa have largely recovered to 1964 levels, except near areas of significant, ongoing groundwater use. Staff clarifies the question of groundwater recovery in the Groundwater Elevations and Direction of Groundwater Flow subsection under Environmental Setting/Groundwater Regional Description.

- **Rate of surface water response to BEP II pumping.** The applicant asserts that the effect of BEP II pumping on Colorado River flows should not be considered because it has been "clearly shown" that it would take years or decades for BEP II pumping induce recharge from surface waters in the Palo Verde Valley.

  Staff response: Staff disagrees with the applicant's assertion. Staff performed an analysis of the recharge response to pumping that would occur for the BEP II project. BEP II pumping would begin to induce recharge from PVID's Rannells

Drain in less than a week at the average anticipated pumping rate. A description of the analysis and results are provided in the Analysis of Direct and Indirect Impacts under Water Resources and Infrastructure - Water Supply and Use in PVID's Service Area.

Comments in Section 3 address the following issues.

- **SWRCB Policy 75-58.** The applicant asserts that staff misinterpreted and misapplied SWRCB Policy 75-58.

  Staff response: Staff disagrees with the applicant's position on the project's use of groundwater. Staff provides clarification on its position with regards to SWRCB Policy 75-58 and Energy Commission 2003 Integrated Energy Policy Report (IEPR)'s Water Policy under the State Water Policy.

Comment 20: Stormwater Retention basin design. Applicant states the retention basin design was already approved under BEP I and it is not necessary to provide an emergency spillway.

Staff Response: Staff disagrees that the retention basin was properly designed and continues to assert the need for an emergency spillway. Staff has performed an independent analysis of the retention basin, and has identified additional capacity in its as-built configuration as well as features that will serve as an emergency spillway. Staff's analysis is provided in the section titled Stormwater – Analysis of Direct and Indirect Impacts.

Comment 21: Analysis of alternative water supplies and cooling methods. Applicant states it disagrees with staff's analysis.

Staff Response: Staff has updated its Analysis of Water Supply and Cooling Options as shown in **SOIL AND WATER RESOURCES Appendix A**, and continues to conclude the proposed project has associated unmitigated significant cumulative impacts to the state's Colorado River water supply and it's users, and is not consistent with state water policy. Dry Cooling, as demonstrated in staff's analysis, is an economical and environmentally sound alternative that avoids these impacts to water resources, and wet cooling using agricultural drain water from Rannals Drain in conjunction with a verifiably effective WCOP would also prevent a net increase in Colorado River water use within the PVID. Both of these alternatives are subject to resolution/mitigation of aircraft safety issues.

PVID'S PSA COMMENTS

Staff has prepared the following responses to PVID's letter dated December 19, 2003 offering comments to the PSA. Staff will prepare responses to PVID's letter (PVID 2005a) dated May 27, 2005, prior to hearings.

Comment #1: PVID's Water Rights - PVID has the water right to beneficially use Colorado River water on 16,000 acres on the Palo Verde Mesa area. We do not consider the proposed use of 3,300 AF of Colorado River water a significant impact.

We should be able to use this water for the good and betterment of this area instead of losing its use to other areas. Other districts in California and Arizona are able to use Colorado River water for power plant cooling, so we should be able to also.

Staff Response: Energy Commission staff does not dispute either PVID's water rights or its entitlements to beneficially use water within its district. The determination of whether the proposed BEP II use of Colorado River derived groundwater for primarily cooling water would result in a contribution to a significant cumulative impact to regional water supplies is a responsibility of the Energy Commission under its Power Plant Siting Regulations as CEQA lead agency. Staff has reflected PVID's position that it does not consider the proposed project to cause a significant impact to PVID's water supplies, which is reflected in several sections of the **FSA** (CEC 2005) and this Technical Report.

Comment 2: WCOP. PVID does not believe a WCOP is necessary.

Staff Response: While staff recognizes PVID's right to serve its customers subject to other LORS for powerplant water use, the WCOP is a project component that the applicant proposed, the USBR apparently now requires, and is a key component of both the proposed project and the wet cooling alternative using Rannells Drain water. If the Energy Commission adopts staff's recommendation for dry cooling, a WCOP may not be necessary for Energy Commission purposes, but may still be necessary if the USBR requires it.

Comment 3: Impact to PVID's Water Supplies. PVID does not consider BEP II's proposed use of PVID's water to cause a significant direct impact to its water supply.

Staff Response: Staff has revised its position so as to no longer characterize BEP II's proposed use of PVID's water supply as a significant direct impact to PVID's water supply.

Comment 4: Impact to Agricultural Economy. PVID does not believe that implementation of the WCOP would cause a significant impact to the agricultural economy.

Staff Response: This issue is addressed in the **Socioeconomic Resources Section** of the FSA (CEC 2005p).

Comment 5: PVID's Water Rights. See Comment 1.

Staff Response: See Staff Response to Comment 1.

Comment 6: Minority Population. PVID suggests that a minority population of 59.29% should be considered a majority.

Staff Response: Please see the **Socioeconomic Resources Section.**

Comment 7: Mesa irrigated acreage. PVID provides correction to irrigation acreage for the mesa. PVID also provides information regarding municipal pumping by the City

of Blythe. In addition, PVID subsequently provided extensive data to the Energy Commission describing historical irrigation data for the mesa (PVID, 2004)

Staff Response: Staff revises statements regarding irrigated acreage on the mesa and adds information on pumping by the City of Blythe, according to the data provided by PVID, in the section on Water Resources and Infrastructure – Environmental Setting.

Comment #8: PVID's Water Rights. See Comment #1

Staff Response: See Response #1.

Comment #9: PVID's Water Rights. See Comment #1

Staff Response: See Response #1.

Comment #10: Priority of Use - "The use of Colorado River water pumped as groundwater has been found to be inconsistent … be conserved for the highest beneficial use." This should be for all waters in the state, not just groundwater that may be classified as Colorado River water. As far as we know, there has been no determination as to ranking of the various beneficial uses. Please send me a copy of that and their basis for the ranking of the various beneficial uses.

Staff Response: The **SOIL AND WATER RESOURCES Appendix B** is intended to address the proposed BEP II Project's use of Colorado River derived groundwater, not general use of water in the state. There are several references addressing the hierarchy of beneficial uses of the state's waters or the requirement to conserve water whenever reasonable. The primary references are as follows:

a. State Constitution Article X, Section 2 –-"… the water resources of the state be put to beneficial use to the fullest extent of which they are capable, and that the waste or unreasonable use or unreasonable method of use of water be prevented, and that the conservation of such waters is to be exercised with a view to the reasonable and beneficial use thereof in the interest of the people and for the public welfare."
b. Water Code 1254 – Provides an example of how the SWRCB uses the following guidance in its water rights appropriation process: "In acting upon applications to appropriate water the board shall be guided by the policy that domestic use is the highest use and irrigation is the next highest use of water."
c. SWRCB Resolution 75-58 – With respect to using fresh water, the Resolution articulates an underlying policy "to protect beneficial uses of the state's water resources and to keep the consumptive use of freshwater for power plant cooling to that minimally essential for the welfare of the citizens of the state." The Board further states as a matter of principal. "Where the Board has jurisdiction, use of fresh inland waters for power plant cooling will be approved by the Board only when it is demonstrated that the use of other water supply sources or other methods of cooling would be environmentally undesirable or economically unsound."

d. Warren-Alquist Act - "It is further the policy of the State and the intent of the Legislature to promote all feasible means of energy and water conservation and all feasible uses of alternative energy and water supply sources."

e. 2003 Integrated Energy Policy Report's Water Policy – See Response #1

Comment 11: Groundwater recharge. PVID states that staff's description on groundwater recharge is misleading, referring to staff's statement, "Colorado River filled the valley sediments through lateral underground flow from the river channel and from vertical percolation to the groundwater system during periodic overbank flooding." PVID states that the valley is recharge by irrigation water diverted from the Colorado River, rather than from direct recharge from the Colorado River. Irrigation water raised groundwater levels not underflow from the Colorado River.

Staff Response: Staff clarifies in this Technical Report that the above statement regarding groundwater recharge refers to conditions prior to the arrival of man. Staff agrees with PVID that since the advent of irrigation, irrigation water derived from the Colorado River has become the primary source of groundwater recharge. Clarification is provided in the section entitled Groundwater Recharge and the Hydrology of the Groundwater System section under Environmental Setting/Regional Description/Groundwater.

Comment 12: Groundwater recharge. Comment 12 is similar to the previous comment. PVID states that irrigation water diverted from the Colorado River is the primary source of recharge to the mesa and valley, rather than from lateral flow from the Colorado River. Correspondingly, recharge from irrigation determines the direction of groundwater flow, and recharge to mesa wells comes from PVID irrigation, canals and drains.

Staff Response. Staff response is the same as for Comment 11. Staff agrees with PVID and clarifies meaning of PSA descriptions in the section entitled Groundwater Recharge and the Hydrology of the Groundwater System, under Environmental Setting/Regional Description/Groundwater.

Comment 13: Mesa irrigated acreage. PVID provides correction to irrigation acreage for the mesa. In addition, PVID subsequently provided extensive data to the Energy Commission describing historical irrigation data for the mesa (PVID 2004)

Staff Response: Staff revises statements regarding irrigated acreage on the mesa, according to the data provided by PVID, in the section on Water Resources and Infrastructure.

Comment 14: Recharge to Chuckwalla Valley. PVID states that "The prisons in Chuckwalla Valley about 11 miles west of the Palo Verde Valley are currently pumping groundwater that is higher in elevation that the proposed USGS accounting surface elevations. PVID questions USGS findings cited by staff that "groundwater recharge from the river extends…into the Chuckwalla Valley (Wilson, 1994)."

Staff Response: As in the text cited in Comments 11 and 12, the PSA was referring to the initial formation and filling of the Colorado River aquifer system, based on USGS isotopic studies. However, a discussion of the origins of stored groundwater in the Chuckwalla Basin is not an essential point for the staff's assessment of project impact, so, rather than clarifying the topic, it was simply deleted from this Technical Report.

Comment 15: Mesa irrigated acreage. PVID provides correction to irrigation acreage for the mesa. In addition, PVID subsequently provided extensive data to the Energy Commission describing historical irrigation data for the mesa (PVID 2004)

Staff Response: Staff revises statements regarding irrigated acreage on the mesa, according to the data provided by PVID, in the section on Water Resources and Infrastructure.

Comment 16: Source of recharge to BEP II wells. PVID's asserts that its drain at the toe of mesa would be a source of recharge to the BEP II wells.

Staff Response: Staff agrees with PVID's statement. The section entitled Supply under Project Water Supply reflects this assessment.

Comment 17: Mesa irrigated acreage. PVID provides correction to irrigation acreage for the mesa. In addition, PVID subsequently provided extensive data to the Energy Commission describing historical irrigation data for the mesa (PVID, 2004)

Staff Response: Staff revises statements regarding irrigated acreage on the mesa, according to the data provided by PVID, in the section on Water Resources and Infrastructure.

Comment #18: PVID's water rights. It should be stated somewhere herein that the Blythe Energy project lies within PVID's boundaries. PVID's #3 Priority to use Colorado River water is not quantified and applies to 16,000 acres on the mesa. The power plant can use this water the same as an adjacent farmer. This use would be accounted for in PVID's use by having less return water in the "Diversion less Return" method of accounting for PVID's use. Steps would need to be taken so that if this water is used, it would not be counted twice.

Staff Response: Staff agrees that the proposed BEP II is located in PVID's boundaries, and will assure that this fact is clearly indicated in appropriate sections of the **FSA** (CEC 2005) and this Technical Report. However, a power plant is subject to the Energy Commission's licensing process, and different regulations may apply compared to agriculture, such as those noted above in Response #'s 1 and 10.

Comment #19: PVID's water rights. Finish the paragraph with Comment #18.

Staff Response: See Response #18;

Comment #20: BEP II's Proposed Use of Water. Since Blythe II is in the PVID, it has a right to use Colorado River water. The phrase "unauthorized use" should be deleted. See Comments #1 and #2.

> **Staff Response:** The right for BEP II to use PVID's water is not governed solely by PVID's willingness to allow such use, but is also subject to a host of other state regulations and policies because BEP II is a power plant. The phrase "potentially unauthorized use" is expressed from the perspective of other water contract holders along the Colorado River, as indicated in the Colorado River Board's (CRB's) letter to the Energy Commission dated September 11, 2003 and Coachella Valley Water District's letter to the Energy Commission dated October 23, 2003.

Comment #21: BEP II's Proposed Use of Water. See Comment #2. Blythe Energy II lies in PVID, has access to PVID's #3 Priority to use Colorado River water, therefore no mitigation should be required

> **Staff Response:** The right for BEP II to use PVID's water is not governed solely by PVID's willingness to allow such use, but is also subject to a host of other state regulations and policies because BEP II is a power plant.

Comment #22: PVID's water rights. Blythe Energy Plant Phase I is in PVID and has access to PVID's #3 Priority for use of Colorado River water on the mesa. See Comment #1. We don't feel PVID should be singled out and excluded from this usage.

> **Staff Response:** – See response to Comment #'s 1 and 10.

Comment #23: PVID Impacts. PVID does not feel this is an unauthorized use. If the courts decide it is an unauthorized use, PVID knows of no statements that allows mitigation of an unauthorized use to become an authorized use. PVID's use is not quantified, so delete phrase 'represents water that would be unavailable to the PVID and its water users."

> **Staff Response:** In using the phrase "unauthorized use", Energy Commission staff is merely using terminology consistent with that of the Colorado River Board (CRB) as indicated in their letter to the Energy Commission dated September 11, 2003. The Energy Commission will clarify that this perspective is not that of PVID's, but appears to be the view of other water contract holders along the Colorado River. The CRB also characterizes in their letter to the Energy Commission in Paragraph 8 that "A water conservation offset program could be used to mitigate impacts of unauthorized use on the condition that it be acceptable to Reclamation and junior water right holders." Staff has not attempted to resolve this issue for the purposes of this assessment.

Comment #24: Beneficial Use. For PVID to supply water to Blythe Energy 1 and 2, the USBR must agree such a water use is a beneficial use. Since Colorado River water is already being used in other districts in California and Arizona for cooling towers, PVID should be treated no differently.

Staff Response: In addition to the USBR's determination of whether the proposed BEP II project's use of Colorado River derived groundwater is an authorized use within PVID's service area, the Energy Commission must apply its own power plant siting regulations for determining conformance with LORS, consider the guidance provided by state water policy, and must weigh the significance of potential impacts under CEQA.

Comment #25: Use of Colorado River water The 3,300 acre-feet per year of Colorado River water is going to be used somewhere in southern California. Is it going to be used in the Blythe area or in Los Angeles is the question.

Staff Response: Comment noted.

Comment #26: PVID's water rights. PVID's entitlement is for an unquantified amount of water for beneficial use on 104,500 acres in the valley and 16,000 acres on the mesa. If we supplied water in any manner, our use would increase which is acceptable to PVID. The state's entitlement to 4.4 million acre-feet remains unchanged. Other districts are currently using Colorado River water for cooling towers. This use has been accepted and approved by USBR and our contract should allow the same.

Staff Response: The USBR is not the only approving regulatory agency for Colorado River water use associated with power plant siting in California. The Energy Commission must apply its own power plant siting regulations for determination of consistency with LORS, consider the guidance provided by state water policy, and must weigh the significance of potential impacts under CEQA.

Comment #27: PVID's water rights. See Comment #1, #3;

Staff Response: See Response #'s 1 and 3;

Comment #28: See Comment #1, #3;

Staff Response: See Response #'s 1 and 3;

Comment #29: Beneficial Use. See Comment #20; Mitigation should not be needed for such an insignificant volume of water.

Staff Response: Energy Commission staff does not consider 3,300 acre-feet/year, or nearly 100,000 acre-feet over the 30-year lifetime of the project to be an insignificant volume of water. State water policy directs that all water use in the state must be reasonable and beneficial. Use of this volume of water for power plant cooling can be avoided if dry cooling is found by the Energy Commission to be environmentally desirable and economically sound. A less conservative approach that would at least result in no net increase of Colorado River water within the PVID is wet cooling with Rannells Drain water and a verifiably effective WCOP.

COLORADO RIVER BOARD'S PSA COMMENTS

Comment 1: Current status of the Colorado River water supply. The Colorado River Board of California (CRB) summarizes conditions that have caused or demonstrate the current water shortage in the Colorado River supply for California.

> **Staff Response:** Staff agrees with CRB's assessment of California's Colorado River supply shortage. The information provided by CRB is discussed in the section titled Cumulative Impacts to the state's Colorado River Water Supply.

Comment 2: Valid water contract required for BEP II pumping. The CRB asserts that BEP II pumping would occur within the USBR/USGS accounting surface of the Colorado River system. Therefore, proposed groundwater pumping by BEP II requires a valid water contract from the Secretary of the Interior, according to the US Supreme Court Decree of 1964.

> **Staff Response:** Staff agrees with CRB's conclusion that BEP II would require a valid water contract from the Secretary of the Interior to pump groundwater at the project site, or a water service agreement from an entity that has such a contract already with USBR, such as PVID. The information provided by CRB is discussed in the section titled Cumulative Impacts to the state's Colorado River Water Supply.

Comment 3: Lower Colorado Water Supply Project. The CRB provides a description of the development and purpose of the Lower Colorado Water Supply Project, explaining that this project was created to provide a water supply to California entities in the Colorado River basin, including industrial users, who lack Colorado River water rights.

> **Staff Response:** Staff has analyzed the potential for BEP II's use of water from the Lower Colorado Water Supply Project as an alternative source of water as discussed in **SOIL AND WATER RESOURCES Appendix A** – Water Supply and Cooling Options. The eligible beneficiaries are limited to persons or agencies whose lands or interests in lands are located adjacent to the Colorado River in California within the accounting surface, who do not hold rights to Colorado River water or whose rights are insufficient to meet their present or anticipated future needs. Because the proposed project is located in PVID's service area, and they indeed hold sufficient rights to Colorado River water to serve BEP II subject to consideration of statewide impacts and LORS, BEP II would not appear to be eligible for the Lower Colorado Water Supply Project.

Comment 4: Impact of unauthorized use. CRB discusses the impact of unauthorized groundwater use on the state's water supply for authorized users of the Colorado River. CRB reports that for 2003, the water supply for authorized users was reduced by the amount of water used by unauthorized users, as quantified by USBR to be about 6,600 AF.

> **Staff Response:** Staff has noted CRB's observation of the impact of unauthorized use on those who are authorized users, and this is included in the discussion of Cumulative Impacts to the state's Colorado River Water Supply.

Comment 5: Impact to MET and Coachella. CRB discusses the impact of unauthorized water use on Metropolitan Water District (MWD) and the Coachella Valley Water District (CVWD).

> **Staff Response:** Staff notes that both MWD and CVWD were among the authorized users affected by unauthorized use of Colorado River water in the **SOIL AND WATER RESOURCES Appendix B** which describes the state's Colorado River Water Supply in greater detail.

Comment 6: Quantification of Unauthorized Groundwater use. The CRB discusses the USBR's current assessment of unauthorized groundwater use.

> **Staff Response: See response to Comment 4.**

Comment 7: Lower Colorado Water Supply Project. The CRB describes the subscription status of the Lower Colorado Water Supply Project.

> **Staff Response:** Staff does not consider BEP II eligible for the Lower Colorado Water Supply Project because BEP II would reside within PVID's service area. See response to Comment 3.

Comment 8: Water conservation offset program (WCOP). CRB states that a WCOP could mitigate impacts of unauthorized use if it were acceptable to both the USBR and junior water rights holders and if the water savings were not illusory.

> **Staff Response**: Staff recognizes and agrees with the CRB's position on the BEP II WCOP as discussed in Cumulative Impacts to the state's Colorado River Water Supply.

Comment 9: WCOP Validation and PVID position on WCOP. CRB states that a WCOP must result in actual water conservation and must be verifiable. CRB also notes that PVID takes the position that BEP II is not an unauthorized water user since the project is located with the District's service area, and that the District's water right would cover service to the project. CRB notes that other Colorado River water contract holders disagree with the position of PVID on this issue.

> **Staff Response**: Staff is in complete agreement that any WCOP must be verifiably effective and have no unmitigated significant impacts. Staff has summarized the CRB's comments regarding the WCOP, and has noted PVID's and CVWD's views as to whether or not the proposed use of Colorado River water withdrawn as groundwater for supply to BEP II would be considered an authorized use of Colorado River water. (See Cumulative Impacts to the State's Colorado River Water Supply). Although staff supports PVID's authority to determine who it may serve within its water service area, staff observes that there is no service agreement at this time formalizing the applicant as a potential customer of PVID, and thus an authorized user of PVID's water rights, i.e., the PVID does not exercise any control over the BEP II project's use of Colorado River derived groundwater within its service area.

Furthermore, in considering the state water policy applicable to evaluating water use for the proposed power plant, staff has determined dry cooling, as demonstrated in the Water Supply and Cooling Options Study or wet cooling with Rannells Drain water in conjunction with a verifiably effective WCOP (**SOIL AND WATER RESOURCES Appendix A**), are economical and environmentally sound alternatives that avoid the cumulative impacts to the state's Colorado River water supplies and would be consistent with state water policy. However, staff's conclusion is in consideration that the project could be sited at an alternative location where dry cooling and a zero-liquid discharge to solids system could be employed to achieve maximum conservation of water and avoid contributing to a significant cumulative environmental impact. An alternative site could avoid significant adverse impacts to aviation safety, which is common with any water supply and cooling scheme associated with the proposed project site. (See **Executive Summary** in the **FSA** [CEC 2005p]).

DIFFERENCES BETWEEN BLYTHE I AND BLYTHE II

Although the Energy Commission licensed the BEP I project in 2001 to use Colorado River water withdrawn as groundwater, the following evolution of information and events has occurred since the BEP I certification that substantially changes some of the physical and regulatory conditions and assumptions affecting the licensing of the proposed BEP II project. These are listed as follows:

1. The USBR's abrupt suspension of surplus Colorado River water deliveries to the state on January 1, 2003 immediately cut California from an annual use of about 5.2 – 5.4 million acre-feet per year down to 4.4 million acre-feet per year. The reduction had an immediate effect on the entities that hold the more junior water entitlements to Colorado River water in the state, particularly MWD (including SDCWA) and CVWD.
2. As a result of reductions in the state's allocation of Colorado River water, the member agencies within the districts of MWD and SDCWA are having to rely on significant conservation measures and transfers of agricultural water that are leading to the fallowing of over 40,000 acres of agricultural lands within IID's and PVID's service areas in order to meet water supply needs.
3. The certainty of available supplies, including surplus water in the relative short-term, for meeting the needs of entities having entitlements to Colorado River water has improved as a result of the Quantification Settlement Agreement entered into by MWD, IID and CVWD, and the Water Delivery Agreement entered into between these entities and the Secretary of the Department of Interior as approved by Interior on October 10, 2003.
4. The states vulnerability to water shortages during drought years, particularly in Southern California, is extreme. Based on DWR's State Water Project (SWP) Delivery Reliability Report, if conditions similar to 1977 were to repeat, SWP deliveries are projected to be about 20 percent of the primary contractual amount of supply (DWR 2002c).

5. The BEP II project reduces the amount of Colorado River water available to the state by 3,300 acre-feet per year, and by nearly 100,000 acre-feet over the 30-year life of the project. The cumulative effects for both BEP I and BEP II's proposed water use would double these amounts.
6. A better understanding of the Colorado River surface water–groundwater system, particularly within the PVID service area, leads us to conclude that BEP II's unmitigated use of Colorado River water withdrawn as groundwater would contribute to a significant cumulative impact to the state's Colorado River water supply.
7. Staff and the Commission did not have the benefit of a Water Supply and Cooling Options Study for BEP I, as they do for BEP II (see **SOIL AND WATER RESOURCES Appendix A**) to support the feasibility of dry cooling and wet cooling with Rannalls Drain water in conjunction with a verifiably effective WCOP in the Blythe environment as mitigation for the project's water use and to provide consistency with state water policy.
8. The Commission has since adopted the 2003 Integrated Energy Policy Report, that reiterates the state's policy to allow the use of fresh water for power plant cooling only where alternatives are environmentally undesirable or economically unsound.
9. California power projects utilizing dry cooling are now either currently operating (Sutter and Crockett) or under construction (Otay Mesa) and are/will be competing in the same merchant power market as BEP II.

CONCLUSIONS AND RECOMMENDATIONS

Staff's conclusions and recommendations are in recognition that there is an unmitigated significant adverse impact to aviation safety common to the proposed project and any alternative water supply and cooling method considered at the proposed BEP II site. Therefore, implementing staff's recommendations for mitigating potentially significant adverse impacts to soil and water resources may also be subject to mitigating aviation safety impacts as well as potential significant adverse impacts associated with other resources and unique to a particular alternative water supply and cooling method analyzed.

1. BEP II's proposed groundwater pumping would likely cause two significant adverse impacts to groundwater quality. First, the project's proposed use of deep, high-capacity wells on the mesa would likely cause some degree of upwelling of brackish water from the deeper Bouse Formation into the shallower fresh water zones, irreversibly impacting the quality of the groundwater supply for all uses on the Palo Verde mesa. Second, low levels of hazardous chemicals in groundwater were detected on the BEP I property. Based on the potential for concentration and volatilization of these chemicals, the BEP I Final Decision adopted a condition requiring annual groundwater monitoring. Given proximity of the BEP II project wells to BEP I, the same potential would exist for BEP II.
2. The potential, irreversible significant adverse impact to groundwater quality can be avoided by BEP II avoiding groundwater pumping and using dry-cooling, or mitigated by utilizing as its water supply agricultural drain water from PVID's Rannells Drain, or equivalent with wet cooling and a verifiably effective WCOP.

3. PVID's sole source of water supply is from the Colorado River, according to its entitlement as specified under contract with U.S. Bureau of Reclamation (USBR). PVID's water use is accounted for by its diversion from the Colorado River less agricultural drain water returned to the Colorado River. The groundwater wells proposed by BEP II would yield water that would be replaced by Colorado River water. Project pumping would induce groundwater recharge from PVID's Rannells Drain, reducing PVID's return flows to the Colorado River.
4. BEP II's proposed use of Colorado River water derived from groundwater, as well as the alternative for the project to use agricultural return water from Rannells Drain, could cause potentially significant cumulative impacts to other users of the state's Colorado River water supply. The unmitigated use of either water supply could effectively reduce the amount of Colorado River water available to the state. This would effectively reduce Colorado River supplies to Coachella Valley Water District (CVWD) and Metropolitan Water District (MWD) resulting from increasing the quantity of water consumed within PVID's service area attributable to BEP II.
5. BEP II's implementation of dry cooling, or wet cooling using agricultural drain water together with a verifiably effective Water Conservation Offset Plan (WCOP), could mitigate the potentially significant cumulative impact to other users of the state's Colorado River water supply by avoiding any net increase in consumptive water use within PVID's service area attributable to BEP II.
6. Consistent with state water policy, BEP II's use of agricultural drain return water from Rannells Drain, or equivalent, would utilize the most degraded source of water supply reasonably available to the project.
7. Dry cooling and a zero-liquid discharge to solids system would achieve the maximum conservation of water compared to the proposed project and other alternatives. Dry cooling would reduce annual water use from 3,300 acre-feet/year to about 100 – 150 acre-feet/year, and avoid the need for a WCOP, which has associated potentially significant adverse impacts resulting from land fallowing due to soil erosion if not properly implemented.
8. The proposed use of Colorado River derived groundwater by the BEP II project would not be recognized under a legal entitlement to Colorado River water from the perspective of the Colorado River Board (CRB), since there would not be a water supply agreement with PVID who serves as the local purveyor with legal entitlement to Colorado River water. CRB feels that a verifiably effective WCOP could address its concerns if it were to result in no net increase in Colorado River water use within the PVID attributable to the project.
9. The alternative use of Colorado River water derived from PVID's Rannells Drain could be recognized under a legal entitlement from the perspective of CRB because BEP II's water supply would be secured under a water supply agreement with PVID, and would be accounted for directly rather than indirectly as will be the case with groundwater pumping.
10. California's Colorado River Water Use Plan (CRB 2000), a constantly evolving effort to end the state's dependence on surplus river flows and reduce consumption to it's allocation of 4.4 million acre-feet per year as amicably and fairly as possible, has as a principal tenet "…core cooperative water conservation/transfers from agricultural to urban use …" (CRB 2000). The project's unmitigated use of this

same water supply would unnecessarily further reduce the volume of agricultural water available for transfer.

11. Staff recommends that BEP II use either dry cooling or wet cooling with agricultural drain water from Rannells Drain, or equivalent, in conjunction with a verifiably effective WCOP. However, staff can not recommend approval of the BEP II project either as proposed or with either these cooling alternatives at the proposed site due to aviation safety concerns.

PROPOSED CONDITIONS OF CERTIFICATION

Staff recommends the following Conditions of Certification subject to resolution and mitigation of various outstanding significant adverse impacts, including aircraft safety, wildlife, and transmission capacity. In order to provide information on how the various recommended alternatives would be addressed, Conditions of Certification have been developed for various project configurations as noted.

SOIL and WATER 1: The project owner shall comply with the requirements of the General National Pollutant Discharge Elimination System (NPDES) Permit for Discharges of Storm Water Associated with Construction Activity. The project owner shall develop and implement a Storm Water Pollution Prevention Plan for the construction of the entire Blythe Energy Project II (BEP II) project (construction SWPPP).

Verification: The project owner shall submit copies to the CPM of all correspondence between the project owner and the RWQCB about the General NPDES permit for the Discharge of Storm Water Associated with Construction Activities within 10 days of its receipt (when the project owner receives correspondence from the RWQCB) or within 10 days of its mailing (when the project owner sends correspondence to the RWQCB). This information shall include copies of the Notice of Intent and Notice of Termination for the project.

SOIL and WATER 2: Prior to site mobilization, the project owner shall obtain CPM approval for a site-specific Drainage, Erosion and Sedimentation Control Plan (DESCP) that ensures protection of water quality and soil resources of the project site and all linear facilities for both the construction and operations phases of the project. This plan shall address appropriate methods and actions, both temporary and permanent, for the protection of water quality and soil resources, demonstrate no increase in off-site flooding potential, meet local requirements, and identify all monitoring and maintenance activities. Monitoring activities shall include routine measurement of the volume of accumulated sediment in the stormwater retention basin. Maintenance activities must include removal of accumulated sediment from the retention basin when an average depth of 0.5 feet of sediment has accumulated in the retention basin. The plan shall be consistent with the grading and drainage plan as required by **Condition of Certification CIVIL-1** and may incorporate by reference any SWPPP developed in conjunction with any NPDES permit. The DESCP shall contain the following elements:

- ***Vicinity Map*** – A map shall be provided indicating the location of all project elements with depiction of significant geographic features to include watercourses, washes, irrigation and drainage canals, and sensitive areas.
- ***Site Delineation*** – The BEP II site and all project elements shall be delineated showing boundary lines of all construction areas and the location of existing and proposed structures, pipelines, roads, and drainage facilities.
- ***Watercourses and Critical Areas*** – The DESCP shall show the location of nearby watercourses including washes, irrigation and drainage canals, and drainage ditches. Indicate the proximity of those features to the BEP II construction site and all pipeline and transmission line construction corridors.
- ***Drainage*** – The DESCP shall provide a topographic site map showing existing, interim and proposed drainage systems; drainage area boundaries and water shed sizes in acres; the hydraulic analysis to support the selection of BMPs to divert off-site drainage around or through the site and laydown areas. On the map, spot elevations are required where relatively flat conditions exist. The spot elevations and contours shall be extended off-site for a minimum distance of 100 feet in flat terrain.
- ***Clearing and Grading*** – The plan shall provide a delineation of areas to be cleared of vegetation and areas to be preserved. The plan shall provide elevations, slope, location, and extent of all proposed gradings as shown by contours, cross sections or other means. The locations of any disposal areas, fills, or other special features will also be shown. Illustrate existing and proposed topography tying in proposed contours with existing topography. The DESCP shall include a statement of the quantities of material excavated or filled for each element of the BEP II (project site, transmission corridors, and pipeline corridors), whether such excavations or fill is temporary or permanent, and the amount of such material to be imported or exported.
- ***Project Schedule*** – The DESCP shall identify on the topographic site map the location of the site specific BMPs to be employed during each phase of construction (initial grading, project element excavation and construction, and final grading/stabilization). Separate BMP implementation schedules shall be provided for each project element for each phase of construction.
- ***Best Management Practices*** – The DESCP shall show the location, timing, and maintenance schedule of all erosion and sediment control BMPs to be used prior to initial grading, during project element excavation and construction, final grading/stabilization, and following construction. BMPs shall include measures designed to control dust and stabilize construction access roads and entrances. The maintenance schedule should include post-construction maintenance of treatment control BMPs applied to disturbed areas following construction.
- ***Erosion Control Drawings*** -- The erosion control drawings and narrative must be designed and sealed by a professional engineer/erosion control specialist.

Verification: No later than 60 days prior to start of site mobilization, the project owner shall submit a copy of the plan to Riverside County and the City of Blythe for

review and comment, and to the CPM for review and approval. The CPM shall consider comments received from Riverside County and the City of Blythe. During construction, the project owner shall provide an analysis in the monthly compliance report on the effectiveness of the drainage, erosion and sediment control measures and the results of monitoring and maintenance activities. Once operational, the project owner shall provide in the annual compliance report information on the results of monitoring and maintenance activities.

SOIL and WATER 3: The project owner shall comply with the requirements of the General NPDES Permit for Discharges of Storm Water Associated with Industrial Activity. The project owner shall develop and implement a Storm Water Pollution Prevention Plan for the operation of the BEP II site (operation SWPPP).

Verification: The project owner shall submit copies to the CPM of the operational SWPPP for the entire BEP II site prior to commercial operation and all correspondence between the project owner and the RWQCB about the General NPDES permit for Discharge of Storm Water Associated with Industrial Activity within 10 days of its receipt (when the project owner receives correspondence from the RWQCB) or within 10 days of its mailing (when the project owner sends correspondence to the RWQCB). This information shall include a copy of the Notice of Intent and Notice of Termination. A letter from the RWQCB indicating no General NPDES Permit for Discharges of Storm Water Associated with Industrial Activity is required will satisfy this condition.

SOIL and WATER 4: The on-site septic system shall be designed and operated to comply with County and City standards and prevent any adverse impacts to water quality. Prior to the start of commercial operation and/or discharge of waste to the septic system, the project owner shall provide the CPM with documentation from Riverside County and the City of Blythe confirming that the septic system design and operational plan is consistent with County and City standards. Waste shall not be discharged to the septic system until the documentation confirming that the system design and operating plan are consistent with County and City standards has been reviewed and approved by the CPM.

Verification: No later than sixty days prior to start of commercial operation and/or discharge of waste to the septic system the project owner shall submit the required documentation from the County and City to the CPM for review and approval.

SOIL and WATER 5: (*Note: This condition applies to a final project design that discharges wastewater from a brine concentrator to evaporation ponds.*) The project owner shall comply with all of the requirements of the RWQCB to discharge wastewater to the project's evaporation ponds. The project owner shall follow RWQCB Waste Discharge Requirements (WDRs) for these ponds, and shall not discharge any waste to the evaporation ponds without final WDRs in place. The project owner shall report to the CPM any notice of violation, cease and desist order, cleanup and abatement order, or other enforcement action taken by the RWQCB related to the WDRs. The project owner shall describe all actions taken to correct violations and operate the project in compliance with WDRs permit conditions. The project owner shall provide confirmation from the

RWCQB that any violations have been resolved to the satisfaction of the RWQCB.

Verification: Final RWQCB WDRs must be received by the CPM prior to start of commercial operation and/or discharge of waste to the ponds. The project owner will report violations and the final resolution of the violation within 10 days of notice by the RWQCB.

SOIL and WATER 6: (*Note: This condition applies to a final project design that discharges wastewater to a Zero Liquid Discharge wastewater treatment system that produces either a solid cake or slurry residual waste that will be disposed of offsite at an appropriate waste facility.*) The project shall operate with a Zero Liquid Discharge (ZLD) wastewater treatment system. A liquid wastewater discharge either on or off-site is prohibited. The design shall include a schematic, narrative of operation, maintenance schedules, on-site salt cake or slurry storage facilities, containment measures and influent water quality. The design information shall also include characterization of the residual cake solid or slurry waste to be produced by the ZLD system that adequately describes the physical and chemical properties for consideration of appropriate storage, transportation, and disposal. The project owner shall provide annual reporting of the functionality of the ZLD system and document any problems to the CPM.

Verification: Sixty (60) days prior to the start of construction, the project owner shall submit to the CPM the final design of the Zero Liquid Discharge (ZLD) system for approval. In the annual compliance report, the project owner shall submit a status report on operation of the ZLD system, including disruptions, maintenance, volumes of interim wastewater streams stored on site, volumes of residual cake solids or slurry generated and the landfills used for disposal.

SOIL and WATER 7: *(Note: This condition applies only if the Commission determines that a verifiably effective WCOP with no potentially significant unmitigated impacts resulting from fallowing is necessary.)* Prior to site mobilization, the project owner shall provide a Water Conservation Offset Plan (WCOP) for review and comment by the Natural Resources Conservation Service (NRCS), US Bureau of Reclamation (USBR), Colorado River Board (CRB), and the Palo Verde Irrigation District (PVID), and for review and approval by the CPM. The Final WCOP shall be approved by the CPM prior to the start of any site mobilization activities, and remain in effect for the life of the project. The Final WCOP shall include the following:

a) Best Management Practices (BMPs) to prevent significant impacts resulting from soil erosion of the fallowed lands for all soil types including coarse granular soil.

b) A tabulation and corresponding maps of lands and the acreages proposed for fallowing and documentation to verify that they have been irrigated during at least 4 of the 5 most recent years.

c) An estimate of the water required and the methods planned to measure water use as needed to prevent soil erosion of fallowed agricultural lands,

i.e., water used by a cover crop, etc., and the proposed means to include such use in the accounting method of actual water conserved.

d) Demonstration in the water conservation accounting method that BEP II will not be credited with other independent water conservation activities occurring within PVID's service area for which the WCOP has no effect.

e) Methodology for annual monitoring, reporting, and independent confirmation of the results of the WCOP demonstrating actual water conservation equivalent to BEP II's proposed annual water use of up to 3,300 acre-feet per year.

f) Demonstration that the WCOP meets the requirements of the CRB, PVID, and the USBR..

Verification: At least one hundred twenty (120) days prior to the start of site mobilization, the project owner shall submit a WCOP to NRCS, USBR, CRB and PVID for review and comment, and to the CPM for review and approval. In the annual compliance report, the project owner shall submit its annual accounting under the WCOP demonstrating the actual conservation of Colorado River water equivalent to BEP II's annual water use, and that stormwater, erosion, and sedimentation impacts from fallowed land remain less than significant.

SOIL and WATER 8: *(Note: This condition applies if the Commission adopts staff's recommendation that the project use irrigation return water as an alternative water supply.)* The project shall use only irrigation drain water for all non-potable uses, except during Palo Verde Irrigation District's (PVID) maintenance period when irrigation supply water may be used. The project owner shall obtain a water supply agreement from the PVID for the delivery of irrigation return water to meet the construction and operation water requirements of the project.

Verification: The project owner shall provide to the CPM a copy of a water supply agreement from PVID for review and approval ninety (90) days prior to the start of site mobilization activities.

SOIL and WATER 9: *(Note: This condition applies if the Commission adopts staff's recommendation that BEP II use irrigation return water to meet project water supply requirements.)* The project owner shall install metering devices to record the daily amount of nonpotable water used by BEP II. BEP II's annual use of water shall not exceed a maximum of 3,300 acre-feet per year. The project owner shall prepare an annual water use summary coordinated with the annual compliance report, that shall include:

- the total water used by the project on a daily basis in gallons, and
- the total water used by the project on an annual basis in acre-feet.

Following the first year, the annual water use summary shall also include for all operating years:

- the yearly range of water use by the project and
- the yearly average of water use by the project.

Verification: As part of its annual compliance report, the project owner shall submit an annual water use summary to the CPM, the Palo Verde Irrigation District, and the United States Bureau of Reclamation .

SOIL and WATER 10: *(Note: This condition applies if the Commission allows the project's proposed use of groundwater.)* The project owner shall install metering devices to record the daily amount of groundwater withdrawn by BEP II, separate and distinct from water use metered and reported by the BEP I project. The project owner shall prepare an annual water use summary coordinated with the annual compliance report for each well, which shall include:

- the total water withdrawn by the project on a daily basis in gallons, and
- the total water withdrawn by the project on an annual basis in acre-feet.

Following the first year, the annual water use summary shall also include:

- the yearly range of water withdrawn for each well by the project and
- the yearly average of water withdrawn for each well by the project.

Verification: As part of its annual compliance report, the project owner shall submit annual groundwater use data for each well as part of its annual water use summary to the CPM, the Palo Verde Irrigation District, and the United States Bureau of Reclamation for the life of the project.

SOIL and WATER 11: (*Note: This condition applies only if the Commission permits the Applicant's proposed use of groundwater*.) The project owner shall pay or reimburse all wells owners (at the affected well owner's option) whose wells are located on the Palo Verde Mesa, 3 miles or less from the midpoint of the BEP II - BEP I well field, in accordance with the Energy Commission staff analysis that predicts, for these wells, a cumulative decline in static groundwater level of 5 feet or more. The project owner shall pay or reimburse the well owner an amount equal to the customary local cost of lowering the well owner's pump setting necessary to accommodate the decline in water level caused by the project, unless the project owner can demonstrate to the satisfaction of the CPM that the existing pump setting is sufficiently deep that lowering is unnecessary. In the event that the pump setting cannot be lowered without deepening the well, the project owner shall pay or reimburse the well owner an amount equal to the customary local cost of deepening the well. If the well cannot be deepened, the project owner shall pay or reimburse the well owner an amount equal to the customary local cost of installation of a new well.

Protocol: The project owner shall provide evidence of notification describing the BEP II well interference mitigation requirements to all Palo Verde Mesa property owners whose land is located 3 miles or less from the midpoint of the BEP II - BEP I well field.

Verification: At least 90 days prior to well construction, the project owner shall provide evidence to the CPM that it has notified all Palo Verde Mesa property owners, whose land is located 3 miles or less from the midpoint of the BEP II - BEP I well field, regarding the BEP II well interference mitigation requirements. At least 30 days prior to well construction, the project owner shall submit a compliance report describing compensation for pump lowering as well as any well modifications undertaken to comply with the provisions of this condition to the CPM for review and approval.

At least 90 days prior to well construction, the project owner shall provide evidence to the CPM that it has notified all Palo Verde Mesa property owners, whose land is located 3 miles or less from the midpoint of the BEP II – BEP I well field, regarding the BEP II well interference mitigation requirements. The project owner shall submit an annual compliance report describing compensation for pump lowering, pump replacement, or well deepening as well as any other well modifications undertaken to comply with the provisions of this condition to the CPM for review and approval.

SOIL and WATER 12: (*This condition applies only to a final project design that allows the use of groundwater*.) The Applicant shall conduct an annual water quality sampling and analysis of groundwater from any one of the operational wells constructed to supply the project with groundwater and report the results of the analysis to the CPM in both electronic and hard-copy formats. The report shall include a summary table that, at a minimum, lists for each of the constituents analyzed, the name of the constituent, the unit of measurement, the method, the applicable standard, the detection level, the sample results, the date sampled and the date analyzed. The report shall also include copies of the original laboratory reports.

Water quality sampling shall include the analysis of the following constituents:

Constituents	**Constituents (continued)**	**Constituents (continued)**
Total Hardness	Cyanide	Total Organic Carbon
Calcium	Foaming Agents (MBAs)	Aluminum
Calcium as Calcium Carbonate	Phenols	Antimony
Magnesium	Ortho Phosphate Phosphorus	Arsenic
Total Alkalinity	Kjeldahl Nitrogen	Barium
Hydroxide	Total Nitrogen	Lead
Carbonate Bicarbonate	Boron	Cadmium
pH	Hexavalent Chromium	Copper
Total Dissolved Solids	Manganese	Iron
Langelier Index	Reactive Silica	Mercury
Glyphosate	Total Silica	Nickel
Triazine Pesticides	Tin	Selenium
Chlorothalonils	Carbon Dioxide	Strontium
Chlorinated Herbicides and Bentazon	Nitrate – Nitrogen	Zinc
Ethylebenzene	Nitrite – Nitrogen	Odor
Toluene	Fluoride	Aggressive Index
Total Zylenes	Specific Conductance	Sulfate
1,4-Dichlorobenzene	Total Cations	Chloride
Methylene Chloride	Total Anions	Potassium

Styrene	Total Suspended Solids	Silver
Di (2 Ethyl Hexyl) Adipate, Benzo (a) Pyrene, and Di (2 Ethyl Hexyl) Phthalate	Biochemical Oxygen Demand	Thallium
Dibromochloropropane and Ethylene Dibromide	Oil and Grease	Coliform
Carbamate Pesticides	Total Phosphorus	Gross Alpha
Sodium	Color	2,3,7,8-TCDD (Tetrachlorodibenzo-P-Dioxin)
Ammonia-Nitrogen	Turbidity	Diquat

Appropriate sampling and analytical quality assurance and quality control documentation from the laboratory of choice shall be included with the analytical results (in both electronic and hard-copy formats).

If any annual analysis indicates that the concentration of any contaminant found in groundwater is above its Environmental Screening Level (ESL as determined by the San Francisco Bay Regional Water Quality Control Board), the project owner shall be required to develop a mitigation workplan for one of the three mitigation options. Based on discussions between the CPM, the project owner, and the Colorado River Basin Regional Water Quality Control Board, the CPM will direct the project owner to prepare either (a) prepare a human health risk assessment, using methodology reviewed by the Colorado River Basin Regional Water Quality Control Board and approved by the CPM, demonstrating that the increased level(s) of groundwater contaminant(s) pose an insignificant risk to on-site workers and the off-site public, <u>or</u> (b) cease groundwater pumping and obtain an alternative water supply or cooling method, or (c) provide pre-treatment of groundwater to reduce the contaminant levels to below their ESLs.

The workplan shall be submitted to the Colorado River Basin Regional Water Quality Control Board for review and comment and to the CPM for review and approval.

If mitigation option (a) is performed, the complete health risk assessment, including all input and output files, shall be provided in both electronic and hard-copy formats. If the risk assessment is approved by the CPM, groundwater shall continued to be used for the project and the workplan shall provide for annual groundwater sampling, additional risk assessment as required by the CPM, and reporting for the life of the project to demonstrate that the level(s) of groundwater contaminant(s) continue to pose an insignificant risk to on-site workers and the off-site public. However, if subsequent risk assessments indicate a significant risk to on-site workers or the off-site public, a new mitigation workplan shall be required and the project owner shall be required to implement mitigation (b) or (c).

If mitigation option (c) is selected and treated groundwater is used for the project, the workplan shall include quarterly sampling, analysis, and reporting to verify that groundwater treatment is effective and all constituent concentrations of the project water supply remain below the ESLs. Should

the treatment method be determined ineffective at maintaining contaminant levels below the ESL(s), a new workplan shall be required and the project owner shall be required to implement mitigation (b) or to modify the water treatment method.

Verification: The results of the required groundwater analyses shall be provided to the CPM and the Colorado River Basin Regional Water Quality Control Board, including a summary and a complete copy of the analytical laboratory reports in both electronic and hard-copy formats, on an annual basis beginning after one year of operation on the anniversary date the BEP II begins operation and continuing for a total of 5-years. If no annual analyses during the first five years of the project indicate that the concentration of any contaminant found in groundwater is above its ESL, the need for continued monitoring shall be reassessed at the end of the 5-year period, and the monitoring program shall be modified as appropriate by the CPM.

If any annual analysis indicates that the concentration of any contaminant found in groundwater is above its ESL, the required mitigation workplan shall be submitted to the CPM for review and approval with 90 days of the submittal of the annual water quality sampling and analysis report.

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DECLARATION OF
John S. Kessler

I, **John S. Kessler,** declare as follows:

1. I am presently a consultant employed by the California Energy Commission in the Water and Soil Resources Unit of the Energy Facilities Siting and Environmental Protection Division as a Senior Technical Specialist.

2. A copy of my professional qualifications and experience is attached hereto and incorporated by reference herein.

3. I helped prepare the staff testimony on Soil and Water Resources, for the **Blythe Energy Project - Phase II** based on my independent analysis of the Application for Certification and supplements hereto, data from reliable documents and sources, and my professional experience and knowledge.

4. It is my professional opinion that the prepared testimony is valid and accurate with respect to the issue addressed therein.

5. I am personally familiar with the facts and conclusions related in the testimony and if called as a witness could testify competently thereto.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief.

Dated: June 1, 2005 Signed: John S. Kessler

At: Pollock Pines, California

JOHN S. KESSLER
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PROFESSIONAL EXPERIENCE:

Mr. Kessler is a licensed Civil Engineer in California with over 25 years experience in water supply and power generation, which includes planning and managing project dams, water conveyance facilities and powerhouses with responsibilities in operations, maintenance, regulatory compliance and safety. Since forming Kessler and Associates, LLC in May 2000, Mr. Kessler has served on numerous projects evaluating and coordinating water supply developments. As a consultant to the California Energy Commission, Mr. Kessler has assessed potential soil and water resource impacts and evaluated water supply alternatives for over ten proposed gas-fired generation plants, ranging in total development costs from $10 - $500 million. His guidance to the Energy Commission has been instrumental in conserving the state's limited fresh water supplies for higher priority uses such as domestic and irrigation needs, and substantiating a sound basis for the Commission to approve power plants subject to avoiding or minimizing the use of fresh water for power plant cooling. The Water Supply Alternatives analyses have included evaluation of alternative sources of water supply, pipeline routes, reliability, environmental effects and economic feasibility. In 2001, Mr. Kessler was awarded the Outstanding Performance Award from the California Energy Commission, and continues to support the Energy Commission in this capacity today.

Another significant water supply project was accomplished when Mr Kessler, teamed with Carlton Engineering, managed the replacement of Utica Power Authority's (UPA's) Flume 14 on the Utica Canal following the Darby Fire in September 2001. This expedited flume replacement project was completed within 9 months and involved environmental analysis, regulatory permitting and approvals, preparation of plans, specifications and a quality control inspection program, construction during fall – spring, and mitigating significant personnel safety challenges working in the steep Stanislaus River canyon. The project was completed in-budget for a cost of about $2.5 million, and was performed in a manner that made UPA eligible and successful in reimbursement from OES disaster relief funds. Also noteworthy, is that the USFS - Stanislaus National Forest highly commended UPA and the consulting team for the manner in which the project was planned and conducted. At the USFS' request, the project team and USFS jointly presented a summary of the project at the April 2003 conference titled "Managing Water", held at Columbia College and sponsored by the Central Sierra Watershed Coalition. Mr. Kessler also serves UPA as their dam safety engineer and environmental coordinator, which included guiding the final stages of FERC Relicensing and preparing and/or coordinating all resource management plans prepared in accordance with the new Angels and Utica Project licenses and USFS 4(e) conditions.

During 1997 – 1999 as Hydroelectric Director of El Dorado Irrigation District (EID), Mr. Kessler supported negotiations to acquire the El Dorado Hydroelectric Project from PG&E, managing regulatory

processes before FERC, CPUC and the supporting EIR in compliance with CEQA. Following the successful acquisition of the El Dorado Hydroelectric Project in October 1999, Mr. Kessler was awarded the Outstanding Achievement Award by EID's Board of Directors for Transfer of the El Dorado Hydroelectric Project from PG&E to EID.

May 2000 - Present: Principal - Kessler and Associates
Established Kessler and Associates to provide engineering, regulatory and operating services related to energy and associated water supply projects;

California Energy Commission (CEC) – Soil & Water Resource Assessments of Proposed Gas-Fired Generating Facilities (Serving as Project Manager or Technical Lead to assess potential soil and water resource impacts and evaluate water supply alternatives for the following projects:)

- Valero Cogeneration Project, 01-AFC-05, a 4-month certification proceeding of two combustion turbine generators rated at 51 MW each; Provided a unique water conservation condition to avoid use of fresh water by either implementing recycled water from City of Benicia or by conserving an equivalent quantity of fresh water within the refinery operations, so as to avoid a net increase from existing fresh water use; Testified in Evidentiary Hearings and the final Commission decision adopted our recommendation to require use of recycled water or to otherwise conserve;

- East Altamont Energy Center, 01-AFC-6, a 12-month certification proceeding of a natural gas-fired, combined cycle generating facility rated at 1,100 MW; Prepared a Water Supply Alternatives Analysis, and coordinated closely with representatives of DWR, Byron-Bethany Irrigation District and the Mountain House Community to demonstrate the feasibility of using recycled water for EAEC cooling and landscape irrigation purposes; Testified in Evidentiary Hearings and the final Commission decision adopted our recommendation to require use of recycled water;

- Russell City Energy Center, 01-AFC-7, a 6-month certification proceeding of a natural gas-fired, combined cycle generating facility rated at 600 MW; Developed conditions to assure the implementation of recycled water supply as proposed;

- Los Esteros Critical Energy Facility, 01-AFC-12, a 4-month certification proceeding of four combustion turbine generators rated at a combined total of 180 MW; Developed conditions to assure the implementation of recycled water supply as proposed, and coordinated the resolution of storm water discharge issues into Coyote Creek with responsible agencies including City of San Jose, Santa Clara Valley Water District, San Francisco Regional Water Quality Control Board, and the U.S. Army Corps of Engineers; Testified in Evidentiary Hearings;

- Inland Empire Energy Center, 01-AFC-17, a 12-month certification proceeding of a natural gas-fired, combined cycle generating facility rated at 670 MW; Developed conditions to assure the implementation of recycled water supply as proposed;

- Avenal Power Plant, 01-AFC-20, a 12-month certification proceeding of a natural gas-fired, combined cycle generating facility rated at 600 MW; Duke Energy suspended processing of its application until further notice.

- Tesla Power Plant, 01-AFC-21, a 12-month certification proceeding of a natural gas-fired, combined cycle generating facility rated at 1,120 MW; Prepared a Water Supply Alternatives Analysis, and coordinated closely with representatives of DWR, Zone 7 of the Alameda County Flood Control District and City of Tracy to demonstrate the feasibility of using recycled water for Tesla cooling, process and landscape irrigation purposes; Testified in Evidentiary Hearings and the final Commission decision adopted our recommendations to require use of recycled water;

- San Joaquin Valley Energy Center, 01-AFC-22, a 12-month certification proceeding of a natural gas-fired, combined cycle generating facility rated at 1,060 MW; Developed conditions to assure the implementation of recycled water supply as proposed; Testified in Evidentiary Hearings;

- Blythe II Energy Project, 02-AFC-01, a 12-month certification proceeding of a natural gas-fired, combined cycle generating facility rated at 520 MW; Prepared a Water Supply & Cooling Alternatives Analysis to demonstrate the feasibility of using Dry Cooling to minimize use of Colorado River groundwater for cooling, process and landscape irrigation purposes;

- San Francisco Electric Reliability Project, 04-AFC-01, a 12-month certification proceeding of a natural gas-fired, simple cycle generating facility rated at 145 MW; Developed conditions to assure the implementation of recycled water supply as proposed;

CEC – Assessment of Alternative Generation Technologies
Served as the author of the Hydropower Chapter discussing the status of development, potential for new development, costs, and deployment constraints including environmental effects, in comparison to development of gas-fired generation technologies;

CEC - Water Discharge Assessment of Coastal Power Plants – Executive Order 22-01
Served as Project Manager of Water Resources to assess the generation curtailments resulting from regulatory-required cooling water discharge limitations at various coastal thermal power plants;

CEC - Environmental Performance Report of California's Electric Generation Facilities
Co-authored the 2001 and draft 2003 Water and Biological Resources Sections, providing research and analysis of trends in power plant water resource utilization affected by technological changes, improved environmental safeguards, regulatory influences in market development, and diminishing supplies of fresh water;

CPUC – EIR for PG&E's Application for Authorization to Divest its Hydroelectric Generating Facilities and Related Assets
Served as Hazards Section Leader and Team Member of the Public Services and Utilities Section in preparing the EIR for considering PG&E's divestiture of its entire hydroelectric system; The environmental assessment included evaluating the safety and potential risks of PG&E's dams throughout its hydroelectric system in Northern California.

Upper Hangtown Creek Watershed Restoration Project
Serving as the Hydrologist to define reaches of stream running as both surface and sub-surface flow, and quantifying contributions from those reaches in order to assess and recommend restoration opportunites to Upper Hangtown Creek after 150 years of alteration from mining and lumber mill activities. The project is being coordinated with the Resource Conservation District and other local, state and federal agencies.

Utica Power Authority – Dam Safety and Regulatory Compliance Services
Serving as UPA's FERC License Coordinator, managing the implementation of new license conditions for environmental protection and compliance monitoring in consultation with state and federal agencies. I have personally prepared resource management plans in water resources addressing minimum instream flows, flushing flows, drought contingencies, water conveyance, canal dewatering, water quality monitoring, stream gaging, and transportation. In addition, I have guided the preparation of other resource management plans including those in biological, cultural resource and geotechnical categories. Serving as UPA's Dam Safety Engineer in analyzing project monitoring data and advising on various regulatory matters, including the successful restoration of Flume 14 ($2.5 MM) that was destroyed in a wildfire during September 2001 which presented numerous environmental, construction and safety challenges in the Stanislaus River canyon; Prepared a comprehensive regulatory checklist and schedule for compliance monitoring of applicable federal, state and local regulations and agreements.

El Dorado Irrigation District – Regulatory Permitting and Compliance Services
Supported EID with regulatory permitting including securing a FERC License Amendment for its El Dorado Hydroelecric Project. Project repairs, at a cost of over $30MM, were recently completed to repair flood damages to El Dorado Diversion Dam, construct a new 2-mile long tunnel, and rehabilitate two generating units and associated equipment. In support of EID's dam safety program, I prepared new Emergency Action Plans for Caples, Silver, and Echo Lakes and El Dorado Forebay Dams in accordance with FERC's revised guidelines. Subsequently, I provided annual updates and personnel training including facilitating EAP Tabletop and Functional Exercises with emergency response agencies. I am currently preparing Standard Operating Procedures and facilitating employee training for project operations, supporting historic water rights documentation, preparing license compliance plans in accordance with the Relicensing Settlement Agreement, and developing a work management database for scheduling future regulatory compliance and O&M tasks, and documenting history.

Haida Corporation – Advisor for Project Feasibility, Regulatory and Strategic Matters
Served as co-author and preparer of a feasibility study and report for development of the Reynolds Creek Hydroelectric Project on Prince of Wales Island, Alaska; I also developed regulatory permitting and interconnection negotiating strategies in preparation for project construction;

September 1995 – April 2000: Hydroelectric Director - El Dorado Irrigation District
Managed operation, maintenance and regulatory activities and the acquisition of the El Dorado Hydroelectric Project from PG&E to EID; Acquisition activities included providing technical expertise in sale negotiations, FERC and CPUC regulatory approval processes, serving as EID's representative before hearings at the CPUC, and managing the preparation of the EIR to support EID's Acquisition, Operation and Permanent Repairs of the El Dorado Hydroelectric Project and the Acquisition of 17,000 AF/year New Water Rights; After several previous court challenges, this EIR continues to be valid and served as a critical step in the SWRCB issuing its final decision to award EID with the new water rights. The EIR also supported EID's success in acquiring the El Dorado Project on October 15, 1999 that included an unprecedented $15 Million payment from PG&E to EID to assume ownership. During 1998 – 2000, I represented EID and assisted in the preparation of a License Application for renewing the major license of the El Dorado Hydroelectric Project. This project has significant public and regulatory interests to assure that it provides a balance of environmental protection, focusing on aquatic resources and recreation in the alpine lakes and South Fork American River.

Aug. 1993 – Sept. 1995: Project Engineer - Northern California Power Agency
Managed planning of various enhancements and aquatic resource studies, including small hydro and fish screen improvements, associated with the North Fork Stanislaus River Hydroelectric Project and relicensing studies associated with the Angels and Utica Projects; Coordinated initial development phases of new biomass generation for the Gridley Rice Straw Project in conjunction with D.O.E., private and U.C. Davis research groups which led to receiving a $1 Million federal grant for prototype development testing in the production of ethanol;

July 1984 – August 1993: Hydro Supervisor – Pacific Gas & Electric Company
Supervised the operations, maintenance, capital improvements and regulatory compliance activites for the El Dorado and Chili Bar Hydroelectric Projects;

Aug. 1979 – July 1984 - Hydraulic Engineer and Hydrographer/Hydrologist - PG&E
Managed various capital projects within PG&E's and its water district/agency partner's hydroelectric systems; Coordinated the establishment of computerized operations modeling for PG&E's hydroelectric system for the purpose of predicting hydropower production in order to determine the most economical mix of hydro and thermal resources, and supported various relicensings throughout PG&E's hydroelectric system. I also maintained numerous stream gages and prepared final records for USGS approval and publication.

EDUCATION AND PROFESSIONAL CERTIFICATES:

- State Of California Professional Civil Engineer, License No. C034897;
- B.S. Civil Engineering, University Of California, Davis, June 1979;
- A.A. Diablo Valley College, Pleasant Hill, June 1976;

HONORS AND AWARDS:

- 2001 Outstanding Performance Award from the State of California - Energy Commission;
- 1999 Outstanding Achievement Award for Transfer of the El Dorado Hydroelectric Project from PG&E to the El Dorado Irrigation District;

PROFESSIONAL ASSOCIATIONS:

- American Society of Civil Engineers

Jsk:JK's Resume – 2005

BLYTHE II ENERGY PROJECT FSA

SOIL AND WATER RESOURCES APPENDIX A

WATER SUPPLY AND COOLING OPTIONS

Testimony of James Schoonmaker and John Kessler

EXECUTIVE SUMMARY

To mitigate the significant cumulative adverse impact to users of Colorado River water, the significant adverse impact to groundwater quality on the Palo Verde Mesa and non-conformance with LORS, staff analyzed the following water supply and cooling alternatives in detail in comparison to the proposed Blythe Energy Project Phase II (BEP II):

The Proposed Project – Use of Colorado River Water derived from Groundwater with Wet Cooling;

Alternative 1 – Reclaimed Water from City of Blythe's Wastewater Treatment Plant (WWTP) with Wet Cooling;

Alternative 2 – Irrigation Return Water from Palo Verde Irrigation District (PVID) with Wet Cooling;

Alternative 3 –Irrigation Return Water from PVID with Hybrid Cooling (1/3 Wet and 2/3 Dry);

Alternative 4 – Dry Cooling;

Alternative 5 – Dry Cooling with 50 MW Peaker (The addition of a peaking unit is to offset losses from dry cooling during high ambient temperatures.)

All use of water in the Proposed Project and Alternatives 1, 2 and 3 results in the use of Colorado River water and contributes directly to the significant shortage of regional Colorado River water supply. The implementation of a verifiably effective Water Conservation Offset Plan (WCOP) could mitigate the potentially significant cumulative impact to other users of the State's Colorado River water supply by avoiding any net increase in water use within PVID's service area attributed to BEP II. However, a WCOP by itself will not meet state policy to utilize the most degraded source of water supply reasonably available. From a water conservation standpoint and to achieve consistency with state regulations and policies including those of the Energy Commission, Alternative 4 - Dry Cooling would accomplish the highest conservation of Colorado River water, reducing average annual water use from 3,262 acre-feet/year (AFY) to about 100 AFY. Alternative 5 – Dry Cooling with 50 MW Peaker would require about 150 AFY. Both Alternatives 4 and 5 assume gas turbine inlet cooling would be accomplished using mechanical chillers with radiator (dry) coolers for the ultimate heat

sink. No new water supply infrastructure (wells, pumps or off-site pipelines) would be needed, as the minimal 100 – 150 AFY needed to support the dry cooling alternatives could be made available using the existing BEP I infrastructure. Staff believes conservation of water supplies throughout California, but particularly in the Colorado River basin, is imperative. Considering that all of California's entitlements from the Colorado River are fully allocated, the need to preserve Colorado River water for highest beneficial use is paramount in light of California being mandated to reduce its historical use by over 1 million acre-feet/year.

Based on the compilation of environmental and engineering measures presented in **Soil and Water Resources Appendix Table 8**, and subject to mitigation of significant adverse impacts as noted in the table and discussed in the FSA, staff believes either Alternative 4 – Dry Cooling or Alternative 5 – Dry Cooling with a 50 MW Peaker are preferable alternatives to the proposed use of Colorado River water withdrawn as groundwater and wet cooling (Proposed Project). Staff can also equally support Alternative 2 and 3 – Irrigation Return Water from PVID with Wet or Hybrid cooling with the use of water from Rannells Drain if a verifiably effective WCOP is implemented. This approach would be consistent with state water policy to utilize the most degraded source of water supply reasonably available to the project. Staff cannot recommend use of dry cooling at this site, however, due to significant adverse impacts to aviation safety common to the proposed project and any water supply and cooling alternative associated with the proposed project site. Staff believes there would not be significant adverse impacts in any technical area associated with dry cooling and a zero-liquid discharge to solids wastewater treatment system at an alternate site. Feasible alternate sites were identified in the **Alternatives Section of the FSA (CEC 2005p)**. Staff has not evaluated the environmental effects of Alternative 5 – Dry Cooling with a 50 MW Peaker, and while they are assumed to be reasonably equivalent to Alternative 4 – Dry Cooling, staff can provide this assessment in an addendum to the FSA if necessary and desired by the Energy Commission.

Staff evaluated the costs of the proposed project compared to the alternatives and concludes the costs are reasonably equivalent to implement any of the alternatives including dry cooling compared to the proposed project. Staff has developed two indicators for cost comparison intended to evaluate if alternatives to the proposed project are economically sound and feasible, providing the basis for staff's conclusions.

In considering water supply and cooling cost as a percent of total BEP II power production cost and to bracket the range of costs, even the highest cost alternatives (both Dry Cooling alternatives) are reasonably comparable to the Proposed Project highlighted as follows:

1. When assuming a power value of $30 per megawatt-hour (MWH) and the effects of lost power revenues associated with Alt. 4 - Dry Cooling, or the gained revenues associated with Alt. 5 - Dry Cooling & a 50 MW Peaker, the total BEP II production costs of these alternatives compared to the proposed project differ by a maximum of only 1.8%.

2. When assuming a power value of $60/MWH and the effects of lost power revenues associated with Alt. 4 - Dry Cooling, or the gained revenues associated with Alt. 5 - Dry Cooling & a 50 MW Peaker, the total BEP II production costs of these alternatives compared to the proposed project differ by a maximum of only 3.5%.

In considering the incremental power production cost attributable to only water supply and cooling, the results are highlighted as follows:

1. Before accounting for effects in power generation, Alternatives 1 – 4 are reasonably comparable in cost to the proposed project (within $0.0001 per kilowatt-hour (KWH)). Alternative 5 - Dry Cooling with 50 MW Peaker is $0.0005 per KWH higher than the proposed project before considering the revenues from additional generation capacity.
2. The incremental power production cost is only about $0.0006 to $0.0012 per KWH higher (assuming power values ranging from $30 - $60 per MWH) to implement Alternative 4 - Dry Cooling compared to the proposed project.
3. The incremental power production cost is only about $0.0002 to $0.0004 per KWH higher (assuming power values ranging from $30 - $60 per MWH) to implement Alternative 5 - Dry Cooling with a 50 MW Peaker compared to the proposed project

Staff concludes dry cooling is economically sound and feasible, and the associated costs will not significantly affect project economics or the owner's ability to market power among competitors. The applicant has estimated that its average annual production costs will range from $0.035/KWH - $0.050/KWH (BEPII 2002 - AFC Table 6.0-3, Project Alternatives). In evaluating dry cooling, staff has estimated that in the worst case, BEP II's cost of production would increase only $0.001/KWH. This would result in an increase in BEP II's annual production cost in the low range from $0.035/KWH to $0.036/KWH and in the high range from $0.050/KWH to $0.051/KWH. The minimal increase in production cost would not compromise the project owner's ability to recover its investment and earn a return (profit) considering power values from sales are typically ranging from 100% to 300% of the cost of production.

As further evidence of the viability of dry cooling, some of these competitors already rely entirely on dry cooling such as the currently operating Crockett and Sutter Power Plants, and Otay Mesa, which is under construction.

INTRODUCTION

The Blythe II Energy Project (hereafter abbreviated BEP II), as proposed, is a nominal 520 MW combined cycle power plant using two gas turbines and one steam turbine. AFC information is based on a Siemens V84.3 Combined Cycle. As proposed, the plant includes a cooling system using wet (evaporative) cooling towers, which would use an average of 3,262 acre-feet/year (AFY) of groundwater from on site wells. Groundwater used by this project is replaced by Colorado River water and is hereafter referred to as Colorado River groundwater. The Applicant proposes to avoid discharge of process

wastewater from BEP II by utilizing a brine concentrator, which separates water suitable for reuse from the brine waste conveyed to the evaporation ponds.

1.0 PURPOSE OF REPORT

The purpose of this report is to consider alternatives to the proposed cooling system and water supply for BEP II (02-AFC-01).

The analysis of alternative water sources for BEP II was undertaken to determine if feasible options exist to the proposed use of Colorado River groundwater. The analysis of cooling options was undertaken to determine whether there are available cooling technology options that would reduce the demand for water. Two potential sources of reclaimed or degraded water (City of Blythe's treated wastewater and PVID's irrigation return flows) and three cooling technology options (dry cooling, dry cooling with peaker and hybrid cooling) are considered in detail as alternatives to the proposed project. In addition, an alternative source of water supply, the Lower Colorado Water Supply Project, is considered briefly, and dismissed as not being available to the BEP II Project.

Applicable LORS have been discussed and addressed in the FSA. Unless otherwise noted, the alternatives have been considered for consistency with LORS.

1.1 REPORT CONTENTS

This report consists of six parts and a sub-appendix and is organized as follows:

Introduction

Part 1 describes the purpose of the report, the cooling water supply and technology options and other report contents.

Potential Alternative Water Sources

Part 2 describes in detail the availability of wastewater that may be reclaimed from the City of Blythe's wastewater treatment plant and the availability of degraded water from Palo Verde Irrigation District's (PVID's) irrigation return water. In addition, water supply from the Lower Colorado Water Supply Project is considered and then dismissed as not being available to the BEP II Project.

Conceptual Designs of Cooling Technology Options

Part 3 describes potential designs for dry and hybrid cooling systems at the BEP II.

Cost Comparison and Engineering Measures for Water Conservation

Part 4 describes the engineering technologies or measures that could reduce the amount of water used at BEP II. This section also discusses the feasibility and cost of implementing these water-conserving measures.

Environmental and Engineering Analysis

Part 5 analyzes the environmental and engineering effects of the different cooling technologies and the use of degraded water from both City of Blythe's wastewater treatment plant and PVID's irrigation return drains for each of the technical issue areas that would be substantially affected (e.g. noise, visual and air quality).

Conclusions

Part 6 presents overall conclusions about the environmental and engineering effects of the cooling and water supply options at BEP II.

Background on Water Supply and Cooling Options

Appendix A.1 provides an overview of water use at the BEP II and the water supply and cooling options considered in this report: (dry cooling, wet cooling, hybrid cooling and the use of reclaimed or degraded water for power plant cooling). It describes the basic technologies and how they work, where the technologies are currently used, and the advantages and disadvantages of each.

Glossary of Terms

This section relates to this Appendix only.

2.0 POTENTIAL ALTERNATIVE SOURCES OF WATER SUPPLY

Three alternative sources of water supply are considered as alternatives to the proposed Colorado River ground water for the BEP II cooling water demand of 2.4 mgd average and 4.0 mgd maximum. Two of these sources are considered in detail and include reclaimed water from the City of Blythe's Wastewater Treatment Plant (WWTP) and Irrigation Return Water from Palo Verde Irrigation District (PVID). The third alternative source of water supply from the USBR's Lower Colorado Water Supply Project is analyzed in less detail because staff has determined that BEP II is not eligible to receive this water. Availability and cost for each potential viable source is compared to the use of Colorado River ground water. Only irrigation return water from PVID is currently available in sufficient quantities to meet 100% of BEP II demands beginning in 2006, the earliest date the project could operate if approved by the Energy Commission. The water supply and cooling alternatives that are being analyzed in detail in comparison to the proposed project are summarized as follows:

2.1 PROPOSED PROJECT – USE OF COLORADO RIVER GROUND WATER SUPPLY WITH WET COOLING

The proposed project is as described in the **Soil and Water Resources Section** this FSA. In support of the economic analysis in this appendix, staff is supplementing the discussion already included in the FSA with the following background:

PVID currently charges $85/acre-foot for water supplied for irrigation purposes. The proposed BEP II Water Conservation Offset Program (WCOP) is intended to provide the volume of water needed by the plant by taking active agricultural land out of production

so the net change in water use would be zero. In a similar WCOP, Metropolitan Water District (MWD) is proposing to export a portion of PVID's Colorado River allocation for municipal and industrial purposes subject to a fallowing agreement with local farmers within PVID's district. Staff's understanding of the primary terms of MWD's fallowing agreements with local farmers in PVID's district, are as follows:

1. Term of 35 years;
2. Initial payment of $3,250 per acre;
3. Annual payment of $500 per acre;
4. Acreage totaling approximately 25,000 acres;

Based on an average water use of 4.2 acre-feet per acre of land, the annual cost of MWD's water is about $120 per acre-foot after the initial one-time fee of $3,250 per acre. Since the Applicant has not apparently negotiated financial terms for its WCOP, staff is using MWD's costs as being representative for BEP II's cost of water supply associated with the proposed project.

2.2 RECLAIMED WATER FROM CITY OF BLYTHE'S WWTP WITH WET COOLING – ALTERNATIVE 1

The City of Blythe's Wastewater Treatment Plant (WWTP) was placed into operation in 1979 at an initial capacity of 1.5 mgd. The existing capacity of the City's WWTP is 2.4 mgd. The wastewater collection system includes several lift stations for conveying wastewater to the WWTP. During 1991 and 1992, the City initiated a Wastewater Treatment Facility Analysis to consider alterations needed to improve the reliability of meeting its discharge criteria as well as to increase its capacity to meet projected populations to the year 2010. In 1992, the City's population was 11,100 with average daily flows of 1.1 mgd in winter and 1.6 mgd in summer. In 2003, the City's population is about 14,000 (excluding the approximately 8,000 inmates at the Ironwood and Chuckwalla State Correctional Facilities which are located about 16 miles west of the City) with average daily flows of 1.5 mgd in winter and about 2.1 mgd in summer. As of 1992, the projected population for 2010 was 17,070 or an average annual increase from 1990 to 2010 of 2.2%/year. The projected 2010 WWTP flows were expected to result in average daily flows of 1.7 mgd in winter and 2.5 mgd in summer using Per Capita Unit Flow values of 95 gallons per capita day (gpcd) during winter and 140 gpcd in summer. If City of Blythe's population continues to grow at the same average annual rate of 2.2%/year, population in 2020 and 2030 would be 21,220 and 26,380 respectively. The corresponding WWTP average dry weather flows for winter and summer would be 2.0 mgd winter and 3.0 mgd summer by 2020 and 2.5 mgd winter and 3.7 mgd summer by 2030. (Blythe 1992 & Blythe 2003)

The City of Blythe treats its wastewater to advanced secondary treatment and discharges its effluent into percolation ponds located onsite at the WWTP, which serve to recharge the groundwater aquifer (and is returned to the Colorado River). Total dissolved solids (TDS) concentration of the wastewater effluent is about 1,185 mg/l. PVID believes the City of Blythe's wastewater effluent percolating to groundwater

contributes to the flows returning to the Colorado River, which effectively reduces PVID's use of Colorado River water as accounted for by USBR (PVID 2003a).

To meet current Title 22 regulations for use of reclaimed water for industrial cooling at BEP II, the effluent from City of Blythe's Wastewater Treatment Plant would need to be upgraded from advanced secondary to tertiary treatment. At this time, City of Blythe has neither any plans for upgrading its wastewater treatment plant to tertiary treatment nor plans for employing a reclaimed water program. Even though the Applicant could possibly fund this expense, or at least fund its proportionate share of the cost to implement tertiary treatment, this is not likely to occur.

Staff's view is that Alternative 1 – Reclaimed Water from City of Blythe's WWTP with Wet Cooling is not presently a viable alternative due to the following:

1. The potential supply of reclaimed water is not sufficient to meet BEP II demands over the life of the project, while other sources of lesser quality water already exist (See SOIL & WATER RESOURCES APPENDIX Tables 2 and 3 below).
2. City of Blythe does not have any existing or foreseeable plans to implement Title 22 tertiary wastewater treatment or a reclaimed water program.
3. The use of reclaimed water would essentially be use of Colorado River water, because BEP II's use would preclude recharge to the groundwater aquifer and reduce PVID's return flows as accounted for by USBR.

City of Blythe's Pipeline Route to BEP II

A specific pipeline route was not selected for this alternative because staff believes adequate information already exists to dismiss it from being considered a preferred alternative for BEP II water supply. If a pipeline route had been identified, it would have been approximately 4.5 – 5 miles in length to convey reclaimed water from City of Blythe's WWTP to BEP II. A conceptual cost for the pipeline and associated water supply costs has been included.

2.3 IRRIGATION RETURN WATER FROM PVID WITH WET COOLING – ALTERNATIVE 2

PVID operates a system of irrigation supply and return (drainage) ditches. The drainage ditches are about 10 to 20 feet deep in order to intercept groundwater averaging (valley wide) about 10 feet below the ground surface. As water is applied to crops for irrigation, excess irrigation water is applied to keep salts from building up in the soil. Excess water percolates into the ground to reach ground water. Ground water then flows to the drainage channels and is returned to the Colorado River.

In total for all of PVID's drainage system, irrigation return flows normally range from a minimum average daily flow of 280 cubic feet per second (cfs) during January to 800 cfs during summer. In the vicinity of BEP II along the Rannells Drain, the irrigation return flows normally range from a minimum average daily flow of 2 cfs during January to about 15 cfs during the balance of year. Minimum flows occur during a 2-week annual outage of the irrigation supply canals, and otherwise, irrigation supply (and thus irrigation return) occurs at higher flows for the balance of the year. (PVID 2003b) The rate and pattern of flow in PVID's irrigation return drains is not expected to significantly change as a result of the recently approved Quantification Settlement Agreement (QSA).

Flow in the Rannells Drain is made-up of intercepted shallow groundwater (after being applied for irrigation) and operational spillage from Canal B, a source of irrigation supply for the immediate area. Flows in the Rannells Drain in excess of 2-3 cfs contributed from intercepted shallow groundwater typically reflect some irrigation spillage from Canal B. Intercepted groundwater in the Rannells Drain is a function of the extent of adjacent lands being irrigated for agriculture. Therefore, the quality of water in the Rannells Drain is largely influenced by local agriculture activity (which degrades the drainage water quality) and Canal B irrigation spillage (which enhances the drainage water quality). As an indication of water quality in the Rannells Drain, PVID's observed TDS was 1,510 mg/l on an undisclosed date in September 2002 and 1,590 mg/l on March 14, 2003. In comparison, irrigation water diverted from the Colorado River on those dates was observed to have TDS concentrations of 552 mg/l and 728 mg/l respectively (PVID 2003d). PVID typically collects water quality data on a quarterly basis for its irrigation supply as diverted from Colorado River and on a bi-annual basis for its irrigation return flows in Rannells Drain (PVID 2003d).

In comparison, average and peak water demands for BEP II are 3.5 cfs (2.4 mgd) and 6.2 cfs (4.0 mgd). PVID indicated that during its normal 2-week outage in January that it could make special arrangements to provide continuity for meeting BEP II's water demands. During the outage, PVID could either impound drain water or provide canal water to BEP II's water delivery location on Rannells Drain (PVID 2005a.) Whether water for BEP II comes from drain, irrigation canal or groundwater, water from any of these sources would be accounted for under PVID's water right. PVID currently charges $85/acre-foot for water supplied for irrigation purposes (PVID 2003a, PVID 2003b).

PVID's Pipeline Route to BEP II

Alternative 2 – Irrigation Return Water from PVID would require construction of an approximately 1.5 mile water supply pipeline from a turnout on PVID's Rannells Drain to BEP II. The pipeline would be expected to follow one of the two alternative routes described below. (See **Soil & Water Resources Appendix Figure 1** at the end of this report for the Alternative A & B pipeline routes)

Pipeline Route Alternative A (1.5 miles)

- Beginning at a new turnout from Rannells Drain adjacent to 12th Ave., and approximately 0.5 miles west of Highway 78;
- West approximately 1.0 mile along Riverside Drive, which turns to Chanslor Way (12th Ave.) to the northern boundary of the BEP II site;
- Inside the project boundary, the pipeline would run along the property centerline in a southerly direction to tie-in to the BEP II water tank.

Pipeline Route Alternative B (1.5 mile)

- Beginning at a new turnout from Rannells Drain adjacent to Hobsonway, and approximately 0.5 miles west of Highway 78;
- West approximately 1.0 mile along Hobsonway to the southern boundary of the BEP II site;
- Inside the project boundary, the pipeline would run along the property centerline in a northerly direction to tie-in to the BEP II water tank.

Conveyance of the irrigation return water via one pump station located at the new turnout from Rannells Drain would likely be the most economical arrangement. The pump station would require an area of about 0.1 acres to accommodate parking, a wet well (underground sump) for submerging the pump inlets, a small housing to cover pumping equipment and controls, and to provide electrical service. Electrical service would be extended using wood poles and overhead line.

The water pipeline would be constructed within appropriate rights-of-way. Along paved roads, the pipeline would be constructed preferably along the shoulder, so as to work within the existing road easement and areas already affected by the road. This would also avoid or minimize disturbance to vehicle travel. Through agricultural fields, the pipeline would be constructed within existing public utility easements or within or along the shoulder of agricultural access roads wherever possible. If the pipeline requires any road crossings, construction of 2 – 5 days duration would be staged to allow vehicle traffic to share a minimum of a single lane. The trench dimensions would generally be about 4 feet wide by 5 feet deep. Temporary construction disturbance along the pipeline route would average about 50 feet wide, for a total of about 6 acres. Along the water pipeline route, the surface would be restored to existing conditions. No new permanent access roads would be required.

2.4 IRRIGATION RETURN WATER FROM PVID WITH HYBRID COOLING – ALTERNATIVE 3

Using Irrigation Return Water from PVID with Hybrid Cooling – Alternative 3 is similar to Alternative 2 - Irrigation Return Water from PVID with Wet Cooling, except for the demand for cooling water is reduced to about one third of the average annual demand of a wet cooling system, or about 1,100 AFY rather than 3,300 AFY respectively.

2.5 DRY COOLING – ALTERNATIVE 4

Dry cooling would require only about 100 AFY and thus could rely on the existing BEP I water system, and avoid any new infrastructure or disturbance outside of the BEP power plant boundaries. Dry Cooling would also be associated with wastewater treatment consisting of a Zero Liquid Discharge (ZLD) to solids system. Dry Cooling is more fully described in **Section 3.**

2.6 DRY COOLING WITH 50 MW PEAKER – ALTERNATIVE 5

Dry Cooling with 50 MW Peaker would require only about 150 AFY and thus could also rely on the existing BEP I water system, and avoid any new infrastructure or disturbance outside of the BEP power plant boundaries. The addition of a 50 MW peaking unit is a reasonable means to offset losses from dry cooling during high ambient temperatures of the proposed 520 MW BEP II power plant. The peaker would be expected to be capable of producing nearly 50 MW under all ambient air conditions. For a worst-case condition at ambient air temperatures of 114°F, the expected capacity loss of the dry-cooled BEP II plant would be about 34 MW, which could be more than offset by the 50 MW peaker, for a net increase in generating capacity of up to 16 MW compared to the proposed project. At more moderate ambient temperatures, the expected capacity loss of the dry-cooled BEP II plant would be about 8 MW. When offset by the 50 MW peaker, the combined generating capacity could realize a net increase of up to 42 MW more than the proposed project. Fuel use and costs would not change significantly as a portion of the fuel that would be used for the proposed project for peaking during high ambient temperatures coinciding with lower fuel efficiency, could instead be used by the 50 MW unit. The change in operating and maintenance costs would be negligible compared to the proposed project, since the 50 MW unit would not require additional staffing and would need minimal maintenance considering its limited hours of operation each year.

2.7 USBR'S PROPOSED LOWER COLORADO WATER SUPPLY PROJECT

The Lower Colorado Water Supply Project (LCWSP) was authorized by Congress in 1986 to supply water for domestic, municipal, industrial, and recreational purposes. The eligible beneficiaries are limited to persons or agencies whose lands or interests in lands are located adjacent to the Colorado River in California within the accounting surface, who do not hold rights to Colorado River water or whose rights are insufficient to meet their present or anticipated future needs. The project consists of well fields in the Sand Hills along the All American Canal in Imperial County, and will have an ultimate capacity to supply up to 10,000 afy. Currently, Phase 1 of the project, which

has developed capacity for half, or 5,000 afy of the ultimate capacity, has contracted for 3,500 afy for the City of Needles and 1,150 afy for the U.S. Bureau of Land Management, leaving 350 afy of unallocated existing capacity and 5,000 afy of additional capacity yet to be developed. Imperial Irrigation District assumed the operation and maintenance responsibilities for the Phase I project beginning in 2000.

The process for obtaining water from the LCWSP begins by submitting an application to the Colorado River Board (CRB). After reviewing the application, the CRB provides its recommendation to USBR. If approved by USBR, the City of Needles who serves as USBR's contractor, is contacted to administer the subcontract. An initial cost of $300 per acre-foot is assessed for the subcontract quantity of water, as well as an annual cost of about $250 per acre-foot for project operations and maintenance. LCWSP water is delivered via existing water conveyance facilities using a portion of Imperial Irrigation District's or Coachella Valley Water District's Colorado River entitlements in exchange for an equivalent quantity and quality of groundwater as developed by the LCWSP.

Water for agricultural uses is not available from the LCWSP, nor is supply within an existing purveyor's service area where adequate water supplies already exist. In the case of BEP II, because it is located within PVID's service area, it is not eligible to be supplied by the LCWSP. Therefore, this alternative was not explored further. (CRB 2003a)

2.8 PROJECTED QUALITY & QUANTITIES OF ALTERNATIVE WATER SUPPLIES COMPARED TO BEP II DEMANDS

The availability of alternative water supplies from the City of Blythe's WWTP and PVID's irrigation return flows is presented by time increments (2003 to 2030) in **SOIL AND WATER RESOURCES APPENDIX Table 1**.

SOIL AND WATER RESOURCES APPENDIX Table 1
Comparison of BEP II's Dependency on Fresh Water & Availability of Alternative Water Supplies based on Average & Peak BEP II Demands (mgd)

Source	2003	2006	2010	2020	2030	TDS
Proposed Project – Use of Colorado River Groundwater with Wet Cooling @ BEP II Avg. Demands						
PVID's Groundwater	N/A	2.4	2.4	2.4	2.4	1010
Proposed Project – Use of Colorado River Groundwater with Wet Cooling @ BEP II Peak Demands						
PVID's Groundwater	N/A	4.0	4.0	4.0	4.0	1010
Alt. 1: Reclaimed Water from City of Blythe's WWTP with Wet Cooling– Winter Flows @ BEP II Avg. Demands						
City of Blythe's Wastewater	1.5	1.6	1.7	2.0	2.5	1185
Supplemental Water	N/A	0.8	0.7	0.4	0	
Alt. 1: Reclaimed Water from City of Blythe's WWTP with Wet Cooling – Summer Flows @ BEP II Peak Demands						
City of Blythe's Wastewater	2.1	2.3	2.5	3.0	3.7	1185
Supplemental Water	N/A	1.7	1.5	1.0	0.3	
Alt. 2: Irrigation Return Water from PVID with Wet Cooling – Winter Flows @ BEP II Avg. Demands						
PVID's Irrig. Return Water	2.4	2.4	2.4	2.4	2.4	1550
Supplemental Water	N/A	0	0	0	0	
Alt. 2: Irrigation Return Water from PVID with Wet Cooling – Summer Flows @ BEP II Peak Demands						
PVID's Irrig. Return Water	4.0	4.0	4.0	4.0	4.0	1550
Supplemental Water	N/A	0	0	0	0	
Alt. 3: Irrigation Return Water from PVID with Hybrid Cooling @ BEP II Avg. Demands						
PVID's Irrig. Return Water	N/A	0.8	0.8	0.8	0.8	1550

Alt. 3: Irrigation Return Water from PVID with Hybrid Cooling @ BEP II Peak Demands						
PVID's Irrig. Return Water	N/A	1.3	1.3	1.3	1.3	1550
Alt. 4: Dry Cooling @ BEP II Avg. Demands						
PVID's Groundwater	N/A	0.15	0.15	0.15	0.15	1010
Alt. 4: Dry Cooling @ BEP II Peak Demands						
PVID's Groundwater	N/A	0.35	0.35	0.35	0.35	1010
Alt. 5 – Dry Cooling w/ Peaker @ BEP II Avg. Demands						
PVID's Groundwater	N/A	0.2	0.2	0.2	0.2	1010
Alt. 5 – Dry Cooling w/ Peaker @ BEP II Peak Demands						
PVID's Groundwater	N/A	0.4	0.4	0.4	0.4	1010

Notes:
1) Assumes the average BEP II water supply requirements are 2.4 mgd for wet cooling, 0.8 mgd for 1/3 wet/2/3 dry hybrid cooling, and 0.15 – 0.20 mgd for dry cooling;
2) Assumes the peak BEP II water requirements are 4.0 mgd for wet cooling; 1.3 mgd for hybrid cooling, and 0.35 – 0.40 mgd for dry cooling;
3) Assumes the BEP II could begin operation by 2006, with average annual demands of 3,262 afy for wet cooling, 1,100 afy for hybrid cooling and 100 – 150 afy for dry cooling;
4) Colorado River water has a TDS concentration ranging from about 550 mg/l to 800 mg/l depending on season and hydrology.

Also presented is the amount of supplemental water that would be needed to supplement the alternative water in order to meet the average and peak demand requirements of BEP II. In addition, the table identifies the amounts of fresh or alternative water that would be required using the wet evaporative cooling towers as proposed by the applicant and alternative hybrid and dry cooling approaches.

Based on the above table, it is apparent that PVID's irrigation return water is the only alternative water source that will meet both average and peak demands for the proposed BEP II at the beginning of its projected operation in 2006. Reclaimed water from City of Blythe's WWTP is not projected to provide sufficient water supply to BEP II until around 2028 based on average daily flow and beginning around 2034 based on peak daily flow. In addition to considering the quantity of reclaimed water that may be available, other considerations include comparing water quality to understand the pre-treatment requirements, in addition to environmental impacts and cost. It is also apparent that the salinity (TDS) of PVID's irrigation return water is the highest compared to other sources of supply. **SOIL AND WATER RESOURCES APPENDIX Table 2** summarizes TDS concentrations for two water sampling periods collected by PVID, comparing the quality of Colorado River water to its irrigation return water

SOIL AND WATER RESOURCES APPENDIX Table 2
Observed Total Dissolved Solids (TDS) Measurements of Alternative Water Supplies (mg/l)

Location	September 2002	March 2003	Average
Colorado River Water @ PVID's Blythe Intake	552	728	640
Irrigation Return Water in Rannells Drain @ 24th Ave. Bridge	1,510	1,730	1,630
Total Irrigation Return Water @ the Colorado River Outfall	1,364	1,590	1,477

(PVID 2003d)

In comparison to the average TDS value of 1,630 mg/l shown above for irrigation return water in Rannells Drain, average values for City of Blythe's treated wastewater and the Mesa groundwater are 1,185 mg/l and 1,010 mg/l respectively. Clearly, in comparing water quality using TDS concentrations as an indicator, the irrigation return water in Rannells Drain is lower in quality compared to the Proposed Project (using Colorado River groundwater) and Alternative 1 – Reclaimed Water from City of Blythe's WWTP.

2.9 CONSISTENCY OF ALTERNATIVE WATER SUPPLIES WITH LOCAL AGENCY POLICIES

Clarity of Entitlement, Availability & USBR Accountability

As an indicator as to whether water use in accordance with the proposed project and considered alternatives could negatively impact other more senior entitlements to Colorado River water, staff has assessed the clarity of entitlement, its availability, and the ability to demonstrate accountability of water use for each. The intent of this comparison is to show the following:

a) A clear link to a specific and recognized Colorado River entitlement,

b) Authorization for use of a specified amount of water by the party who possesses the entitlement, and

c) That BEP II's water use over time will be properly included in the accounting method for Colorado River allocations and use.

This assessment is summarized as follows:

SOIL AND WATER RESOURCES APPENDIX Table 3
Comparison of Entitlement, Availability & USBR Accountability of Alternative Water Supplies

Alternative	USBR Accountability
Proposed Project – Use of Colorado River Groundwater with Wet Cooling Average Annual Water Use = 3,262 AFY	Indirectly Accountable – a) Applicant has not linked its proposed use of groundwater with a USBR-recognized entitlement to Colorado River water. b) PVID has not formally authorized BEP II's use of groundwater, because it does not normally regulate groundwater use within its District. c) USBR, USGS, PVID, CRB and staff believe Mesa groundwater is within the Colorado River accounting surface, yet USBR has no current methodology to account for groundwater use.
Alternative 1 - Reclaimed Water from City of Blythe with Wet Cooling Average Annual Water Use = 3,262 AFY	Indirectly Accountable – a) The treated wastewater is considered City of Blythe's use under PVID's entitlement until it is returned to groundwater via percolation ponds. After which, PVID considers the groundwater as part of its diversion less return of Colorado River water. b) City of Blythe and PVID would need to approve use of the treated wastewater. c) Reducing the return of treated wastewater to the groundwater aquifer is a less direct method of accounting for PVID's net use (diversion less return) than accounting for surface water in accordance with USBR's current procedures. USBR has no current methodology to account for groundwater use and returns.
Alternative 2 - Irrigation Return Water from PVID with Wet Cooling Average Annual Water Use = 3,262 AFY	Clearly Accountable – a) Linked to PVID's Priority 3 Colorado River water supply entitlement; b) PVID has indicated its willingness to supply Irrigation Return water; c) Included as part of PVID's Diversion less Return as monitored by USBR;
Alternative 3 - Irrigation Return Water from PVID with Hybrid Cooling Average Annual Water Use = 1,100 AFY	Clearly Accountable – a) Linked to PVID's Priority 3 Colorado River water supply entitlement; b) PVID has indicated its willingness to supply Irrigation Return water; c) Included as part of PVID's Diversion less Return as monitored by USBR;
Alternative 4 - Dry Cooling Average Annual Water Use = 100 AFY	Indirectly Accountable – a) Applicant has not linked its proposed use of groundwater with a USBR-recognized entitlement to use of Colorado River water. b) PVID has not formally authorized BEP II's use of groundwater, because it does not normally regulate groundwater use within its District. c) USBR, USGS, PVID, CRB and staff believe Mesa groundwater is within the Colorado River accounting surface, yet USBR has no current methodology to account for groundwater use.

Alternative	USBR Accountability
Alternative 5 - Dry Cooling with 50 MW Peaker Average Annual Water Use = 150 AFY	Indirectly Accountable – a) Applicant has not linked its proposed use of groundwater with a USBR-recognized entitlement to use of Colorado River water. b) PVID has not formally authorized BEP II's use of groundwater, because it does not normally regulate groundwater use within its District. c) USBR, USGS, PVID, CRB and staff believe Mesa groundwater is within the Colorado River accounting surface, yet USBR has no current methodology to account for groundwater use.

In considering the Proposed Project, staff believes that due to a lack of clarity for BEP II's proposed use in terms of entitlement, availability & USBR Accountability, that BEP II's use has significant cumulative impacts to other users of Colorado River water. Complicating the ability to account for groundwater use from the Lower Palo Verde Mesa (Mesa) is the following:

a) PVID does not currently regulate groundwater use within its District.

b) USBR has not implemented any generally applicable methodology to account for groundwater use within the Colorado River accounting surface.

c) The groundwater-surface water hydrology within the PVID indicates that consumptive use of Colorado River groundwater by the project will be counted against PVID's allocation based on diversion less return (see the Soil and Water Resources section of the Staff Assessment).

2.10 PROJECTED WATER CONVEYANCE COSTS OF ALTERNATIVE WATER SUPPLY & COOLING OPTIONS

SOIL AND WATER RESOURCES APPENDIX Table 4 below presents the design factors and approximate cost of constructing and operating the water supply pipelines and associated wells and pumping stations for each alternative.

SOIL AND WATER RESOURCES APPENDIX Table 4
Design Factors and Approximate Cost of Water Pipelines & Pumping

Description of Item	Proposed Project Colorado River Groundwater with Wet Cooling	Alt. 1 Reclaimed Water from City of Blythe's WWTP with Wet Cooling	Alt. 2 Irrigation Return Water from PVID with Wet Cooling	Alt. 3 Irrigation Return Water from PVID with Hybrid Cooling
Pipe material	No Pipeline	HDPE	HDPE	HDPE
Pipe Inside Diameter, Inches	Needed	30.0 / 18.0	30.0 / 16.0	20.0 / 10.0
Velocity @ 2,785 gpm, (6.2 cfs) fps		3.5	4.4	
Velocity @ 930 gpm, (2.1 cfs) fps				3.8
Friction loss, ft/100 ft		0.20	0.32	0.25
Length, ft		23,760	7,920	7,920
Friction loss, ft		48	25	20
Elevation gain, ft		100	90	90
Miscellaneous losses, ft		36	24	24
Total head, ft	150	184	139	134
Average pumping total power, BHp	175	220	165	55
Number of pump stations	1	1	1	1
Primary Pump Stations, typical pump Hp, 2 constant speed & 1 variable frequency	175 Hp / Pump (for 1 Well)	75 Hp / Pump	60 Hp / Pump	20 Hp / Pump
Pumping Energy @ 60 percent Duty Factor, 365 Days/yr, 24 Hours/day	686,000 KWH	863,000 KWH	647,000 KWH	216,000 KWH
Capital Cost Items				
Primary pump station or Well	600,000	450,000	400,000	300,000
Pipeline cost @$180/lf for 18-inch, & @$165/lf for 16-inch & $120/lf for 10-inch ID	0	4,280,000	1,310,000	950,000
Rannells Drain Turnout	0	0	150,000	100,000
Subtotal – Capital Costs	**600,000**	**4,730,000**	**1,860,000**	**1,350,000**
Engineering and services during construction @ 10%	60,000	473,000	186,000	135,000
Detail allowance & contingency @ 10%	60,000	473,000	186,000	135,000
Total Capital Cost	**$720,000**	**$5,676,000**	**$2,232,000**	**$1,620,000**
Water Pumping O&M Cost Items				
Annual pumping power cost @ $0.06/kWh	$ 41,000	$52,000	$39,000	$ 13,000
Annual maintenance	60,000	80,000	70,000	50,000
Annual labor	90,000	90,000	90,000	80,000
Total O&M Cost	**$191,000**	**$222,000**	**$199,000**	**$143,000**

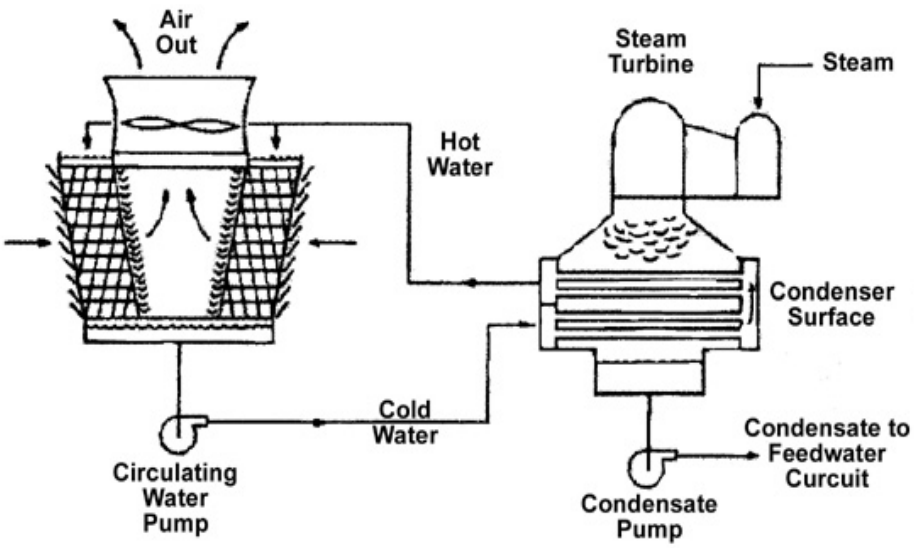
Note on Soil and Water Appendix Table 4: A cost of a water supply pipeline & pumping was not estimated for Alternative 4 – Dry Cooling and Alternative 5 – Dry Cooling with 50 MW Peaker, because there would be no such infrastructure outside of the plant boundaries.

CONCEPTUAL DESIGNS OF COOLING TECHNOLOGY OPTIONS

3.1 EQUIPMENT REQUIRED AND BASIC CONFIGURATION

As discussed above, wet cooling towers are proposed in the AFC and Supplements. For comparison purposes, a schematic representation of the proposed main wet cooling system is shown below in **SOIL AND WATER RESOURCES APPENDIX Figure 2** (CEC/EPRI 2002). With this design, exhaust steam from the steam turbine is condensed by a "surface condenser", which in turn is cooled by circulating water, which is cooled by the cooling towers.

SOIL AND WATER RESOURCES APPENDIX Figure 2
Wet Cooling System with Surface Condenser and Mechanical Draft Cooling Tower

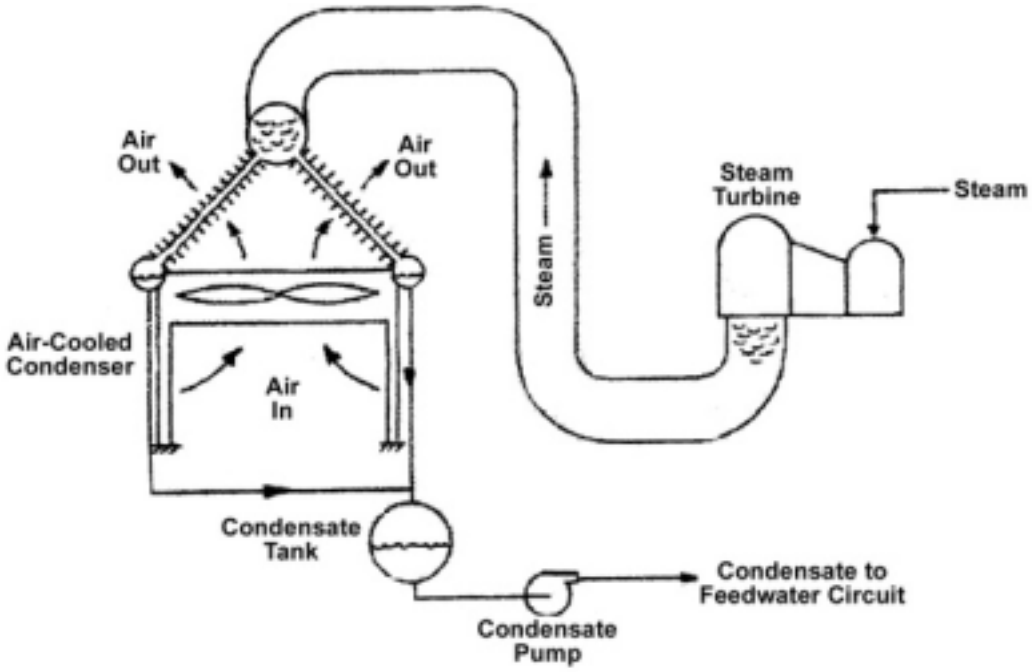


In the gas turbine inlet cooling system a similar diagrammatic representation can be used, by substituting the mechanical chiller system condenser for the steam turbine condenser. The chiller system condenses a refrigerant (ammonia or fluorocarbon) instead of steam, but is still very similar.

Dry cooling, or non-evaporative cooling, is accomplished using Air Cooled Condensers (ACCs). The ACC's consist of multiple finned heat exchange tubes mounted on a large steel framework as shown in the schematic representation below in **SOIL AND WATER RESOURCES APPENDIX Figure 3**. An ACC is somewhat like an automotive radiator, but much larger. The cooling media is ambient air. Fans are used to draw air in the bottom of the frames and direct it upward through the bundles of tubes discharging the warmed air to the atmosphere. The tubes are internally fed with exhaust steam from the steam turbine. The steam turbine exhaust is transported in steam ducts 13 to 17 feet in diameter. These very large ducts distribute steam to increasingly smaller headers and eventually to tubes of approximately 1-inch diameter. The ACC must be

located close to the steam turbine because of the expense of the large steam ducts both in terms of capital and operating costs.

SOIL AND WATER RESOURCES APPENDIX Figure 3
Diagram of Direct Dry Cooling System



The ACC is composed of multiple “cells”, each cell consisting of a single fan and many tubes over which the fan-forced air flows. The majority of ACC designs utilize fans of approximately 32 feet diameter. With this size, this installation could require anywhere from 30 to 45 “cells”.

The ACC is a simple device requiring no support equipment other than the electric power supply which is not conceptually different than that required for the wet cooling tower system, although more than double in power requirement. Because no cooling water is needed, there are several pieces of equipment that can be eliminated when using ACC. Cooling water supply piping, storage tanks, on-site chemical treatment equipment, and waste discharge piping are unnecessary with an air-cooled system. A schematic of an ACC is shown in **SOIL AND WATER RESOURCES APPENDIX Figure 3**. Note that the wind barrier surrounding the coils is not shown in the diagram. The ACC visually looks like a large box on narrow columns, the box being the wind barrier that surrounds the cells and extends from approximately 35 ft from the ground to 85 ft above the ground.

As in the case of evaporative cooling, it is possible to cool the gas turbine inlet cooling system using a radiator for the ultimate heat sink rather than the evaporative (cooling tower) system. Diagrammatically it would look similar to the above sketch except refrigerant rather that steam is condenser in the cooling coils.

Hybrid cooling is an option considered for this location by this study. The driving situation in this case is that some volume of non-potable water, including irrigation return and treated wastewater, could be made available. The AFC indicates that there is not enough to supply all 3,300 AFY of cooling requirements, but as indicated above, at least 1,100 AFY may be available from the most limited alternative source of water supply, from City of Blythe's WWTP. Therefore, this study includes a hybrid cooling system where 2/3 of the cooling requirements might be provided by ACC, and 1/3 by available alternative water. There are many variations of design of hybrid cooling that might perform the cooling function in this situation. All have tradeoffs related to economics and operating regime (base-load or peaking, 12 month or seasonal, etc.).

3.2 STUDY PROCESS

This Water Supply and Cooling Options Study may not necessarily use the exact economic factors and other criteria that an owner would use in designing its power plant. However, many studies, including the Electric Power Research Institute (EPRI)/Energy Commission study and recent multiple studies done by applicants for Energy Commission plant authorizations as well as staff and support organizations, provide data/information that leads us to conclude that the selections made will not be materially different than those that will be made in an optimized design by the actual owner of a facility.

In an ACC or hybrid system, the layout of the plant needs to include locating the ACC near the steam turbine. This is because the steam duct from the turbine to the ACC is expensive and a source of pressure loss and thus efficiency loss. In order to minimize the loss it is usual to arrange the power plant so that these two devices are close to each other. The wind also affects plant layout. ACC performance and reliability are particularly sensitive to wind direction, and needs to be located with consideration to "wind storms" as well as prevailing wind. However, at this site the necessity of changing the plant layout should have minimal/moderate consequences, as the available space is very flexible as well as large. In AFC Appendix 6.0, the applicant includes the cost of new engineering/design for a plant with ACC. This is apparently based on the premise that the evaporative cooling tower design is "standard" and any other design will cost additional.

For this study the assistance of GEA Power Cooling Systems, and Hamon is specifically recognized and appreciated. These are major suppliers of both evaporative and dry condenser cooling equipment and systems. They have provided estimates of cooling system performance, cost, auxiliary (parasitic) power requirements, size and arrangement, for ACC and hybrid designs.

3.3 INFORMATION USED

The technical information needed for a study of this type includes basic cooling system design, cost information, and other application information such as structural, noise, and performance data. This type of information for ACC and evaporative cooling tower systems has been developed for many facilities that the Energy Commission has evaluated over the last several years. This category of information includes Palomar

Energy Project, Potrero, Cosumnes, Morro Bay, Three Mountain Power Project, and Tesla power projects. This background of information is one of the sources used in this evaluation.

A major study was prepared in February of 2002, by EPRI and the Energy Commission, on the subject of alternate cooling methods applicable to power plants in California. This provides a substantial source of useful information in the evaluation of alternate cooling methods in major California climatic areas, and was used here as well.

Useful weather information for the project site was obtained from data recorded at the Blythe Airport, and published by the Western Regional Climate Center or WRCC. This is associated with the Desert Research Institute and administered by the National Oceanic and Atmospheric Administration.

Staff has reviewed and utilized to a significant extent in this Water Supply and Cooling Options Study the cost information as provided by the applicant in its study of cooling options, AFC Appendix 6.0.

3.4 DESIGN CRITERIA/ECONOMIC OPTIMIZATION

Cooling system design criteria are substantially affected by the available water supply. When low cost water is available, the cost of ACC is generally greater than the cost of evaporative cooling both in terms of capital cost and operating cost. Because of the higher ACC cost, the normal process of optimizing economics results in a system that causes a higher steam turbine back pressure for the ACC than for evaporative cooling. One consequence of ACC selection is a reduction in the ultimate capacity of the steam turbine at higher ambient temperatures. The amount of reduced capacity of the steam turbine is a function of balancing the greater capital cost of the ACC in relation to the lost revenue of the lower peak capability on the few high ambient temperature days. The final selection of ACC size varies with the applicant's view of future power prices during peak conditions and the applicant's overall project-specific economic objectives.

This is an important issue since only the applicant can perform the final optimization of plant design in compliance with its specific project economic factors and belief in future power sales. However, because many California power plants use similar sized gas fueled combined cycle plants, it is possible for this study to achieve reasonably accurate results, typical of a feasibility study.

Other than economics, the most important variables in determining the cost and performance of cooling alternatives at this location will be the criteria used for noise and visual impact. For that reason an evaluation of both of these factors are necessary in this evaluation. The proximity of the Blythe Airport means that the thermal plume and the vapor plume from the power plant are factors that need to be analyzed in consideration of aircraft safety.

3.5 COOLING TOWER EQUIPMENT SIZE

Evaporative

The proposed cooling tower as designed consists of 8 cells and is 52 feet by 472 feet ground surface (footprint) (AFC Appendix 6.0 Alternatives). Height of the cooling tower is given as several different values in varying places in the AFC, but Appendix 6.0 specifies "approximately 41 ft high". The footprint area of the above cooling tower is 24,544 ft^2; the volume is 1.006 million cubic feet.

ACC

This study concludes that the most likely ACC design, when accomplished by the applicant using its own economics and other criteria, would likely use 45 "cells." These would be configured in a 9 cell by 5 cell array. Therefore the size of the ACC would be approximately 350 ft by 200 ft, or 70,000 ft^2 (AFC Appendix 6.0 specifies 380 ft by 190 ft, with a height of 117 ft). The 17 ft diameter main steam duct would achieve an upper height of 115 ft above ground level (Appendix 6.0 specifies 20 ft diameter steam duct). The volume of the main structure would be approximately 7.0 million cubic feet. **SOIL AND WATER RESOURCES APPENDIX Figure 4** (located at the end of this appendix) shows a modified BEP II arrangement accommodating dry cooling.

Hybrid

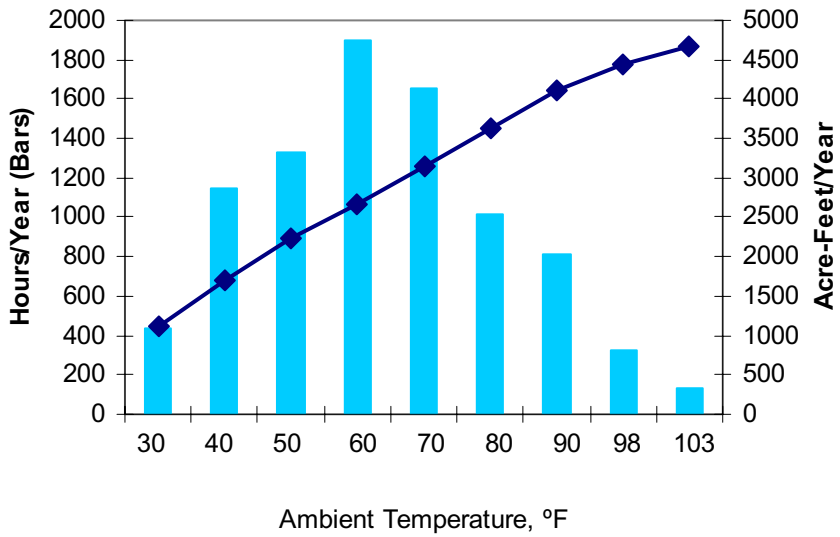
The Hybrid option would optimize somewhat differently since the cost of the evaporative portion of the system would be a comparatively low cost. This study concludes that 30 cells of ACC would be used, along with a single-cell evaporative cooling tower. This would require 2 areas; one of ~255 by 196 ft for ACC, and one of 42 ft square for the evaporative cooler; 51,744 ft^2 total area.

3.6 EVAPORATIVE COOLING WATER USE AS A FUNCTION OF AIR TEMPERATURE

In order to understand the relationship of BEP II water demands for cooling as a function of air temperature, staff has prepared an analysis to illustrate the increase in cooling water required using wet tower technology as temperature increases. The temperature history of the plant, using Desert Research Institute data, has been partitioned into 10 ºF "buckets". Each bucket is represented by its center. Thus, as an example of reading the chart, the bar chart for 50 ºF indicates that temperatures from 45 to 55 ºF are reached about 1,300 hours each "typical" year. At this temperature the plant as proposed would consume approximately 2,200 AFY, reading off the continuous dark line. Thus, if only 2,200 AFY water were available, the plant could operate (400 + 1100 + 1300) 2,800 hours per year out of 8,760 hours total, until other cooling was required.

SOIL AND WATER RESOURCES APPENDIX Figure 5

Blythe 2
Water Required vs Temperature



3.7 COOLING TOWER CAPITAL & OPERATING COSTS

Capital Cost

The evaporative cooling system as proposed requires the cooling tower, a condenser, supporting storage tanks, the well system, chemical controls, and the means of handling the cooling tower blowdown; the brine concentrator and evaporation pond. By comparison, the ACC requires none of these supporting systems, although the complete water system for process water is still required. The process water system consumes approximately 1% of the requirements of the evaporation cooling system.

The hybrid system would handle about 1/3 of the water that the full evaporative system requires, thus the supporting systems, while similar to the evaporative system, would cost somewhat less.

In preparing estimates of the considered cooling options, comparison is made with the applicant's similar consideration in Appendix 6.0 of the AFC. Cooling, or a heat sink, is required in two systems of the power plant; the steam turbine condenser and the gas turbine inlet cooling system (GTIC). For purposes of this study staff considered the steam turbine condenser cooling requirements. In Appendix 6.0 the applicant used as its base design, evaporative cooling for both the gas turbine inlet cooling system and the steam turbine condenser. In the AFC Supplement, the applicant assumes a mechanical chiller system for the GTIC which then transfers heat to a cooling tower specifically for the inlet cooling system, separate from the steam turbine condenser cooling system. Then, in postulating a dry or ACC for comparison purposes, the applicant assumed the heat sink for the gas turbine inlet cooling system would also use

a radiator for the ultimate heat sink, which is essentially the same as the ACC for the steam turbine condenser. Therefore the values the applicant reaches vary somewhat from the staff values.

Estimates for each of the considered options are summarized in **SOIL AND WATER RESOURCES APPENDIX Table 5** below. The costs are study level estimates only, more suitable for comparison rather than as absolute values.

The Estimated Capital Costs for Cooling Options as summarized above in **SOIL AND WATER RESOURCES APPENDIX Table 5** contribute to the analysis of total alternative costs as later summarized in **SOIL AND WATER RESOURCES APPENDIX Table 7**. For comparison purposes, Sutter Energy Center is in an area where 1% highest temperature is 101 ºF, compared to Blythe at 112 ºF. Sutter uses a 30 cell ACC, and is reported to have incurred an increase in capital plant costs of $10 million (Fahey 2003). Staff anticipates BEP II would use a 45 cell ACC resulting in an estimated increase in capital plant costs of about $18 million. The total capital cost of the BEP II plant is estimated to be $250 Million (per AFC Section 1.5).

SOIL AND WATER RESOURCES APPENDIX Table 5
Estimated Capital Costs for Cooling Options ($ millions)

	Evaporative System		Dry ACC System		Hybrid
	Applicant **	Staff	Applicant ***	Staff	Staff
Condenser	2.0	included	0	included	included
Cooling Tower	3.0	"	0	"	"
Circ Water Pumps	0.6	"	0	"	"
Condensate Pumps	0.4	"	Not Included*	"	"
ACC Purchase			23.5	18.0	14.0
Construction	1.2		9.4	14.0	13.0
Subtotal	**7.2**	**8.0**	**32.9**	**32.0**	**27.0**
Evaporation Ponds	3.2	2.5	1.2	0	1
Water Treat Equip/Brine Concentrator	7.5	5.5	3.0	1.0	2.5
Added Engineering.	0.0		0.5	0.5	0.5
Change "Standard" plant design	0.0	0.0	1.5	0.0	0.0
Subtotal	**10.7**	**8.0**	**6.2**	**1.5**	**4.0**
Constructed Sum	**17.9**	**16.0**	**39.1**	**33.5**	**31.0**
Capital Cost in Excess of Evap. Cooling	Base	Base	+ 21.2	+ 17.5	+ 15.0
Capacity Cost, $/kw			40.8	33.7	28.8

* Not evident why condensate pumps are not included here. They should be essentially same with either option. Not significant.

** Option includes gas turbine inlet air cooling accomplished by cooling tower for all cooling, per Appendix 6.0.

*** Option includes gas turbine inlet cooling using mechanical chiller with an air cooled heat sink – another form of air cooled condenser.

Operating Cost

The operating cost of the evaporative system for steam turbine condenser and mechanical chiller with evaporative cooling tower heat sink, which is now the proposed design, is considered the "baseline," and any changes resulting from selection of the options are evaluated

Since the AFC Appendix 6.0 uses both gas turbine inlet cooling and main condenser cooling, and the staff study uses only main condenser cooling, the results are in close agreement. In any case, the differential energy consumption is very small compared to the total cost of generation of electricity. The Estimated Operating Costs for Cooling Options as summarized above in **SOIL AND WATER RESOURCES APPENDIX Table 6** contribute to the analysis of total alternative costs as later summarized in **SOIL AND WATER RESOURCES APPENDIX Table 7**. The total annual BEP II operating costs

are estimated at $8 Million/yr for O&M & $175 Million/yr for fuel, totaling $183 Million/yr per AFC Section 1.5.

.SOIL AND WATER RESOURCES APPENDIX Table 6
Estimated Operating Costs for Cooling Options ($ millions)

	Evaporative System		Dry ACC System		Hybrid
	Applicant	Staff	Applicant	Staff	Staff
Parasitic	Power				
Fans	8 of 160 hp	8 of 170 hp	50of 164 hp	45of 200 hp	31of 200 hp
Fan energy, kwh / yr	5.6 million	7.1 million	35.6 million	37.8 million	26.0 million
Circulating Water Pumps	2 of 1100 hp	2 of 800 hp	N/A	N/A	1 of 400 hp
Pump energy, kwh / yr	13.6 million	9.9 million	0	0	4.7 million
Water Well Pumps	150 hp	150 hp	0	0	100 hp
Pump energy, kwh / yr	1.1 million	1.0 million	0	0	0.8 million
Wastewater Treatment	1.2 MW	1.2 MW	0.24 MW	0.24 MW	Included
Energy, kwh/yr	10.8 million	10.0 million	2.2 million	2.2 million	1.0 million
Subtotal,kwh/yr	31.1 million	28.0 million	37.8 million	40.0 million	32.5 million
Gas Turbine Inlet Cooling kwh/yr	21.6 million	0.0	39.2 million	0.0	0.0
Energy Sum kwh/yr	52.7 million	28.0 million	77.0 million	49.9 million	32.5 million
Value @ 3 ¢/kwh, M $/yr	1.581	0.840	2.310	1.497	0.975
Energy Addition for ACC, M$/yr			0.729	0.657	0.135
Cost of Energy, $/kwh			0.00017	0.00015	.00003
Other	Factors				
Chemical Costs	$350,000/yr	$300,000/yr	$50,000/yr	$20,000/yr	$120,000/yr
Other O&M			Differences	are trivial	

3.8 INCOME OR PEAK POWER PENALTY

The cost of providing the additional auxiliary (parasitic) power for the ACC or hybrid option is expressed above in operating costs. However, there are other costs of selecting either of the options compared to evaporative cooling.

- The greater consumption of auxiliary power reduces the peak load capability of the plant, thus potentially reducing capacity payments.
- Typical economically designed ACC or hybrid systems will result in higher steam turbine back pressure – and lower generating capacity - during hot weather periods when the potential income is typically greatest.

The parasitic or auxiliary power that is used for cooling the steam turbine condenser is unavailable for delivery to the grid. The cost of generating that power has been estimated based on typical power values in California over the past year, considering a likely replacement cost averaging $30 per MWH. However, the revenue per unit of electric power will typically be greatest during the hot weather, which is when the auxiliary power requirement is greatest. The higher auxiliary load in essence creates a "smaller" power plant.

Another typically greater source of peak power loss is the reduction in power capability (or plant capacity) during hot weather. Since either the ACC or the hybrid has a greater capital cost than the evaporative system, optimizing economics will result in poorer steam turbine performance and lower peak power capability. This is particularly acute on hotter weather days as the amount of loss increases.

These two sources of income reduction (parasitic power and plant capacity) are difficult to evaluate. Accuracy would require knowledge of either the applicant's power sales arrangements, or if power is to be sold at market rates, knowledge of future power prices. These data are neither available nor accurately predictable at this time. As a general guideline, the Energy Commission/EPRI study evaluated these losses for 500 MW nominal power plants at various locations using several assumptions, and concluded that the most likely losses would be in the range of $0.8 to $2 million per year. It might be expected that this plant would be on the higher end of this cost range as it is located in a temperature extreme location. Therefore, staff has evaluated the effect of lost power generation within expected best to worst case scenarios assuming power values ranging from $30 to $60 per MWH as included in **SOIL AND WATER RESOURCES APPENDIX Table 7** below. Staff has also evaluated Alternative 5 – Dry Cooling with 50 MW Peaker to consider the benefits of adding peaking capacity as a possible means to offset losses from dry cooling during high ambient temperatures of the proposed 520 MW BEPII power plant.

4. COST COMPARISON AND ENGINEERING MEASURES FOR WATER CONSERVATION

An economic summary of the proposed project and cooling and water supply alternatives is presented in **SOIL AND WATER RESOURCES APPENDIX Table 7**. This analysis serves to combine the water supply cost elements developed in Section 3 and cooling cost elements developed in Section 4 of this Appendix A, and provide a bottom line equivalent basis for cost comparison of the respective alternatives with the proposed project.

SOIL AND WATER RESOURCES APPENDIX Table 7
Economic Summary of Alternatives & the Proposed Project (Interest Rate of 7%)

Cost Component	Proposed Proj.	Alt. 1 - Blythe's	Alt. 2 - PVID Irrig.	Alt. 3 - PVID Irrig.	Alt. 4	Alt. 5
	Ground Water	Reclaim Water	Return Water	Return Water	Ground Water	Ground Water
Capital Costs	& Wet Cooling	& Wet Cooling	& Wet Cooling	& Hybrid Cooling	with Dry Cooling	with Dry Cooling
		4.5 mi. of 18" @ $180/lf	1.5 mi. of 16" @ $165/lf	1.5 mi of 10" @ $120/lf	Use BEP1 Water	& 50 MW Peaker
Water Pipeline & Well/Pump Station (Table 5)	$720,000	$5,676,000	$2,232,000	$1,620,000	$0	$0
BEP2 Water Treatment System (AFC App. 6)	$7,500,000	$9,500,000	$10,500,000	$3,000,000	$1,500,000	$1,500,000
Wet Cooling Tower	$8,000,000	$8,000,000	$8,000,000			
Hybrid Cooling Tower				$27,000,000		
Dry Cooling Tower					$32,000,000	$32,000,000
50 MW CT Peaker Unit	$0	$0	$0	$0	$0	$19,500,000
Evaporation Ponds (AFC App. 6)	$3,200,000	**$3,200,000**	**$3,200,000**	$1,000,000	$0	$0
786 acres @ $3250/acre						
WCOP Program Fallowing Initial Cost	$2,555,000	**$0**	**$0**	$0	$0	$0
Subtotal - Pres. Value of Capital Costs	**$21,975,000**	**$26,376,000**	**$23,932,000**	**$32,620,000**	**$33,500,000**	**$53,000,000**
Equiv. Annual Cost of Capital	**$1,655,034**	**$1,986,493**	**$1,802,424**	**$2,456,756**	**$2,523,032**	**$3,991,663**
Annual O&M Costs						
Annual Water Pumping O&M/Energy (Table 4)	$191,000	$222,000	$199,000	$143,000	$0	$0
Annual BEP2 Water Treatment Operations	10,816 MWH x $30/MWH					
Energy (Table 6)	$325,000	$385,000	$475,000	$110,000	$40,000	$50,000
Chemicals (Table 6)	$350,000	$400,000	$450,000	$120,000	$20,000	$25,000
O&M Labor & Parts	$100,000	$110,000	$120,000	$40,000	$20,000	$25,000
Annual BEP2 Water Treatment O&M	$775,000	$895,000	$1,045,000	$270,000	$80,000	$100,000
13,655 MWH x $30/MWH						
Circulating Water Pump Energy (Table 6)	$410,000	$410,000	$410,000	$140,000	$0	$0
5,561 MWH x $30/MWH						
Cooling Tower Fan Energy (AFC App. 6)	$167,000	$167,000	$167,000	$56,000	5,627 MWH x $30/MWH	35,627 MWH x $30/MWH
Air Cooled Condensor Energy (AFC App. 6)				$700,000	$1,069,000	$1,069,000
786 acres x $500/acre						
WCOP Program Fallowing Annual Cost	$393,000					
		3,262 AF x $60/AF	3,262 AF x $85/AF	1,100 AF x $85/AF		
Annual Water Purchase Cost		$196,000	$277,000	$94,000	$0	$0
Subtotal - Annual O&M Costs	**$1,936,000**	**$1,890,000**	**$2,098,000**	**$1,403,000**	**$1,149,000**	**$1,169,000**
PV of Annual Costs (2003 $, 7%, 30 Years)	**$25,705,577**	**$25,094,804**	**$27,856,560**	**$18,628,577**	**$15,256,048**	**$15,521,601**
	Costs before Considering Lost (or Gained) Power Revenues					
PV of All Costs (2003 $, 7%, 30 Years)	**$47,680,577**	**$51,470,804**	**$51,788,560**	**$51,248,577**	**$48,756,048**	**$68,521,601**
Total - Annual Costs - Capital & O&M	**$3,591,034**	**$3,876,493**	**$3,900,424**	**$3,859,756**	**$3,672,032**	**$5,160,663**
Incremental Power Prod. Cost ($/KWH)	**$0.00117**	**$0.00126**	**$0.00127**	**$0.00126**	**$0.00120**	**$0.00168**
% of Total BEP2 Prod. Cost @ $.035/KWH	**3.3%**	**3.6%**	**3.6%**	**3.6%**	**3.4%**	**4.8%**
Difference in % with Proposed Project	**0.0%**	**0.3%**	**0.3%**	**0.3%**	**0.1%**	**1.5%**
% of Total BEP2 Prod. Cost @ $.050/KWH	**2.3%**	**2.5%**	**2.5%**	**2.5%**	**2.4%**	**3.4%**
Difference in % with Proposed Project	**0.0%**	**0.2%**	**0.2%**	**0.2%**	**0.1%**	**1.0%**

To bracket the range of costs for all alternatives, staff summarizes the difference in cost between the proposed project and the dry cooling alternatives. Before considering the lost power revenues associated with Alt. 4 - Dry Cooling, or the gained revenues associated with Alt. 5 - Dry Cooling & a 50 MW Peaker, the total BEP II production costs of these alternatives compared to the proposed project differ by a maximum of only 1.5%.

After considering the lost power revenues associated with Alt. 4 - Dry Cooling, or the gained revenues associated with Alt. 5 - Dry Cooling & a 50 MW Peaker, the total BEP II production costs of these alternatives compared to the proposed project are estimated as follows:

(Continuation of SOIL AND WATER RESOURCES APPENDIX Table 7)

	Costs with Effect of Lost (or Gained) Power Revenues @ $30/MWH					
Est. Ann. Loss (or Gain) of Pwr. Revenue	$0	$0	$0	$1,200,000	$1,840,000	($525,600)
Avg. Ann. Costs w/ Lost/Gained Power	**$3,591,034**	**$3,876,493**	**$3,900,424**	**$5,059,756**	**$5,512,032**	**$4,635,063**
Incremental Power Prod. Cost ($/KWH)	**$0.00117**	**$0.00126**	**$0.00127**	**$0.00165**	**$0.00180**	**$0.00151**
% of Total BEP2 Prod. Cost @ $.035/KWH	**3.3%**	**3.6%**	**3.6%**	**4.7%**	**5.1%**	**4.3%**
Diff. in % with Prop. Proj. @ $.035/KWH	**0.0%**	**0.3%**	**0.3%**	**1.4%**	**1.8%**	**1.0%**
% of Total BEP2 Prod. Cost @ $.050/KWH	**2.3%**	**2.5%**	**2.5%**	**3.3%**	**3.6%**	**3.0%**
Diff. in % with Prop. Proj. @ $0.050/KWH	**0.0%**	**0.2%**	**0.2%**	**1.0%**	**1.3%**	**0.7%**
	Costs with Effect of Lost (or Gained) Power Revenues @ $60/MWH					
Est. Ann. Loss (or Gain) of Pwr. Revenue	$0	$0	$0	$2,400,000	$3,680,000	($1,051,200)
Avg. Ann. Costs w/ Lost/Gained Power	**$3,591,034**	**$3,876,493**	**$3,900,424**	**$6,259,756**	**$7,352,032**	**$4,109,463**
Incremental Power Prod. Cost ($/KWH)	**$0.00117**	**$0.00126**	**$0.00127**	**$0.00204**	**$0.00240**	**$0.00134**
% of Total BEP2 Prod. Cost @ $.035/KWH	**3.3%**	**3.6%**	**3.6%**	**5.8%**	**6.9%**	**3.8%**
Diff. in % with Prop. Proj. @ $.035/KWH	**0.0%**	**0.3%**	**0.3%**	**2.5%**	**3.5%**	**0.5%**
% of Total BEP2 Prod. Cost @ $.050/KWH	**2.3%**	**2.5%**	**2.5%**	**4.1%**	**4.8%**	**2.7%**
Diff. in % with Prop. Proj. @ $0.050/KWH	**0.0%**	**0.2%**	**0.2%**	**1.7%**	**2.5%**	**0.3%**

1) Avg. Annual Generation is estimated at 3,066,000 MWH/yr assuming a Capacity Factor of 70% x 500 MW x 8,760 Hours/yr;
2) Annual lost power generation associated with Alt. 4 - Dry Cooling is estimated to average 2% of 3,066,000 MWH/yr = 61,320 MWH/yr;
3) Annual lost power generation associated with Alt. 3 - Hybrid Cooling (2/3 Dry, 1/3 Wet) is estimated to average about 40,000 MWH/yr
4) Annual Loss of Power Revenues or Lost Power associated with Hybrid & Dry Cooling is due to a reduction in operating capacity at high air temperatures coincident with peak power production periods;
5) Annual Gain of Power Revenues associated with Alt. 5 - Dry Cooling & 50 MW Peaker is estimated based on the peaker operating about 10% of 8,760 Hours/yr = 876 Hours; At an avg. increase in generation of 20 MW when the peaker operates, the net gain in generation is 20 MW x 876 Hours/yr = 17,520 MWH/yr; The 50 MW peaker offsets generation losses that would otherwise occur with dry cooling. Before accounting for the peaker, losses range from 34 MW at 114 degrees F, to 10 MW at l80 degrees F.
With a loss ranging up to 34 MW, the net gain in generation capacity would be 50 - 34 = 16 MW, and higher at less extreme temperatures.
6) Avg. annual power value is assumed to range from $30/MWH to $60/MWH
7) PV is the Present Value of cost over a 30-year period using 7% as the time value of money.

Staff evaluated the costs of the proposed project compared to the alternatives and concludes the costs are reasonably equivalent to implement any of the alternatives including dry cooling compared to the proposed project. Staff has developed two indicators for cost comparison intended to evaluate if alternatives to the proposed project are economically sound and feasible, and serving as the basis for its conclusions.

In considering water supply and cooling cost as a percent of total BEP II power production cost and to bracket the range of costs, even the highest cost alternatives (both Dry Cooling alternatives) are reasonably comparable to the Proposed Project highlighted as follows:

1. When assuming a power value of $30/MWH and the effects of lost power revenues associated with Alt. 4 - Dry Cooling, or the gained revenues associated with Alt. 5 - Dry Cooling & a 50 MW Peaker, the total BEP II production costs of these alternatives compared to the proposed project differ by a maximum of only 1.8%.

2. When assuming a power value of $60/MWH and the effects of lost power revenues associated with Alt. 4 - Dry Cooling, or the gained revenues associated with Alt. 5 - Dry Cooling & a 50 MW Peaker, the total BEP II production costs of these alternatives compared to the proposed project differ by a maximum of only 3.5%.

In considering the incremental power production cost attributable to only water supply and cooling, the results are highlighted as follows:

1. Before accounting for effects in power generation, Alternatives 1 – 4 are reasonably comparable in cost to the proposed project (within $0.0001 per KWH). Alternative 5 - Dry Cooling with 50 MW Peaker is $0.0005/KWH higher than the proposed project before considering the revenues from additional generation capacity.
2. The incremental power production cost is only about $0.0006 to $0.0012 per KWH higher (assuming power values ranging from $30 - $60 per MWH) to implement Alternative 4 - Dry Cooling compared to the proposed project.
3. The incremental power production cost is only about $0.0002 to $0.0004 per KWH higher (assuming power values ranging from $30 - $60 per MWH) to implement Alternative 5 - Dry Cooling with a 50 MW Peaker compared to the proposed project

Staff concludes all of the alternatives, including dry cooling, are economically sound and feasible and the associated costs will not significantly affect project economics or the owner's ability to market power among competitors. As further evidence of the viability of the highest cost alternatives associated with dry cooling, some of these competitors already rely entirely on dry cooling such as the currently operating Crockett and Sutter Power Plants, and Otay Mesa, which is under construction.

Incremental power production cost attributable to only water supply and cooling is calculated by dividing average annual costs for water supply, treatment and cooling by annual average energy production. Water supply, treatment and cooling cost as a percent of total BEP II power production cost is calculated by dividing the incremental power production cost attributable to only water supply and cooling by the applicant's estimated total BEP II power production cost ranging from $0.035 - $0.050/KWH.

While Dry Cooling would require an additional capital investment of about $12 million over the capital cost of the proposed project attributable to the larger cooling tower, annual BEP II O&M costs are about $800,000 less for Dry Cooling compared to the proposed project attributable primarily to water pumping, treatment and water purchase cost savings. Alternative 4 - Dry cooling would accomplish the highest conservation of fresh water, reducing average annual water use from 3,262 AFY to about 100 AFY. Alternative 5 – Dry Cooling with 50 MW Peaker would reduce annual water use to about 150 AFY. No new water supply infrastructure by way of wells, pumps or off-site pipelines would be needed, as the minimal 100 to 150 AFY needed to support dry cooling could be made available using the existing BEP I infrastructure. Water use associated with the dry cooling alternatives could likely be reduced to about 100 to 150 AFY if the gas turbine inlet cooling mechanical chillers used radiator (dry) coolers for the ultimate heat sink rather than evaporative coolers. While Alternatives 2 and 3 – Rannells Drain Water with either Wet or Hybrid Cooling would not achieve conservation of water to the degree of dry cooling, they would utilitze a degraded source of water. Althernatives 2 and 3 would need to have a verifiably effective WCOP to avoid impacts to other users of Colorado River water. Data in this table is intended to provide an equivalent basis for comparing the proposed project with alternative water supply and cooling methods.

Other Water Conservation Measures Considered

Wastewater Recovery Option - ZLD

Although the water conservation potential of implementing a complete Zero Liquid Discharge to Solid (ZLDS) system at BEP II is not significant compared to the proposed Zero Liquid Discharge of brine to evaporation ponds (ZLDB), there may be other environmental concerns that would lead to eliminating the evaporation ponds (6.48 acres total) and implementation of a complete ZLDS system. The proposed project already includes a brine concentrator for treatment and recovery of plant wastewater. The impact of eliminating the evaporation ponds would be an additional cost for ZLDS brine drying of about $5 million less a savings of about $3.2 million for the evaporation ponds, for a net increase in project cost of about $1.8 million. Water savings of about 100 acre-feet per year could be achieved, reducing the average annual demand from 3,262 AFY to about 3,162 AFY. Staff does not recommend implementation of a complete ZLD system on the merits of water conservation alone. Instead, other environmental issues, such as potential effects to wildlife or other considerations may require its use as mitigation for significant impacts.

ENVIRONMENTAL AND ENGINEERING ANALYSIS

5.1 AIR QUALITY

Testimony of Brewster Birdsall

Introduction

This discussion addresses the changes in emissions and air quality effects of: (1) selecting a degraded water supply and construction of the water conveyance pipeline, and (2) construction and operation of cooling technologies that would reduce water loss to evaporation and drift. The cooling options would also reduce the net power output of the plant because of increased parasitic power requirements over the proposed evaporative cooling system. This discussion assesses the economic "replacement cost" of the lost power, and therefore, assumes that the power plant would not need to increase emissions because of a change in the cooling technology.

PVID's Irrigation Return Water Supply Option

Construction of a water conveyance for the irrigation return water supply option would generate offsite emissions from construction equipment. The nature of these emissions would be similar to those identified for the equipment used onsite, but of a much smaller quantity. Depending on the width of the right-of-way needed to construct the 1.5-mile line, about 15 additional acres would be temporarily disturbed along the conveyance route. Although emissions from construction equipment would be short-term, with the additional linear facility needed for this water supply option, the construction emissions would be slightly greater, and the activities would extend for a slightly longer duration, than those of the proposed project. These emissions would be reduced by Conditions of Certification AQ-SC1 through AQ-SC4 in the Air Quality section of the FSA.

Changing the water supply could change operational emissions at the power plant if the total dissolved solids (TDS) content of the cooling water changes substantially. Cooling tower drift emissions (PM_{10}) were quantified in the AFC, and the supplement for inlet chilling, on the basis of a range of anticipated TDS from 4,000 mg/l (or ppm by weight) to 8,190 mg/l. When preparing the Air Quality section of this staff assessment, staff assumed that the cooling water used in either the cooling tower or the inlet chilling system could have TDS up to 8,190 mg/l. Staff's approach overestimates the PM_{10} emissions from cooling equipment as long as the cooling water is not cycled and concentrated through the cooling system to cause TDS over 8,190 mg/l. This issue would be addressed by a Condition of Certification (**AQ-40**) in the **Air Quality Section of the FSA**.

Irrigation return water would have higher TDS than the groundwater that would be used under the project proposal. Compared to the proposed project groundwater, which has been considered to have a TDS of 1,010 mg/l, irrigation return water is considered to have an average TDS of 1,630 mg/l. Because the irrigation return water supply would have TDS levels well below the 8,190 mg/l used in the Air Quality assessment, the cooling tower drift emissions would not be greater than those characterized in the Staff Assessment.

Operational emissions along the irrigation return water pipeline would only occur if internal combustion engines were used for pumping or emergency power. Because pumping irrigation return water to the power plant site would be accomplished with an electric pump system, no offsite operational emissions are expected.

Dry Cooling

Construction of a dry cooling system would cause a minor increase in the overall construction emissions to accommodate the larger footprint of the system (about one additional acre) compared to the evaporative cooling system proposed in the AFC. In the context of the 66 acres (76 acre site less 10 acres of cultural resource avoidance area) anticipated to be disturbed during on-site construction, the dry cooling option would result in only a minor change to the overall anticipated construction emissions.

Dry cooling systems eliminate cooling water contact with the ambient air, which eliminates potential emissions of cooling water droplets containing drift (PM_{10}). This option would eliminate all operational emissions (15.7 tons per year PM_{10}) from the proposed cooling tower.

Hybrid Cooling

Construction of a hybrid cooling option would involve an air cooled condenser (ACC) and an evaporative cooling tower of reduced footprint. The total area disturbed during construction of this option would be less than one additional acre, which would not substantially change the air quality impacts occurring during construction.

This hybrid cooling system would substantially reduce the quantity of cooling water that contacts the ambient air, which would reduce emissions of cooling tower drift (PM_{10}). Because it would handle approximately one-third of the water that the full evaporative cooling system would require, this option would eliminate approximately two-thirds of the operational PM_{10} emissions from the proposed cooling tower.

Conclusion

The irrigation return water supply option would increase construction emissions by requiring construction of an additional offsite linear facility for water conveyance. Operational emissions from cooling tower drift (PM_{10}) would not change from those shown in the staff assessment because the TDS of the water has been sufficiently overestimated (at a maximum of 8,190 mg/l) in the Staff Assessment.

Construction of the optional dry cooling or hybrid cooling systems would have similar air quality effects as construction of the cooling system proposed in the AFC. Eliminating or reducing the project's reliance on wet cooling would eliminate or reduce the drift emissions (PM_{10}) from the proposed cooling tower, which are a notable portion (about twenty percent) of the total proposed operational PM_{10} emissions of the plant. Dry cooling would entirely eliminate the cooling tower drift emissions.

The applicant would be required to comply with the Energy Commission Conditions of Certification regarding construction emissions to minimize impacts related to construction of the optional pipeline. With these measures, no substantial change in air quality impacts would occur.

5.2 BIOLOGICAL RESOURCES

Testimony of Natasha Nelson

Introduction

This section examines the potential impacts of alternative cooling systems to biological resources at the proposed BEP II site and surrounding areas. The use of degraded water is evaluated in comparison to the use of water from freshwater ecosystems. The use of dry and hybrid cooling was evaluated on the balance of benefits and impacts to freshwater ecosystems versus benefits and impacts to terrestrial species and their habitat. This analysis focuses on impacts to state and federally listed species, fully protected species, species of special concern, wetlands, and other areas of critical biological concern.

In order to determine the ecological significance of project impacts, staff relies primarily upon standards and guidelines established by the Federal and State Endangered Species Acts, the California Environmental Quality Act (CEQA), the Migratory Bird Treaty Act, items found in the Warren-Alquist Act, and recent Presidential (executive) orders relevant to biological resources (e.g., Executive Order 13112 for management of invasive species). Staff must determine significance based on whether populations of endangered, threatened, protected, and sensitive species or biotic communities will be adversely affected by BEP II. Significant impacts are those which affect a species' population size, geographic range, habitat, nesting success, and migration, or those that diminish, fragment, contaminate, or otherwise threaten biotic communities. The Fish and Game Code and other state and local regulations also help staff assess impacts. The above regulations direct Applicants to avoid and mitigate for the loss of habitat for sensitive species and to obtain permits for incidental take of protected species.

PVID's Irrigation Return Water Supply Option

The water borne contaminants are a biological concern because they impact the long-term survival of fish and wildlife populations. The electric conductivity, an indicator for salinity, in PVID canal water is estimated at over 2,000 ppm and total dissolved solids is over 1,700 mg/l (PVID 2003). The selenium is unmeasured, but investigations into selenium levels in Colorado River and its immediate drain water found selenium levels exceed the guidelines for protection of fish and wildlife resources (Radtke et al. 1988). It is likely that selenium levels in Rannells drain are high enough to be of biological concern. When cycled through the proposed project's brine concentrator and then discharged into the evaporation ponds, the PVID irrigation return water would expose birds and bats to levels of salinity and selenium that are unhealthy. This impact could be eliminated by the installation of a zero liquid discharge brine distiller in lieu of using evaporation ponds as part of the design.

The construction of a water supply pipeline would create disturbance in areas with burrowing owls, and potentially desert tortoise habitat. Additional conditions of certification in order to ensure impacts remained less than significant would be necessary. The cost to mitigate the water pipeline would be around $1,200 per acre of

disturbance in desert tortoise habitat, and on-site mitigation per owl pair (or resident individual) including reconstruction of burrows and monitoring of their success, and permanent habitat protection where needed would be required.

In order to connect PVID irrigation system to the power plant site, the analysis proposes two pipeline routes. PVID route A begins at Rannells Drain near 12th Ave and travels north along Rannells Drain to Riverside Ave. Rannells Drain Canal may contain suitable nesting habitat for special status bird species, including vermilion flycatcher (Species of Concern). During the proceedings for Blythe Energy Project (99-AFC-8) the natural gas line route was changed to avoid this exact section of Rannells Drain (between 10th Avenue and Riverside Avenue) to reduce impacts to biological resources (Harvey 2000). PVID Route B also begins on Rannells Drain, but immediately departs from it and continues along Hobsonway. PVID route B would be preferred to PVID route A because it reduces potential impacts to the riparian vegetation in the drain.

Dry Cooling

While there is a minor concern that the withdrawal of freshwater could result in impacts to Colorado River and the species that depend on it, the most significant concern of Biological Resources staff with the proposed evaporative cooling method is the discharge of wastewater high in salts and selenium. The proposed project utilizes a two-cell 6.48-acre evaporation pond to remove remaining liquid from the wastewater brine. As identified in the Biological Resources Section of the FSA, the use of evaporation ponds would have a significant impact on biological resources. Dry cooling would eliminate the need for the evaporation pond (BEP II 2002g, Data Response 59) and would reduce exposure risk of birds and bats to the water borne contaminants predicted in the proposed project.

The land area required for dry cooling (70,000 ft^2 or 1.6 acres) would be smaller than for the evaporative cooling proposed by the applicant (24,544 ft^2 or 0.5 acres plus a 6.48 acre evaporation pond). The loss of desert tortoise habitat was already fully mitigated by the adjacent power plant's use of the site for the disposal of fill. Thus, as long as the dry cooling could be contained within the existing fence line, no additional impacts to desert tortoise habitat would be expected to result from dry cooling.

Hybrid Cooling

Hybrid cooling would still require an open discharge into an evaporation pond, which is a concern for Biological Resources staff as discussed above. The hybrid system would expose birds and bats to levels of salt and selenium that are unhealthy. This impact could be eliminated by the installation of a zero liquid discharge brine distiller in lieu of using evaporation ponds as part of the design.

The land area required for hybrid cooling (51,744 ft^2 total area or 1.2 acres plus an evaporation pond that is less than 6 acres in size) would be equivalent or smaller than for the evaporative cooling proposed by the applicant (24,544 ft^2 or 0.5 acres plus a 6 acre evaporation pond). The loss of desert tortoise habitat was already fully mitigated by the adjacent power plant's use of the site for the disposal of fill. Thus, as long as the

hybrid cooling could be contained within the existing fence line, no additional impacts to desert tortoise habitat would be expected to result from hybrid cooling.

Conclusion

Dry cooling or hybrid cooling, have no biological advantage over the use of evaporative cooling if the wastewater is processed using a zero liquid discharge brine distiller instead of evaporation ponds. The use of the proposed evaporative cooling, PVID return water or hybrid cooling with discharges to an open evaporation pond would be less preferable to dry cooling. In addition, the installation of the PVID return water pipeline is expected to increase the probability of impacts to riparian birds, desert tortoise habitat and to burrowing owls, and this is the least preferred alternative from a Biological Resources perspective.

5.3 CULTURAL RESOURCES

Testimony of Gary Reinoehl and Dorothy Torres

Introduction

In general, impacts to cultural resources are increased when ground disturbance is increased. Cultural resources evaluated as eligible to the National Register of Historic Places (NRHP) or the California Register of Historic Resources (CRHR) would require mitigation. To effectively analyze potential impacts to cultural resources, information from the appropriate California Historic Resource Information System (CHRIS) office is necessary. A record search at the CHRIS has not yet been completed for any of the alternative water supply or cooling systems.

PVID's Irrigation Return Water Supply Option

Trenches for water pipelines, construction activities, and staging areas all result in disturbance of the ground and have the potential to impact archeological deposits. Further off-site study would be required, however, it is assumed that any impact could be mitigated to a less than significant level.

Dry Cooling

Even though in comparison to the proposed BEP II project, the dry cooling structure would have a larger footprint, it would not result in any additional impacts to cultural resources as long as it is within the current BEP II plant site and outside of the fenced area containing the cultural resources site.

Hybrid Cooling

As long as the water treatment facilities, pipeline and cooling facility are all within the current BEP II plant site and outside of the fenced area containing the cultural resources site, there would be no additional impact to cultural resources.

Conclusion

The PVID's Irrigation Return Water Supply Option has the greatest potential for impacts to cultural resources. If all of the components of the Dry Cooling and Hybrid Cooling options are within the current BEP II plant site and outside of the fenced area containing the cultural resources site, there would be no additional impact to cultural resources by either of these alternatives.

5.4 HAZARDOUS MATERIALS MANAGEMENT

Testimony of Rick Tyler and Alvin Greenberg

Introduction

The BEP II is currently proposing to use ground water from on-site wells for cooling. The purpose of this analysis is to determine if there would be any additional impacts due to use of hazardous materials for the different water supply and cooling options.

PVID's Irrigation Return Water Supply Option

The Palo Verde Irrigation District (PVID) operates a system of irrigation supply and return drainage ditches. The drainage ditches are about 10 to 20 feet deep in order to intercept groundwater about 10 feet below the ground surface (valley-wide average depth). During crop irrigation, excess water is applied to prevent salt build-up in the soil. This excess irrigation water percolates through the soil and into groundwater. Groundwater then flows to the drainage channels and is returned to the Colorado River.

The Rannells Drain runs in the vicinity of BEP II and contains intercepted shallow groundwater (after being applied for irrigation) and operational spillage from Canal B, a source of irrigation supply for the immediate area. The quality of water in the Rannells Drain is largely influenced by local agriculture activity (which degrades the drainage water quality) and Canal B irrigation spillage (which enhances the drainage water quality). As an indication of water quality in the Rannells Drain, PVID's observed TDS was 1,510 mg/l on an undisclosed date in September 2002 and 1,590 mg/l on March 14, 2003. In comparison, irrigation water diverted from the Colorado River on those dates was observed to have TDS concentrations of 552 mg/l and 728 mg/l respectively (PVID 2003d). PVID typically collects water quality data on a quarterly basis for its irrigation supply as diverted from Colorado River and on a bi-annual basis for its irrigation return flows in Rannells Drain (PVID 2003d).

Use of irrigation return water from PVID at BEP II would require construction of a 1.5 mile water supply pipeline from Rannells Drain to BEP II. The pipeline would be expected to follow one of the two alternative routes as described in Section 2.3.

Analysis of Construction and Operations Impacts

There are minor amounts of hazardous materials (fuels, solvents, lubricants, etc.) used in the construction of pumping facilities and water pipelines. Because of the small amounts, low potential for off-site migration, and/or solid form, the use of hazardous materials during the construction of any water pipeline or pumping station would not

result in a significant risk to the public. Although not certain, pump motors for these types of pipelines are usually electric, thus obviating the need for fuel use at the pumps.

The drainage water from the irrigation supply and return system would most likely need to be processed and pretreated before it can be used as a cooling medium in the BEP II project. Manufacturers of cooling equipment typically specify that the cooling medium to be used meet certain criteria in order to be acceptable for use with their equipment. This is necessary to alleviate the general water quality problems of scaling, corrosion, biological growth and fouling. The pretreatment involves chemical conditioning and the type, level, frequency and intensity of the pretreatment would depend on two factors, as a minimum. The quality of the water would be one factor. The second would be the technical specifications for the cooling medium as required by the cooling equipment manufacturers. BEP II's design engineer would need to specify the type and amount of each chemical that would be required under PVID's irrigation return water supply option. It is possible that additional hazardous materials storage areas may need to be constructed, complete with berms and drainage protections, in order to accommodate the additional volumes of hazardous materials.

Dry Cooling

In a dry cooling system, fans blow air over a radiator system to remove heat from the system via convective heat transfer (instead of once-through cooling or evaporative heat transfer). The direct dry cooling system, proposed as an alternative for the BEP II is also known as an air-cooled condenser (ACC). In this system, steam from the steam turbine exhausts directly to a manifold radiator system that rejects heat to the atmosphere, condensing the steam inside the radiator. The use of the ACC could reduce by up to 96% the water used by the proposed project. Because no cooling water is needed with this option, several pieces of equipment can be eliminated including cooling water supply piping, storage tanks, on-site chemical treatment equipment, and waste discharge piping.

Analysis of Construction and Operations Impacts

Dry cooling would not use the large volumes of water used in wet or hybrid cooling systems and hence would reduce the volume of chemicals (e.g., sodium hypochlorite) needed to control algae growth within the system (particularly in the condenser tubes). Thus, hazardous materials usage would decrease. On the other hand, the larger volume of piping including seals, flanges, and valves, may result in oxygen entry into the system and therefore require an increased use in oxygen scavengers to prevent corrosion and scaling. The BEP II project is proposing to use carbohydrazide, a material of very low toxicity, as an oxygen scavenger. The increased use of carbohydrazide for a dry cooling system could be significant but would still not result in an increased risk or hazard. Thus, the overall use of hazardous materials with dry cooling would be the same or less than as with wet cooling.

Hybrid Cooling

Hybrid cooling systems combine wet and dry cooling technologies. This analysis considers a hybrid cooling system where 2/3 of the cooling requirements might be provided by ACC, and 1/3 by available non-potable water.

Analysis of Construction and Operations Impacts

The hybrid cooling alternative would use larger volumes of water than dry cooling. Therefore, the amount of hazardous materials and the risk of accidental release would be somewhat greater than with dry cooling. However, because the risk is very low with dry cooling, the difference between dry and hybrid cooling risks are not significant

Conclusion

The construction of any of the cooling options would require very small amounts of hazardous materials. The impacts are expected to be no different from those identified for the construction of the proposed BEP II as described in the **Hazardous Materials Management** FSA Section and can be addressed by adherence to the LORS and proposed Conditions of Certification found in the Staff Assessment.

The use of water from the PVID's irrigation supply and return system in the cooling process would require the storage and use of hazardous chemicals. As a minimum, the quality of the water, cooling medium specification requirements, and applicable waste discharge standards would all influence the types of chemicals needed and their quantities for use of reclaimed water in cooling.

Staff does not consider the impacts from any of the water sources or the cooling options discussed to be significantly different, since rather minor differences in hazardous materials use would exist with any of the options. Any risks associated with chemical usage in cooling water should be adequately mitigated through compliance with the appropriate federal, state, and local requirements for hazardous materials use and adherence to the applicant's and staff's proposed conditions of certification. These proposed mitigation methods are standard for power plants licensed by the Energy Commission and thus the overall risk due to hazardous materials is approximately the same for all proposed water sources and cooling methods.

5.5 LAND USE

Testimony of David Flores

Introduction

The evaluation of cooling technologies for the BEP II for the land use technical area is primarily focused on two issues: (1) consistency with applicable land use plans, ordinances, and policies; and, (2) compatibility with existing and planned land uses.

PVID's Irrigation Return Water Supply Option

If irrigation return water is used for project cooling instead of ground water, a Water Conservation Offset Plan (WCOP) would still be necessary, as there would be project impact on agricultural land or other land uses if irrigated farmlands are permanently retired. Therefore, if the WCOP's land retirement option is chosen, conditions of certification **LAND-3**, as to mitigating for the loss of agricultural land, and **LAND-6**, as to receiving copies of the final approval of the WCOP by the State/Federal agencies, would still be necessary.

Dry Cooling

Dry cooling would eliminate the need for 95 percent of the water necessary for project cooling using wet cooling design as proposed in the AFC. Therefore, the WCOP would not be implemented, and there would be no significant project impact on agricultural land or other land uses. Therefore conditions of certification **LAND-3**, as to mitigating for the loss of agricultural land and **LAND-6**, as to receiving a copy of the final approval of the WCOP by the State/Federal agencies, would not be necessary.

Hybrid Cooling

The hybrid cooling system would reduce water usage for plant cooling by approximately two thirds. Therefore, the need for Rannells Drain water would be lowered by the same percentage. The applicant proposes to use the WCOP to retire irrigated lands permanently or fallow lands on a rotating basis to reduce demand for agricultural irrigation in exchange for the water used by the project. If the permanent land retirement option is chosen, the WCOP may have a significant impact on agricultural land. See the VOLUNTARY WATER CONSERVATION OFFSET PROGRAM section in the Land Use analysis of this FSA for further discussion on the WCOP and possible impacts on agricultural land. If hybrid cooling is used, the impact on agricultural land would be two thirds less than with the wet cooling system. However, there would continue to be a significant impact on agricultural land, and there would be no change in the recommended conditions of certification.

Conclusion

The alternatives to wet cooling are compatible with all LORS. Of the three alternatives studied, adoption of either of the irrigation return water options using wet or hybrid cooling would cause a significant impact on agricultural land, and there would be no change in the recommended conditions. Use of dry cooling would lessen impact on agricultural land to less than significant, and there would be no need for conditions protecting agricultural land use. The cooling alternatives would not affect any other land uses.

5.6 NOISE

Testimony of Jim Buntin

Introduction

Following is a noise analysis of the water supply and cooling options for the BEP II project. The reason for considering these options is that the Applicant is currently proposing to use ground water from on-site wells for cooling. Based on State Water Board Policy encouraging use of recycled or degraded water over potable water for cooling, staff is evaluating (a) sources of degraded water for the BEP II facility and (b) cooling technologies that allow the volume of water to be reduced.

PVID's Irrigation Return Water Supply Option

The source of the cooling water has no direct effect on project noise levels, unless there are differences in pumping requirements that would cause installation of noise-producing pumps or motors in close proximity to sensitive receivers. It does not appear that this condition would occur, so there would be no change in project noise impacts as a result of using an alternative source of cooling water.

Dry Cooling

The evaporative cooling system proposed in the AFC includes 8 fans. The AFC Appendix 6.0 specifies the power rating of these fans at 160 horsepower each. In the ACC option there would be 45 fans of 200 horsepower each, or 50 fans of 175 horsepower each. As a result, noise levels would be increased substantially in the near field. This is relevant for occupational noise exposures, but would be managed to acceptable levels in accordance with the staff's proposed Condition of Certification **NOISE-7**.

The AFC Appendix 6.0 concludes that ACC would produce about 67 dBA at 400 feet compared to 60 dBA at 400 feet for the evaporative system. An increase of about 7 dBA in cooling system noise would be of concern to the developer because the Energy Commission staff has proposed a noise standard for the BEP II (**NOISE-6**) that would require a 2 dBA reduction in the overall power plant noise level for the proposed design. The cooling tower is considered to be one of the larger contributors to the overall power plant noise level at the nearest receptor, so reduction of cooling system noise would be a key factor in achieving the proposed noise standard. It is not known whether it would be feasible to achieve the required noise level reduction for a power plant design including the use of ACC.

ACC noise could be significantly reduced by using low-noise fans, or by installing a larger ACC that could use lower-power, quieter fans. For example, a noise level reduction of about 10 dBA could be accomplished by using low-noise fans in the ACC, with a corresponding increase in cost of the ACC of approximately $1.2 million.

The power plant could be designed so that the ACC would be nearer the midpoint of the site. This would result in a distance to the northern boundary of 1,200 ft or more. This increased distance would reduce cooling system noise at the north plant boundary to about 57 dBA. However, this relocation would place the ACC closer to the sensitive

receiver, which is located south of the proposed BEP II. Therefore the overall power plant noise level would likely be increased at the sensitive receiver.

Hybrid Cooling

A hybrid cooling system would use an intermediate number of fans as compared to the ACC and evaporative systems. The resulting noise levels would also be expected to be intermediate, so that the hybrid system would be expected to produce slightly higher noise levels (estimated by staff to be 4 dBA) than the evaporative system. As with the ACC system, the developer would have to implement noise reduction technology to ensure that the hybrid cooling system noise emissions would be consistent with the objective of reducing overall plant noise levels by about 2 dBA, as required by staff's proposed Condition of Certification **NOISE-6**. It is not known whether it would be feasible to achieve the required noise level reduction for a power plant design including the use of hybrid cooling.

The power plant could be designed so that the hybrid cooling system would be nearer the midpoint of the site. This would result in a distance to the northern boundary of 1,200 ft or more. This increased distance would reduce cooling system noise at the north plant boundary. However, this relocation would place the cooling system closer to the sensitive receiver, which is located south of the proposed BEP II. Therefore the overall power plant noise level would likely be increased at the sensitive receiver.

Conclusion

The use of alternative supplies of cooling water is not expected to have a significant effect on power plant noise levels. The use of either ACC or Hybrid cooling would increase cooling system and overall power plant noise levels. The cooling system is considered to be a major contributor to the overall power plant noise levels. Since the current proposed power plant design would require noise mitigation measures to achieve the Energy Commission staff's proposed Condition of Certification **NOISE-6**, the use of ACC or hybrid cooling would require substantial additional noise reduction, at increased cost.

5.7 PUBLIC HEALTH

Testimony of Ramesh Sundareswaran

Introduction

The BEP II is currently proposing to use ground water from on-site wells (Colorado River groundwater) for cooling. Based on State Water Board Policy encouraging use of recycled or degraded water over potable water for cooling, staff is evaluating (a) sources of degraded water for the BEP II facility and (b) cooling technologies that allow the volume of water used to be reduced. Any public health impacts from cooling-related use of reclaimed water would result from public exposure to any toxic pollutants posing cancer and non-cancer risks. The potential for such impacts would depend on the presence of pollutants in the cooling tower drift, any subsurface contamination that may be unearthed during construction of the water conveyance and treatment facilities or

exposure to fugitive dust emissions as well as heavy equipment operation during such construction.

PVID's Irrigation Return Water Supply Option

Historical and current agricultural activities may have contributed to the presence of pesticides in the irrigation return water. In addition, various events such as spills or leaks could have led to the release of other contaminants into the irrigation water. The potential release of such contaminants via cooling tower drift may pose human health risks.

Potential risks to public health during construction of the irrigation water pipeline may be associated with fugitive dust exposure as well as exhaust from heavy equipment operation. The pipeline construction is expected to be extremely limited in scope and duration. Emissions from these construction activities would invariably be minor and therefore insignificant given the scope and duration of these activities. In addition, subsurface contamination may be encountered during the pipeline construction activities. Compliance with the LORS cited by the Applicant for the proposed BEP II project should adequately ensure that any subsurface contamination would not pose a significant health risk to the construction workers and the public.

Dry Cooling

With the elimination of water as a cooling medium in this option, no contaminants are expected to be present in the drift from the cooling towers. Consequently, dry cooling will not be detrimental to the public as a result of exposure to airborne contaminants.

Hybrid Cooling

The proposed use of hybrid cooling would result in the use of only one-third of the water needed for the proposed wet cooling system. Risks to the public from the use of the Colorado River groundwater for cooling purposes as proposed, would therefore be reduced even further.

Conclusion

Staff concludes that dry cooling and the use of Colorado River groundwater in hybrid cooling would not be detrimental to public health. Any conclusion related to the use of PVID's irrigation return water as a cooling medium depends on obtaining additional water quality information.

5.8 TRAFFIC/TRANSPORTATION

Testimony of James Adams

Introduction

A number of water supply and cooling technology options are currently under consideration. These options are alternatives to the BEP II cooling proposal, which would utilize ground water from on-site wells for the evaporative cooling towers. The traffic and transportation construction and operations impacts of the alternatives, which

include PVID's Irrigation Return Water, Dry Cooling, and Hybrid Cooling, are discussed below.

PVID's Irrigation Return Water Supply Option

The construction of an irrigation return water supply system, including a new pipeline connecting the Rannells Drain with the project, would require additional construction truck and worker traffic. Although construction traffic data is not available for this preliminary analysis, the additional water pipeline construction would probably not have a significant adverse impact on traffic. However, there would still be an impact to aviation safety from the project's use of wet cooling.

Dry Cooling

Construction of a dry cooling system would require additional construction truck and worker traffic. Similarly, athough additional traffic data is not available for this preliminary analysis, construction of a dry cooling system would probably not have a signiificant adverse impact on traffic. However, there would still be an impact to aviation safety from the project's use of dry cooling.

Staff conducted an Exhaust Plume Turbulence analysis (see Attachment B to the Traffic/Transportation Section of the FSA) to consider the plume characteristics of dry cooling using an air-cooled condenser (ACC) at the project site. Based on several simple design assumptions for the ACC, staff concluded the following for the use of an ACC:

1. ACC thermal plumes would have the potential to cause significant turbulence over a much wider range of ambient conditions and number of hours annually than the wet cooling tower thermal plumes.
2. ACC thermal plumes would be more resistant to the effects of wind than wet cooling tower thermal plumes;
3. ACC thermal plumes would cause air turbulence at low altitudes.
4. Turbulence caused by the ACC thermal plumes would likely be worse than that caused by the wet cooling tower during warmer ambient temperatures and during periods with higher wind speeds.

Therefore, staff finds that the use of dry cooling for the proposed BEP II would cause significant impacts on aircraft safety at the proposed site.

Hybrid Cooling

Construction of a hybrid cooling system would require additional construction truck and worker traffic. Although construction traffic data is not available for this preliminary analysis, construction of a hybrid cooling system would probably not have a significant adverse impact on traffic. However, there would still be an impact to aviation safety from the project's use of hybrid cooling.

Conclusion

Construction of the alternative cooling systems would each require additional construction truck and worker traffic. Additionally, an irrigation return water supply system would require the construction of a new pipeline connecting the project with the water treatment plant. Staff assumes that any significant impact caused by the construction of the selected cooling alternative could be adequately mitigated. However, specific traffic data would need to be reviewed before a definitive analysis could be completed. Staff has identified a potentially significant adverse impact to aircraft safety associated with cooling tower plume currents for the proposed project and all water supply/cooling alternatives as discussed in the **Traffic and Transportation** section of the FSA.

5.9 VISUAL RESOURCES

Testimony of Dale Edwards

Introduction

This section presents a general visual analysis of the proposed alternative cooling options as described in the "Executive Summary" of the **SOIL AND WATER RESOURCES APPENDIX A** compared to a baseline using the proposed BEP II project. This discussion focuses on whether construction and operation of the BEP II with the use of an alternative water supply pipeline option, or an alternative cooling technology would cause visual impact(s) under CEQA using the seven representative key observation points (KOPs); and be in compliance with applicable laws, ordinance, regulations, and standards.

Alternative Water Supply Pipeline and Cooling Technology Options

PVID's Irrigation Return Water Supply Option

PVID's irrigation return water supply option would require the construction of 1.5-mile long underground water supply pipeline. The pipeline would be 4-5 feet underground. The pipeline would follow one of two routes to the BEP II site, one along Riverside Drive and Chanslor Way and one along Hobsonway. Construction of the pipeline would result in the visibility of construction vehicles, equipment, materials, and personnel along discrete segments of roadway as construction progresses along the route for a short time period. Any construction through agricultural fields to reach the roadways would be confined to existing utility easements or along the shoulder of agricultural access roads wherever possible. No new access roads would be required. The visibility of construction activities along any portion of the route would be relatively short in time duration. Following installation of the underground pipeline within existing public rights of way, the pipeline would not be visible from any KOP, and would not result in adverse visual impacts during its use.

Dry Cooling Technology

The dry cooling technology would require the use of an air-cooled condenser (ACC) consisting of multiple finned heat exchange tubes mounted on a large steel framework. The steel framework would be approximately 115 feet (tall) x 350 feet (long) x 200 feet (wide).

The ACC would be visible as a large, elevated, geometric structure that would appear prominent and quite massive from foreground to middleground viewing distances along Hobsonway and I-10. The ACC structure would increase the proposed project's industrial visual character, and would result in greater visual contrast and view blockage when compared to the proposed project's 40 feet (tall) x 472 feet (long) x 52 feet (wide) wet cooling tower. The resulting visual impact would be adverse. However, due to various factors including: quality of the existing view, type of viewers, duration of view, and angle of view staff does not expect that the outcome of a detailed visual analysis would result in a finding of significant impact from any of the KOPs representing views from Hobsonway and I-10.

Hybrid Cooling Technology

The hybrid cooling technology would require a single-cell evaporative cooling tower and a 30-cell ACC. At approximately two-thirds the size of and the same height as the dry cooling ACC, the hybrid cooling ACC would be a prominently visible built feature in the landscape, measuring approximately 115 feet (tall) x 255 feet (long) x 196 feet (wide). Similar to the dry cooling ACC, the hybrid ACC structure would increase the proposed project's industrial visual character, and result in greater visual contrast and view blockage when compared to the proposed project's 40-foot tall wet cooling tower. The resulting visual impact would be adverse. However, due to various factors including: quality of the existing view, type of viewers, duration of view, and angle of view staff does not expect that the outcome of a detailed visual analysis would result in a finding of significant impact from any of the KOPs representing views from Hobsonway and I-10.

Conclusion

The installed PVID underground pipeline would not be visible. The use of the PVID's irrigation return water supply option at operation would result in a less than significant visual impact.

Both the dry and hybrid ACC introduce a structure to the proposed project with greater visual contrast, view blockage and dominance. An ACC would increase the proposed project's overall visual intrusiveness and contrast into the expansive agricultural and desert landscape along 1-10, but due to various factors articulated above, staff does not believe that a detailed visual analysis would result in a finding of significant adverse impact.

5.10 VISIBLE PLUMES

Testimony of Mark Hamblin

Introduction

This discussion addresses whether the alternative water supply option and cooling technologies would cause significant adverse visible plumes.

PVID's Irrigation Return Water Supply Option

This option is not expected to significantly change the design or operation of the cooling tower as proposed by the applicant, nor would it change the design or operation of the turbine/HRSG. Therefore, this option, or any other water supply substitution option, would not be expected to change the plume frequency and size characteristics of the cooling tower as evaluated in the **VISUAL RESOURCES** section. The visible plume modeling conducted for the BEP II project found that there would be no significant impacts because the plume frequencies would be below staff's significance criteria threshold of 20 percent of seasonal daylight clear (i.e. high contrast) hours.

Dry Cooling

This option would completely eliminate the cooling tower visible plumes and would not be expected to change the turbine/HRSG visible plumes. Therefore, this cooling option would reduce the visible plume impacts from those that were already found to be less than significant.

Hybrid Cooling

This option would reduce the frequency and size of the wet cooling tower plumes and would not be expected to change the turbine/HRSG visible plumes. The hybrid system will operate with the dry cooling taking most of the heat load so that the cooling tower operation would generally increase with increased load, which would typically happen during duct firing and during summer daylight hours. Therefore, cooling tower operations would be expected to increase during times with lower plume formation potential and decrease during times with higher plume formation potential. Additionally, the size of the cooling tower would be reduced so the plume sizes, assuming similar design characteristics, would also be smaller than for the wet cooling only option. Therefore, this cooling option would reduce the visible plume impacts from those that were already found to be less than significant.

Conclusion

The PVID irrigation return water supply option, or any other water supply substitution option, would not be expected to change the plume frequency and size characteristics of the proposed cooling tower. The dry cooling option would completely eliminate the cooling tower visible plumes and would not be expected to change the turbine/HRSG visible plumes. The hybrid cooling option would reduce the visible plume impacts from those of the proposed wet cooling tower that have been found to be less than

significant. Therefore, related to visible plumes, all of the cooling options are similar in that none are expected to cause significant visible plumes to occur.

The potential impacts of the visible and thermal cooling tower plumes, along with the potential impacts of the thermal gas turbine/HRSG plumes, on aircraft landing and departing from the nearby Blythe Airport are discussed in the **TRAFFIC AND TRANSPORTATION** section in this Final Staff Assessment.

5.11 WASTE MANAGEMENT

Testimony of Ramesh Sundareswaran

Introduction

The purpose of this analysis is to evaluate whether the wastes generated through the use of degraded water and cooling options will be detrimental to the public and the environment.

PVID's Irrigation Return Water Supply Option

The use of PVID's irrigation return water for wet cooling should generate hazardous and nonhazardous waste streams similar to those expected through the use of the Colorado River groundwater. This is because all waste generating activities would basically remain the same in both instances.

Compliance with LORS proposed for the BEP II project involving the Colorado River groundwater should ensure that the generated wastes would be managed in an environmentally safe manner.

Dry Cooling

Waste streams that are typically associated with wet cooling activities will be eliminated as a result of using dry cooling. Overall, a smaller volume of wastes would therefore be generated during the project's life cycle.

Hybrid Cooling

The hybrid option comprises 1/3 wet and 2/3 dry cooling. A reduced waste stream associated with wet cooling can therefore be expected through the use of hybrid cooling.

Conclusion

Both dry and hybrid cooling can be expected to generate a smaller quantity of wastes vis-a-vis wet cooling. Waste streams generated through the use of irrigation return water for wet cooling can be expected to be similar to those generated through the use of the Colorado River groundwater.

5.12 WORKER SAFETY

Testimony of Rick Tyler and Alvin Greenberg

Introduction

The purpose of this analysis is to evaluate use of degraded water, and the different cooling methods and technologies to determine if any additional impacts to worker safety or fire protection services may be expected.

PVID's Irrigation Return Water Supply Option

The use of irrigation return water from the Palo Verde Irrigation District (PVID) would require construction of a 1.5 mile water supply pipeline from PVID's Rannells Drain to BEP II. Conveyance of the irrigation return water would most likely require one pump station located at the new turnout from Rannells Drain.

Analysis of Construction and Operations Impacts

Excavation activities may encounter potentially contaminated soils and/or groundwater. Therefore, proper handling procedures may be necessary. A Phase I Environmental Site Assessment will be needed for the any pumping station site and pipeline route prior to site preparation and a Phase II Environmental Site Assessment may also be needed. Once proper environmental site assessments have been conducted, the potential impacts to workers will be clearer. Standard worker safety regulations, including those for trenching, confined spaces, and exposure to hazardous wastes must be followed. Please also refer to the **Waste Management** and **Worker Safety/Fire Protection** sections of the FSA for discussions on contaminated soils and worker safety standards that specify appropriate mitigation measures and Conditions of Certification to ensure impacts on workers are less than significant.

Fire protection impacts are expected to be no different from those identified for the construction and operations of the proposed BEP II as described in the AFC and can be addressed by adherence to the LORS and proposed Conditions of Certification found in the FSA.

Dry Cooling

In a dry cooling system, fans blow air over a radiator system to remove heat from the system via convective heat transfer (instead of once-through cooling or evaporative heat transfer). The type of dry cooling analyzed in this document is direct dry cooling, also known as an air-cooled condenser (ACC). Because no cooling water is needed, there are several pieces of equipment that can be eliminated when using ACC. Cooling water supply piping, storage tanks, on-site chemical treatment equipment, and waste discharge piping are unnecessary with an air-cooled system.

Analysis of Construction and Operations Impacts

Worker Safety and Fire Protection impacts are expected to be no different from those identified for the construction and operations of the proposed BEP II as described in the AFC and can be addressed by adherence to the LORS and proposed Conditions of Certification found in the FSA.

Hybrid Cooling

Hybrid cooling systems combine wet and dry cooling technologies. This analysis considers a hybrid cooling system where 2/3 of the cooling requirements might be provided by ACC, and 1/3 by available non-potable water.

Analysis of Construction and Operations Impacts

Worker Safety and Fire Protection impacts are expected to be no different from those identified for the construction and operations of the proposed BEP II as described in the AFC and can be addressed by adherence to the LORS and proposed Conditions of Certification found in the FSA.

Conclusion

All of the cooling options described above would consist of some earthmoving and routine construction activities. Worker safety regulations, including those addressing trenching, confined spaces, and hazardous wastes must be followed. The risk to workers would not change significantly with any of the water supply or cooling options. This is mostly due to the generic nature of worker and fire protection required at a power plant licensed by the Energy Commission.

Fire protection impacts are expected to be no different from those identified for the construction and operations of the proposed project as described in the AFC and can be mitigated by following all LORS and the proposed Conditions of Certification found in the FSA.

Staff therefore concludes that the impacts to workers and fire protection are similar with all water supply and cooling options.

5.13 SOCIOECONOMICS

Testimony of Amanda Stennick

Introduction

This section examines the potential impacts of alternative water supply and cooling options to community services and/or infrastructure and related community issues such as environmental justice.

PVID's Irrigation Return Water Supply Option

The PVID alternative will use 3,262 acre-feet per year, or the same amount of water as BEP II. Both options will take water away from agricultural use, but would not cause direct or cumulative significant impacts to agricultural production and jobs.

Dry Cooling

No significant impact due to the small amount of water used for cooling.

Hybrid Cooling

No significant impact due to the small amount of water used for cooling.

Conclusion

The reduction in agricultural production will result in an insignificant change to Riverside County's annual crop revenues. Like BEP II, the alternatives considered will result in some benefits for Riverside County from property and sales tax. The City of Blythe may also benefit from the economic activity generated by the purchase of services, manufactured goods and equipment from local businesses.

Staff expects that implementation of the WCOP with the alternatives would result in a loss of about 6.33 full time jobs, which is not considered significant. To ensure that job loss remains at a less than significant level, staff would recommend that only highly mechanized crops such as grains, cotton, and alfalfa be fallowed or rotated as part of the WCOP. Labor intensive crops such as orchards, melon, vegetable, and citrus would be excluded from participating in the WCOP.

5.14 SOIL & WATER RESOURCES

Testimony of John Kessler and Jim Schoonmaker

Introduction

This discussion evaluates potential impacts resulting from using one of the various water supply options and cooling technologies. The Applicant has proposed using groundwater for cooling and process purposes at an average annual rate of 3,262 AFY with a wet cooling tower.

PVID's Irrigation Return Water Supply Option

Construction of the approximately 1.5-mile water supply pipeline from a new turnout on PVID's Rannells Drain could lead to erosion of soils. Soil types along the pipeline alignment tend to be a sandy loam, which characteristically are free-draining and have low erosion properties. Control of soil erosion would be further assured by preparing and implementing a Drainage, Erosion and Sediment Control Plan (DESCP). The DESCP would specify Best Management Practices (BMP's) for conservation of topsoil, grading plans to restore existing contours for storm water drainage, temporary use of straw or mulch if needed, and restoration of vegetation. The pipeline would be installed along existing right-of-ways and adjacent to existing roads to the extent possible to minimize new disturbance to lands.

Irrigation return water from PVID's Rannells Drain and the associated irrigation return system is currently discharged into the Colorado River. The irrigation return water is not treated and has a relatively high concentration of Total Dissolved Solids (TDS) averaging about 1,630 mg/l, which contributes to increasing salinity concentrations in the Colorado River. The discharge negatively degrades Colorado River water quality for other uses, including other municipal drinking water supplies and maintaining aquatic habitat for sensitive species. The use of irrigation return water by the BEP II would result in a net improvement to Colorado River water quality by reducing the quantity of high TDS irrigation return water being discharged to the Colorado River. With the

implementation of a verifiably effective WCOP, it would not reduce the amount of Colorado River water available to downstream users

Dry Cooling

Dry Cooling would reduce the quantity of water required for BEP II process and cooling demands to about 100 AFY compared to the 3,262 fy average annual demand required for the wet cooling towers proposed by the Applicant. While water use is greatly conserved by using Dry Cooling, additional land would be disturbed. The disturbance of an additional 1-acre of land (an increase from 0.5 to 1.5 acres) is needed to implement dry cooling. This additional land disturbance could be mitigated to avoid soil erosion by implementation of the DESCP. Please refer to Section A.1.2 of this Appendix for additional discussion.

Hybrid Cooling

This option would provide a Hybrid Cooling Tower designed for water conservation comprised of 1/3 wet and 2/3 dry cooling for the steam turbine. Water use for the Hybrid Cooling would use 1/3 of the water needed for the proposed Wet Cooling System. This would reduce water use from an average of 3,262 AFY to about 1,100 AFY. While the facilities for the Hybrid Cooling would have a slightly larger footprint, increasing from about 0.5 to 1.0 acre, disturbance to soil could be mitigated by implementing a DESCP. Although cooling tower blowdown would be reduced by about 2/3, water quality would not be affected due to the ability to recover a portion of the wastewater using the evaporator (brine concentrator) with the brine proposed to be distributed to a two-cell evaporation pond with a total evaporative area of 6.48 acres. Similar to PVID's Irrigation Return Water Supply Option, soil erosion would be prevented along the irrigation return water pipeline route by proper planning and implementation of BMPs in accordance with the DESCP. In addition, this alternative would result in a net improvement to Colorado River water quality by reducing the quantity of high TDS irrigation return water being discharged to the Colorado River. However, it would reduce the amount of Colorado River water available to downstream users, which is considered a cumulative significant adverse impact.

Conclusion

None of the alternative water supply and cooling options would result in a significant adverse impact with respect to soil erosion or degradation of water quality. However, all options other than dry cooling or use of Rannells Drain water with a verifiably effective WCOP would result in a significant adverse cumulative impact to downstream Colorado River water users. Dry cooling would conserve the highest quantity of water and minimize impacts associated with water use by BEP II.

5.15 GEOLOGY/PALEONTOLOGY

Testimony of Pat Pilling

Introduction

This section evaluates the potential impacts of the degraded water source pipeline and the dry and hybrid cooling systems in the areas of geology and paleontology. Detailed geological discussion and information about the project's alternative water supply linears was not included in the AFC (Caithness Blythe II, LLC, 2002) or in this document describing the alternative water supply and cooling options at the BEP II plant. However, given the geology and borings present at the BEP II plant site, potential for these hazards along the alternate linear facilities exists. In order to accurately assess the potential for liquefaction, dynamic compaction, hydrocompaction, subsidence, and expansive soils along the alternative water supply linears, subsurface exploration and associated laboratory testing and analyses should be performed during the design-level geotechnical investigation per **Conditions of Certification GEN-1**, **GEN-5**, and **CIVIL-1** in the **Facility Design** section.

PVID's Irrigation Return Water Supply Option

Use of PVID's irrigation return water would result in the construction of a new water supply linear from the Rannells Drain to the BEP II plant site. The two proposed water supply linear alternatives traverse Quaternary alluvium that consists of sands, gravels, silts, and clays (Stone, 1990).

Faulting and Seismicity

The proposed alternative water supply linears are located within Seismic Zone 3, as delineated on Figure 16-2 of the CBC (2000). No faults are mapped as crossing the proposed water linears. The closest known Holocene (active) faults are the Brawley Fault, Elmore Ranch Fault, and the San Andreas Fault (Southern and Coachella segments), located approximately 61 miles southwest of the alternative water supply linears. Staff has estimated a deterministic peak horizontal ground acceleration for the Brawley Fault, Elmore Ranch Fault, and the Southern and Coachella segments of the San Andreas Fault as 0.05g, 0.05g, 0.08g, and 0.08g, respectively. These estimates are based on a moment magnitude 6.5, 6.6, 7.4, and 7.4 earthquake on the Brawley Fault, Elmore Ranch Fault, and the Southern and Coachella segments of the San Andreas Fault, respectively.

Liquefaction, Subsidence, and Expansive Soils

The potential for liquefaction along the alternative water supply linears is expected to be low given the depth to ground water in excess of 88 feet below the ground surface near the BEP II plant site; however, liquefaction potential may exist in close proximity to the Rannells Drain. A detailed geotechnical investigation and analysis of liquefaction potential, subsidence, and expansive soils should be included in the engineering geology/soils report required for final design.

Slope Failures

The potential for landslides along the alternative water supply linears is considered low, except at the edge of the mesa near the Rannells Drain where the potential is

considered moderate due to high topographic relief. The proposed alternative linear alignments are generally located along existing roads.

Geologic, Mineralogic, and Paleontologic Resources

Staff has reviewed applicable publications regarding geologic and mineralogic resources. No known geologic or mineralogic resources are known to exist along the proposed alternative water supply linears.

The Quaternary alluvium traversed by the proposed alternative water supply linears is also present at the BEP I plant site where two vertebrate fossils were identified during construction of the plant. Based on this information and staff's review of available information (San Bernardino County Museum, 2002), the proposed alternative water supply linears have moderate potential to contain significant paleontological resources.

Dry Cooling

Implementation of dry cooling would require the construction of air-cooled condensers (ACC) immediately adjacent to the proposed plant. This site is geologically similar to the BEP II plant site and geologic hazards and geologic and paleontologic resources sections in the FSA would apply due to the close proximity to the BEPII plant site.

Hybrid Cooling

If the hybrid cooling option would utilize PVID's irrigation return water from the Rannells Drain, the geologic hazards and geologic and paleontologic resource discussion would apply from the PVID's Irrigation Return Water Supply Option section above. Otherwise, the geologic hazards and geologic and paleontologic resources sections in the FSA would apply since the hybrid cooling equipment is located within the footprint of the BEP II plant site.

Conclusion

Seismicity represents the main geologic hazard along the linear alignments with moderate potential for slope failures near the edge of the mesa and liquefaction near the Rannells Drain. In order to accurately assess the potential for liquefaction, dynamic compaction, hydrocompaction, subsidence, and expansive soils along the alternative water supply linears, subsurface exploration and associated laboratory testing and analyses should be performed during the design-level geotechnical investigation per **Conditions of Certification GEN-1**, **GEN-5**, and **CIVIL-1** in the **Facility Design** section. No geologic or mineralogic resources are known to exist adjacent to the proposed linear alignments. Since the proposed linear alignments will have significant excavation during construction and paleontologic resources were identified at the BEP I plant site during excavation activities, **Conditions of Certification PAL-1** through **PAL-7** from the BEP II FSA in the **Geology, Mineral Resources and Paleontology** section are designed to mitigate any paleontological resource impacts to a less than significant level.

5.16 POWER PLANT RELIABILITY AND EFFICIENCY

Testimony of Steve Baker

Introduction

If the cooling system of a combined cycle power plant such as the BEP II fails to operate, or operates at a level of effectiveness lower than intended, the plant's power output may be curtailed (reduced), or the plant may be forced to shut down entirely. Additionally, the plant's fuel efficiency would be adversely impacted by any degradation of cooling system effectiveness.

PVID's Irrigation Return Water Supply Option

Neither reliability nor efficiency of the power plant should be significantly affected by the use of reclaimed or degraded water (City of Blythe's treated wastewater or PVID's irrigation return flows).

Reliability Impacts of Dry Cooling

Dry cooling relies on the dry bulb temperature of the ambient air to provide the needed cooling effect. In hot climates at the BEP II site, extremely hot days may degrade cooling system performance, causing partial curtailment of power. The amount of reduced capacity of the steam turbine is a function of balancing the greater capital cost of the ACC in relation to the lost revenue of the lower peak power output on the few high ambient temperature days. Only the applicant can perform the economic optimization of the dry cooling system design in order to optimize the magnitude of impacts to plant reliability on the extremely hot days experienced at the BEP II site. The dry cooling system design has been used in the power industry for several years now, and can be expected to exhibit typically high availability.

Efficiency Impacts of Dry Cooling

Dry cooling will typically provide less effective cooling, reducing the efficiency of the steam cycle portion of the power plant, and thus the overall fuel efficiency of the facility. The efficiency drop is due to a loss in LP turbine efficiency, as a result of operating the LP turbine at a higher back pressure. Since only about one-third of the power from a combined cycle power plant is produced by the steam cycle, this negative impact on fuel efficiency is diluted. An analysis of the Sutter Power Project (97-AFC-2) showed that annual average fuel efficiency would be reduced 1.5 percent compared to a wet cooling system. A slightly greater reduction in efficiency could be expected for BEP II due to the higher ambient temperatures encountered at the project site.

Reliability Impacts of Hybrid Cooling

There are many variations of design of hybrid cooling that may perform the cooling function in this situation. The balance of wet to dry cooling options that are both incorporated into the hybrid design influence the reliability of the power plant. As the hybrid cooling design shifts from a majority wet cooling system to a majority dry cooling

system, the hybrid cooling system becomes less reliable due to the increased possibility of power curtailment. A hybrid cooling system can be expected to yield reliability at least as great as a dry cooling system, and probably greater, due to the inherent redundancy of the combination of dry and wet systems. Significant adverse impacts on plant reliability from use of hybrid cooling are therefore unlikely.

Efficiency Impacts of Hybrid Cooling

A hybrid cooling system can be expected to provide cooling more effectively than a dry cooling system, especially on the very hot days when dry cooling system performance would show the most degradation. While less effective on an annual average basis than a wet cooling system, a hybrid system would reduce the loss of power plant fuel efficiency to less than the 1.5 percent reduction that might be expected with a dry cooling system. Incorporation of a hybrid cooling system would thus present less of an adverse impact on fuel consumption than dry cooling, but would still likely be less efficient than a wet cooling system.

Conclusion for Reliability

Wet cooling is the most reliable method for cooling the BEP II. Hybrid cooling may exhibit a slight adverse impact on plant reliability, but it is not expected that these impacts would be significant. For dry cooling, only the applicant can perform the economic optimization of the ACC design in order to optimize the magnitude of significant impacts to plant reliability on the extremely hot days experienced at the BEP II site. Use of reclaimed or degraded water from the City of Blythe's treated wastewater or PVID's irrigation return flows, respectively, should have no significant impact on plant reliability.

Conclusion for Efficiency

Wet cooling would yield maximum fuel efficiency. Dry cooling would likely provide a reduction of fuel efficiency of 1.5 percent or more; hybrid cooling would likewise reduce fuel efficiency, but to a lesser degree. Use of reclaimed or degraded water from the City of Blythe's treated wastewater or PVID's irrigation return flows, respectively, should have no significant impact on fuel efficiency.

CONCLUSIONS

Water conservation, environmental and economic measures developed to compare the results of the alternative water supply and cooling schemes for the proposed project and site are shown in **APPENDIX A - SOIL AND WATER RESOURCES APPENDIX Table 8**. The following summarizes these results.

From a water conservation standpoint and to achieve conformity with state regulations and policies, including the Energy Commission's, dry cooling would accomplish the highest conservation of Colorado River water pumped as groundwater, reducing average annual water use from about 3,300 AFY to about 100 - 150 AFY. No new

water supply infrastructure (wells, pumps or off-site pipelines) would be needed, as the minimal water supply needed to support dry cooling could be made available using the existing BEP I infrastructure. Use of Rannells Drain water with either wet or hybrid cooling would accomplish conservation of higher quality Colorado River water derived as ground water by using the most degraded water available to the projecct. The use of Rannells Drain water would need to have a verifiably effective WCOP in order to avoid effects to other users of Colorado River water.

From an environmental view, the proposed project and all alternative water supply and cooling schemes at the proposed site would result in at least one common significant adverse impact, with an effect in Traffic/Transportation impacts to aviation safety. (See **Section 5.8 of this Appendix A,** and the **Executive Summary** and **Traffic/Transportation Sections of the FSA**.) There does not appear to be any mitigation to lessen the significance of the adverse impact to aviation safety, other than for the project to be located at one of the other feasible alternate sites as identified in the **Alternatives Section of the FSA**. To briefly distinguish the proposed project from water supply and cooling alternatives as to other potentially significant adverse impacts besides aviation safety, we summarize them as follows:

PROPOSED PROJECT – USE OF COLORADO RIVER WATER DERIVED FROM GROUNDWATER WITH WET COOLING

1. Biological Resources – Effects to wildlife due to selenium in the evaporation ponds; this can be mitigated with project redesign of the wastewater treatment system to zero liquified discharge (ZLD) to solids system.
2. Land Use – Loss of agricultural lands (only if retirement is chosen) resulting from implementing the WCOP; this can be mitigated through the purchase of agricultural land.
3. Traffic/Transportation – Aviation safety effects due to air currents from cooling tower and HRSG stack, and proximity of evaporation ponds to Blythe Airport flight paths, attracting birds that can damage aircraft.
4. Water (Effects to Surface Supplies) – Potentially significant adverse cumulative impact to downstream Colorado River water users; this can be mitigated with a verifiably effective WCOP.
5. Water (Effects to Groundwater Quality) - Potentially significant impact from project pumping of groundwater (see the Technical Report.).
6. Water Conservation Policies – Would not achieve maximum water conservation considering the project could do so with Dry Cooling at an alternate site.

Alternative 1 – Reclaimed Water from City of Blythe's WWTP with Wet Cooling

(Environmental effects were not considered in detail because the water supply is not adequate to meet the demands of BEP II.)

Alternative 2 – Irrigation Return Water from PVID with Wet Cooling

1. Biological Resources – Effects to wildlife due to selenium in the evaporation ponds; this can be mitigated with project redesign of the wastewater treatment system to a Zero Liquid Discharge (ZLD) to solids system.
2. Land Use – Loss of agricultural lands (only if retirement is chosen) resulting from implementing the WCOP; this can be mitigated through the purchase of agricultural land.
3. Traffic/Transportation – Aviation safety effects due to air currents from cooling tower and HRSG stack, and proximity of evaporation ponds to Blythe Airport flight paths, attracting birds that can damage aircraft.
4. Water (Effects to Surface Supplies) – Potentially significant adverse cumulative impact to downstream Colorado River water users; this can be mitigated with a verifiably effective WCOP.
5. Water (Effects to Groundwater Quality) – Potentially significant impact from project pumping of groundwater (see the Technical Report).
6. Water Conservation Policies – Would not achieve maximum conservation considering the project could do so with Dry Cooling at an alternate site.

Alternative 3 – Irrigation Return Water from PVID & Hybrid Cooling (1/3 Wet & 2/3 Dry)

1. Biological Resources – Effects to wildlife due to selenium in the evaporation ponds; this can be mitigated with project redesign of the wastewater treatment system to ZLD to solids system.
2. Land Use – Loss of agricultural lands (only if retirement is chosen) resulting from implementing the WCOP; this can be mitigated through the purchase of agricultural land.
3. Traffic/Transportation – Aviation safety effects due to air currents from cooling tower and HRSG stack, and proximity of evaporation ponds to Blythe Airport flight paths, attracting birds that can damage aircraft.
4. Water (Effects to Surface Supplies) – Potentially significant adverse cumulative impact to downstream Colorado River water users; this can be mitigated with a verifiably effective WCOP.
5. Water Conservation Policies – Woul dnot achieve maximum water conservation considering the project could do so with Dry Cooling at an alternate site.

Alternative 4 – Dry Cooling

1. Traffic/Transportation – Aviation safety effects due to air currents from cooling tower and HRSG stack, and proximity of evaporation ponds to Blythe Airport flight paths, attracting birds that can damage aircraft.

Alternative 5 – Dry Cooling with a 50 MW Peaker

(Environmental effects were not considered in detail because they are considered to be similar to Alternative 4 – Dry Cooling.)

If the project could be sited at an alternative location, it is likely that dry cooling and a zero-liquid discharge to solids system could be employed to achieve maximum conservation of water and avoid contributing to a significant cumulative environmental impact with regard to Colorado River water supplies to other entitled users. Staff believes there would not be significant adverse environmental impacts in any technical area associated with dry cooling and a zero-liquid discharge to solids wastewater treatment system at an alternate site.

From a financial perspective all alternatives including the highest cost alternative, dry cooling, are economic alternatives that are reasonably comparable in cost to the proposed project. When accounting for financial elements other than lost power effects from hybrid or dry cooling, all alternatives are equivalent in cost to the proposed project. Even when accounting for effects in power production, dry cooling would only result in a 0.5 to 3.5% increase in the total cost of production compared to the proposed project.

The applicant has estimated that its average annual production costs will range from $0.035/KWH - $0.050/KWH (BEPII 2002 - AFC Table 6.0-3, Project Alternatives). In evaluating the highest cost alternative dry cooling, staff has estimated that in the worst case, BEP II's cost of production would increase only $0.001/KWH. This would result in an increase in BEP II's annual production cost in the low range from $0.035/KWH to $0.036/KWH and in the high range from $0.050/KWH to $0.051/KWH. The minimal increase in production cost would not compromise the project owner's ability to recover its investment and earn a return (profit) considering power values from sales are typically ranging from 100% to 300% of the cost of production.

Staff cannot recommend the use of any alterntive at this site, however, due to significant adverse impacts to aviation safety common to the proposed project and any water supply and cooling alternative associated with the proposed project site.

Of the two alternative water supplies considered in detail, only irrigation return water from PVID is available in adequate quantities and is feasible for serving BEP II, but would not avoid significant adverse cumulative impacts to surface water supplies without a verifiably effective WCOP. While all three cooling design options (wet, hybrid and dry) are feasible at this location, wet and hybrid cooling would not avoid significant adverse cumulative impacts to surface water supplies without a verifiably effective WCOP. Absent a WCOP, it would affect users with entitlements to Colorado River water and would not conform with state water policies addressing and providing guidance for conservation of fresh water supplies.

Based on the compilation of water conservation, environmental and economic measures presented in **SOIL AND WATER RESOURCES APPENDIX Table 8**, and subject to mitigation of significant adverse impacts as noted in the table and discussed

in the FSA, staff believes either Alternative 4 – Dry Cooling/Alternative 5 – Dry Cooling with a 50 MW Peaker or Alterntive 2/3 Irrigation Return Water from PVID with Wet or Hybrid Cooling and a verifiably effective WCOP are preferable alternatives to the proposed use of Colorado River water withdrawn as groundwater and wet cooling (Proposed Project). Staff has not evaluated the environmental effects of Alternative 5 – Dry Cooling with a 50 MW Peaker, and while they are assumed to be reasonably equivalent to Alternative 4 – Dry Cooling, staff can provide this assessment in an addendum to the FSA if necessary and desired by the Energy Commission.

Staff believes conservation of water supplies throughout California, but particularly in the Colorado River basin, is imperative, considering that all of California's entitlements from the Colorado River are fully allocated, the need to preserve the highest quality water for the highest beneficial use consistent with state regulations and policies, and that California is mandated to reduce its historical use by over 1 million AFY. The proposed project would cause significant adverse cumulative impacts to surface water supplies. It would affect users with entitlements to Colorado River water and would not conform with LORS addressing and providing guidance for conservation of fresh water supplies. Dry cooling is an entirely feasible technology used in numerous power plants in California and elsewhere where there are either insufficient water supplies, or where the impacts would be adverse and significant to regional water supplies. Staff has concluded that this is the case with the proposed water supply for BEPII. Other California power projects utilizing dry cooling are either currently operating (Sutter and Crockett) or being built (Otay Mesa) and are/will be competing in the same merchant power market as BEP II.

In considering the Proposed Project, staff believes BEP II's proposed consumptive use of Colorado River water withdrawn as groundwater lacks clarity in terms of entitlement, availability, and USBR Accountability issues and is not in conformance with LORS and state policies. BEP II's proposed water use would also cause significant cumulative impacts to other users of this resource in the region.

The compilation of environmental and engineering measures comparing the proposed project with alternatives for water supply and cooling is presented below in **SOIL AND WATER RESOURCES APPENDIX Table 8.** Measures with potential significant adverse impacts or inconsistency with LORS are shaded for ease of recognition. If the project could be sited at an alternative location, it is likely that dry cooling and a zero-liquid discharge to solids system could be employed to achieve maximum conservation of water and avoid contributing to a significant adverse cumulative impact with regard to Colorado River water supplies to other entitled users in southern California. Staff also believes if an alternate site were chosen, there would not be significant adverse environmental impacts in any technical area associated with dry cooling and a zero-liquid discharge to solids wastewater treatment system.

Staff also concludes that Alternative 1 – Reclaimed Water from City of Blythe's WWTP with Wet Cooling is not presently a viable alternative due to the following:

1. The potential supply of reclaimed water is not sufficient to meet BEP II demands over the life of the project, while other sources of lesser quality water already exist (See Soil & Water Resources Appendix Tables 1 and 2).
2. City of Blythe does not have any existing or foreseeable plans to implement Title 22 tertiary wastewater treatment or a reclaimed water program.
3. The use of reclaimed water would essentially be use of Colorado River water.

CONSISTENCY OF ALTERNATIVES WITH THE CALIFORNIA CONSTITUTION, WATER CODE AND STATE WATER POLICY

Staff has determined implementation of the Proposed Project– Use of Colorado River Groundwater would be considered a waste or unreasonable use or unreasonable method of use (see Soil and Water Resources Technical section) of water as defined in the State Constitution, Water Code and other relevant LORS and policies including those of the Energy Commission. State policy promotes the highest and best use of fresh inland water, as well as, conservation of fresh water supplies when possible. A significant number of state statutes set forth policy statements and findings promoting these essential concepts in relation to water quality and resources. These numerous statutes consistently promote efficient use and conservation of California's valuable water resources.

SOIL AND WATER RESOURCES APPENDIX Table 8
Environmental & Economic Summary of Alternatives and the Proposed Project

Environmental & Economic Measure	Proposed Project	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
	Colorado River Groundwater & Wet Cooling	**Reclaimed Water from City of Blythe's WWTP & Wet Cooling**	**Irrigation Return Water from PVID & Wet Cooling**	**Irrigation Return Water from PVID & Hybrid Cooling**	**Dry Cooling**	**Dry Cooling & 50 MW Peaker**
Air Quality – PM10 Construction Emissions	Base Case No Sig. Impact	Not Evaluated in detail due to Water Supply not being available in sufficient quantity	Higher Emissions No Sig. Impact	Higher Emissions No Sig. Impact	Higher Emissions No Sig. Impact	Not Evaluated in Detail
Air Quality – PM10 Operation Emissions	Base Case No Sig. Impact		Same as Base Case No Sig. Impact	Lower Emissions No Sig. Impact	Lower Emissions No Sig. Impact	
Biological – Effects to Birds due to Selenium Contamination in Evaporation Pond	ZLD to solids system needed to mitigate		ZLD to solids system needed to mitigate	ZLD to solids system needed to mitigate	No Sig Impact	
Biological – Cooling Tower & Water Pipeline Habitat Loss for Burrowing Owl & Desert Tortoise	No Sig Impactt		Route B Preferred No Sig Impactt	No Sig Impact	No Sig Impact	
Cultural Resources – Effects to Historically Significant Resources	No Sig Impact		No Sig Impact	No Sig Impact	No Sig Impact	
Geology & Paleontology – Effects to Paleontologic Resources	Can Mitigate Potential Sig Impacts		Can Mitigate Potential Sig Impacts	Can Mitigate Potential Sig Impacts	Can Mitigate Potential Sig Impacts	
Hazardous Materials	No Sig Impact		No Sig Impact	No Sig Impact	No Sig Impact	
Land Use – Power Plant Site Consistency with County LORS	No Sig Impact		No Sig Impact	No Sig Impact	No Sig Impact	
Land Use – Linear Facilities Consistency with County LORS	No Sig Impact		No Sig Impact	No Sig Impact	No Sig Impact	
Land Use – Effect on Agricultural Lands	Ag. Land pruchase needed to mitigate		Ag. Land pruchase needed to mitigate	Ag. Land pruchase needed to mitigate	No Sig Impact	
Noise	No Sig Impact		No Sig Impact	No Sig Impact	Can Mitigate Potential Sig Impacts	
Power Plant Reliability & Efficiency	No Sig Impact		No Sig Impact	No Sig Impact	No Sig Impact	
Public Health	No Sig Impact		No Sig Impact	No Sig Impact	No Sig Impact	
Socioeconomics	No Sig mpact		No Sig Impact	No Sig Impact	No Sig Impact	
Traffic/Transportation – Aircraft Safety	Potential Sig Impacts		Potential Sig Impacts	Potential Sig Impacts	Potential Sig Impacts	
Visual - Effects from Cig. Structures	Can Mitigate Potential Sig Impact		Can Mitigate Potential SigImpact	Can Mitigate Potential Sig Impact	Can Mitigate Potential Sig Impact	
Visual - Water Pipelines	No Sig Impacts		No Sig Impacts	No Sig Impacts	No Sig Impacts	
Waste Management	No Sig Impact		No Sig Impact	No Sig Impact	No Sig Impact	
Worker Safety	No Sig Impact		No Sig Impact	No Sig Impact	No Sig Impact	
Soil & Water Resources - Sediment & Erosion Control	No Sig Impact		No Sig Impact	No Sig Impact	No Sig Impact	
Soil & Water Resources – Colorado River Water Quality	Slight Degradation No Sig Impact		Slight Improvement No Sig Impact	Slight Improvement No Sig Impact	Slight Improvement No Sig Impact	
Soil & Water Resources – Effect to Surface Water Supplies	WCOP needed to mitigate impact	Recycled Supply Not Adequate	WCOP needed to mitigate impact	WCOP needed to mitigate impact	No Sig Impact	No Sig Impact
Soil & Water Resources – Effect to Groundwater Quality	**Potential Sig Impact**		**No Sig Impact**	**No Sig Impact**	**No Sig Impact**	**No Sig Impact**
Soil & Water Resources – Range of Incremental Power Production Costs Attributable to Water & Cooling ($/KWH)	**$0.00117**	**$0.00126**	**$0.00127**	**$0.00126 - $0.00204**	**$0.00120 - $0.00240**	**$0.00134 -$0.00168**
Soil & Water Resources – % Increase in Total BEP II Production Cost compared to Proposed Project	**Baseline**	0.2 - 0.3%	0.2 – 0.3%	0.2 – 2.5%	0.1 – 3.5%	**0.3 – 1.5%**

Notes for Soil and Water Resources Appendix Table 8:

1) The Range of Incremental Power Production Costs Attributable to Water & Cooling includes an accounting before and after considering the effects of power revenue losses or gains related to dry cooling and the peaker unit respectively.
2) The % Increase in Total BEP II Production Cost Compared to the Proposed Project reflects Note 1 above and is based on the Applicant's estimate of average annual production costs ranging from $0.035/KWH - $0.050/KWH (AFC Table 6.0-3, Project Alternatives).

Results of the overall analysis comparing the characteristics of various water supply and cooling alternatives for consistency with State guidelines for fresh water conservation as related to LORS is as follows:

1. Ultimate Dependency on Fresh Water – This is a measure of the extent of fresh water conservation that is achievable. Alternative 4 – Dry Cooling, Alternative 5 – Dry Cooling with a 50 MW Peaker, and Alternative 3 – Hybrid Cooling would diminish fresh water needs for process and cooling to an average of about 100, 150 and 1,100 AFY respectively. Alternative 2 – PVID's Irrigation Return Water would use an average of 3,262 AFY of the most degraded water available. Reclaimed water from City of Blythe's WWTP – Alternative 1 is neither available, nor is it projected to be sufficient to supply BEP II demands within the initial 30 years of the BEP II project. The Proposed Project using groundwater from on-site wells, would use an average of 3,262 AFY of the highest quality water available, other than Colorado River surface water, but has associated unmitigated significant cumulative impacts on regional water supplies.
2. Adequacy of Water Quality Before Treatment – All sources of water supply are adequate for use in power plant cooling at BEP II except for City of Blythe's wastewater, which would need to be treated to a disinfected tertiary level. City of Blythe has no current plans to upgrade its wastewater treatment from advanced secondary treatment to teritiary. Staff has considered the water treatment requirements using a range of water quality from best case using groundwater with a TDS of 1,010 mg/l to worst case using irrigation return water from PVID with TDS averaging about 1,630 mg/l. The distinctions in treatment requirements for each alternative are reflected in the economic analysis.
3. Effect of Recycled or Degraded Water Use on Public Health – Neither Colorado River groundwater nor PVID's irrigation return water would have any adverse impacts on public health. In order to use recycled water from City of Blythe's WWTP, it would first need to be treated to Title 22 tertiary standards in order to avoid potential effects to public health.
4. Adverse Effects to Downstream Water Rights – Dry cooling – Alternative 4 and Dry Cooling with the 50 MW Peaker – Alternative 5 would most clearly avoid adverse impacts to other existing and senior users who have entitlement to Colorado River water. The next best case would be Hybrid Cooling – Alternative 3, which requires only an average of 1,100 AFY water supply. Staff believes that due to a lack of clarity for BEP II's proposed use of groundwater in terms of entitlement, availability, USBR Accountability, and unmitigated significant impacts, that the Proposed Project could potentially impact other users who have senior entitlements to Colorado River water.
5. Degradation to Water Quality – None of the alternatives would result in degradation to water quality compared to existing conditions. Alternative 2 – PVID's Irrigation Return Water has the greatest potential to contribute to improving water quality of the Colorado River. Alternative 2 would utilize up to 6.2 cfs and an average annual quantity of 3,262 AFY of the most degraded water readily available to BEP II. Alternative 2 would avoid discharge of the irrigation return water, which contributes

an average TDS of 1,630 mg/l of degraded water into the Colorado River, compared to the Colorado River's average TDS of about 640 mg/l.

6. Injury to Plantlife, Fish & Wildlife – With respect to water use, none of the alternatives would cause a significant adverse impact to plantlife, fish and wildlife. For Alternative 2 – Irrigation Return Water from PVID with Wet Cooling and Alternative 3 – Hybrid Cooling, the preferred water supply pipeline route is Alternative B because it reduces potential impacts to the riparian vegetation in the Rannells Drain. Please see the discussion of Biological Resources in Section 5.2 of this Appendix A as well as the **Biological Resources** section of the FSA for further discussion of impacts.
7. Reasonable Cost of Water Supply – Based on the preliminary cost comparison as shown in **SOIL AND WATER RESOURCES APPENDIX Table 7**, and before accounting for lost power generation due to reduced capacity with hybrid or dry cooling, all alternatives are comparable in cost. Even after accounting for losses and gains in power generation revenues, the incremental effect on the cost of power production is only about .0002 - .0012 dollars per KWH comparing the two dry cooling alternatives to the proposed project. In staff's view, the incremental increase in costs associated with water supply and power plant cooling is not a significant effect on project economics or on the owner's ability to market power.

These measures are consistent with the criteria set forth under California Water Code Section 13500 et seq. State water policy requires that an examination of alternatives to fresh water for cooling purposes be conducted. In conducting this examination staff has considered the factors set forth under California Water Code Section 13500 et, seq. Staff has concluded that two feasible alternative cooling methods – Dry and Hybrid Cooling and one feasible alternate water supply associated with wet cooling –Irrigation Return Water from PVID, are available.

Staff also believes that based on its cost analysis, its conclusions are consistent with the recent policy adopted by the Energy Commission. In accordance with a recommendation in the 2003 Integrated Energy Policy Report (IEPR), the Energy Commission adopted a policy that would only approve the use of fresh water for cooling purposes by power plants when alternative water supply sources and cooling technologies are shown to be "environmentally undesirable" or "economically unsound" (CEC 2003a, Page 36).

Staff also finds that its recommendation for conservation of water supply through use of Dry Cooling at BEP II – Alternative 4 or 5, or use of degraded water from Rannells Drain – Alternatives 2 and 3, is further supported by the recent release of the Draft CA Water Plan Update 2003. On October 6, 2003, CA Department of Water Resources (DWR) posted a draft of the CA Water Plan Update 2003 (Bulletin 160) to begin receiving comments from stakeholders. Bulletin 160 is updated every five years, and for 2003, the process has included input from a broadly diverse Advisory Committee consisting of 65 members representing all primary interest groups. The draft report includes projections of the state's population growth, which is expected to increase by an average 600,000 people per year, realizing a 50 percent increase by 2030. The report

also identifies the need to provide 3 to 5 million AFY of water for the increasing population and correcting groundwater overdraft, and an additional un-quantified amount for unmet environmental purposes. The recommended measures for providing this additional water supply to California do not rely on any significant new surface storage projects, but instead rely on capturing a variety of conservation and reclamation projects. The recommended measures with the highest level of confidence for implementation include urban and agricultural water use efficiency improvements, recycling municipal wastewater, conjunctive management, water transfers and desalinization of brackish water. (DWR 2003) With this vision for California's water future, it is imperative that water be conserved whenever reasonable, feasible, and environmentally sound consistent with state policies and guidance.

APPENDIX A.1 - BACKGROUND ON WATER SUPPLY AND COOLING OPTIONS

A.1.1 BEP II PROPOSED POWER PLANT OPERATION AND COOLING

The project as proposed would consume approximately 3,262 AFY or approximately 2,220 gallons per minute (gpm) annual average of Colorado River ground water pumped from a well located on the project site. Additional emergency back-up water source from the Blythe Energy Project (BEP) would be used if required due to problems with the on-site well.

The proposed project will use the water for three purposes:

- process makeup at a rate of approximately 108 AFY
- evaporative cooling in a conventional cooling tower at a rate of approximately 3019 AFY
- and for gas turbine inlet cooling at an extremely variable rate which will average approximately 135 AFY over the year.

The proposed cooling towers are not plume-abated; visible plume would be expected infrequently at this location due to the low moisture content of the ambient air under most conditions. The drift from the towers is proposed at 0.0006% of circulating water flow. The cooling towers and supporting water treatment systems are designed for seven cycles of concentration.

Blowdown from the cooling tower is treated by a brine concentrator in order to separate the blowdown into two streams; one of high purity/low dissolved solids and the other of high dissolved solids concentration. The brine concentrator design is based on a mechanical vapor compression process. The brine concentrator recovers approximately 95.5 % of the blowdown from the cooling tower. This recovered water is recycled to the plant as feed to the cooling tower and as feed to the demineralizer, which supplies the plant process water – distilled high purity water. The approximately

4.5% of water that is not returned to the cooling tower or plant process, is discharged to the evaporation pond.

The BEP II plant includes a two cell 6.48-acre Evaporation Pond. The evaporation ponds provide a holding for the high solids waste water from the brine concentrator. In addition, either of the ponds may be taken out of service and the remaining water allowed to evaporate over a period of years. When this is accomplished, the remaining solids in the pond(s) will be removed for disposal at a solids disposal site.

In the AFC and supplements, the applicant proposes using Colorado River ground water as feed source for a conventional evaporative cooling tower for steam turbine exhaust cooling. After several design variations, the applicant desires to maintain flexibility to design its GTIC (gas turbine inlet cooling) using either an evaporative cooler or a mechanical refrigeration cooling system cooled with evaporative cooling. The mechanical cooling system shown in the latest design documents will use an evaporative cooling tower for its ultimate heat sink, located on top of the cooling system structure at the gas turbine inlet. Both cooling towers are designed without plume-abatement.

Cooling in both evaporative coolers – main cooling towers and inlet air cooling towers – is accomplished by the evaporation of water. Evaporation takes advantage of the "fugacity" or heat of evaporation that occurs in changing the state of water from liquid to vapor. This heat content is very large on a per-pound basis compared to the change per pound of water during non-evaporative heating and cooling. However, because evaporation adds moisture to the air that is swept into the cooling towers, and discharged vertically, there is a possibility of creating vapor plumes from the towers. The Blythe airport is very near the project site, so the consequences of a plume are investigated in the Land Use and Traffic/Transportation sections of the FSA. Experience from BEP I should be informative.

Thermal power plants convert fuels (such as natural gas) to electrical power and waste heat. In combustion turbines, or Brayton cycles, almost all the waste heat is rejected in the exhaust gases. In steam turbines, or Rankine cycles, waste heat is rejected in the flue gases and in the condenser/cooling system. BEP II is a combined cycle facility that incorporates both combustion turbines and steam turbines. The combustion turbines will require water for inlet cooling and the hot exhaust gases will be used to generate steam to drive the steam turbines. The steam turbines require cooling for efficient power generation. Operation of a cooling system for steam turbines serves three purposes: (1) condensing steam into water to allow pumping of a liquid instead of compressing a gas to raise the feedback to the boiler to high pressures; (2) recycling of the water back to the boiler to optimize water use; and (3) minimizing the steam turbine exhaust pressure to maximize the output of the steam turbine. The temperature of the heat sink and the heat transfer efficiency of the cooling system affect the overall plant performance. In the case of the BEP II, the proposed cooling medium (or heat sink) is obtained by evaporation of Colorado River ground water.

This section describes three general cooling technologies: dry cooling, hybrid cooling, and wet cooling systems. General background information, conceptual design information, and possible environmental effects are presented for each cooling technology. In addition, this section describes using alternative sources of water of lesser quality instead of fresh ground water for cooling. **SOIL AND WATER RESOURCES APPENDIX Table A.1.1** presents a summary of the most recently operational and approved combined cycle power plants, and indicates the type of cooling water used, the cooling system, and whether ZLD was implemented.

SOIL AND WATER RESOURCES APPENDIX Table A.1.1
Recent Operational and Approved Combined Cycle Power Plants

	Project Name	MW	County	Cooling Method	Water Source	Zero Liquid Discharge
Operational	Delta Energy Center	880	Contra Costa	Wet Cooling	Reclaimed water	No
	GWF Hanford Peaker	96	Kings	Wet Cooling	Fresh water	No
	Los Medanos	559	Contra Costa	Wet Cooling	Reclaimed water	No
	Moss Landing Expansion	1060	Monterey	Once-through cooling	Ocean water	No
	La Paloma	1048	Kern	Wet Cooling	Fresh water	No
	Sunrise Combined Cycle	320	Kern	Wet Cooling	Fresh water	No
	Sutter Power **	540	Sutter	Dry Cooling	None	Yes
	Blythe Energy 1	520	Riverside	Wet Cooling	Fresh water	No
Approved/Under Construction						
	Contra Costa Repower	530	Contra Costa	Wet Cooling	Recycled water	No
	Cosumnes	500	Sacramento	Wet Cooling	Fresh Water	Yes
	Elk Hills	500	Kern	Wet Cooling	Fresh water	No
	High Desert	720	San Bernardino	Wet Cooling	Fresh water	Yes
	Huntington Beach Repower	450	Orange	Once-through cooling	Ocean water	No
	Russell City	600	Alameda	Wet Cooling	Reclaimed water	No
	Palomar	546	San Diego	Wet Cooling	Reclaimed water	No
	Metcalf	600	Santa Clara	Wet Cooling	Reclaimed water	No
	East Altamont	1100	Alameda	Wet Cooling	Fresh and reclaimed water	Yes
	Mountainview	1056	San Bernardino	Wet Cooling	Blended reclaimed water	No
	Otay Mesa	510	San Diego	Dry Cooling	None	No
	Three Mountain Power	500	Shasta	Wet/dry Cooling	Fresh and reclaimed water	Yes
	Western Midway Sunset	500	Kern	Wet Cooling	Fresh water	Yes
Source: Energy Commission,						

** For comparison purposes, Sutter Energy Center is in an area where 1% highest temperature is 101 ºF, compared to Blythe at 112 ºF. Sutter uses a 30 cell ACC, and is reported to have increased plant cost by $10 million. Staff anticipates BEP II would use a 45 cell ACC costing $18 million. (Source Fahey). See below.

A.1.2 DRY COOLING SYSTEMS

Description of the Process and Equipment Required

There are two types of dry cooling systems: direct dry cooling and the lesser used indirect dry cooling. In both systems, fans blow air over a radiator system to remove heat from the system via convective heat transfer (instead of using water for cooling or evaporative heat transfer). In the direct dry cooling system, also known as an air-cooled

condenser (ACC), steam from the steam turbine exhausts directly to a manifold radiator system that rejects heat to the atmosphere, condensing the steam inside the radiator. This process is illustrated in **SOIL AND WATER RESOURCES APPENDIX Figure 3** (See Part 3 of this report). Direct dry cooling at BEP II is analyzed in this report.

Indirect dry cooling uses a secondary working fluid (in a closed cycle with no fluid loss) to help remove the heat from the steam. The secondary working fluid extracts heat from the surface condenser and is transported to a radiator system that is dry cooled (fans blow air through the radiator to remove heat from the working fluid). Because indirect dry cooling is not very common and does not appear to have any particular advantages at the BEP II, it was not analyzed in this report.

Historic, Current, and Proposed Use of Dry Cooling

Dry cooling was first used in 1938 for a vacuum steam turbine installed in a power plant in Germany (Guyer, 1991). By 1971, 14 power plants worldwide had been equipped with condensers for direct dry cooling. The largest installation at that time was a roof-mounted unit for a 160 MW power plant in Utrillas, Spain. By 1991, dry cooling was being used at approximately 40 power plants worldwide with generating capacities greater than 100 MW. Since that time, the use of dry cooling has increased significantly around the world and in the United States (Guyer 1991, EPA 2001, Maulbetsch 2001).

The largest dry-cooled system in the world today is the Matimba plant in South Africa, which began operating in 1991. It represented a major scale-up of dry-cooled technology, using direct dry cooling for six, 660 MW units, totaling 3,960 MW.

The Sutter Power Plant, one of the newest power plants in California (on-line in 2001) was constructed as a dry-cooled facility. This plant was constructed by Calpine Corporation and is a 540 MW, natural gas-fired, combined cycle facility. The combined cycle design consists of two CTGs, two HRSGs with duct burners, and a STG. The Sutter Power Plant uses a 100 percent dry cooling design that reduces groundwater use by over 95 percent from the original proposal of 3,000 gallons per minute (gpm) to a revised annual average of less than 140 gpm. The remaining five percent represents the makeup for the steam cycle, and other non-cooling plant processes. To treat the plant wastewater stream, Sutter uses a zero liquid discharge system that eliminates any discharge of any process waste fluids to land or water.

The Energy Commission also permitted the Crockett Co-Generation Plant, a 240 MW co-generation facility with dry cooling in Crockett, which went on-line in 1995. The Crockett Co-Generation Plant uses 12 fans to cool the steam output from the 80-MW steam turbine. Energy Commission staff visited the facility in June 2000 and found the dry cooling to be operating as expected, with no major problems. The Energy Commission also permitted in 2001 the Otay Mesa facility, a 510 MW combined-cycle facility in San Diego County, which is under construction. Reliant Energy had also proposed a new dry-cooled facility, the 500 MW Colusa Power Project that proposed using 40 fans. This project was undergoing environmental review by the Energy Commission when its application for certification was withdrawn. California power projects utilizing dry cooling

are either currently operating (Sutter and Crockett) or being built (Otay Mesa) and are/will be competing in the same merchant power market as BEP II.

Dry cooling is also becoming a common technology for power plants in Nevada. Currently, the El Dorado Energy Project is the only operational air-cooled power plant facility in the State of Nevada. This 480 MW combined cycle facility is located in Boulder City. Two other combined cycle air-cooled power plants are currently under construction in Nevada: the Duke Energy 1,200 MW Moapa Energy Facility (approximately 20 miles northeast of Las Vegas in Apex Industrial Park) and the 575 MW Big Horn Power Plant (in Primm, approximately 55 miles southwest of Las Vegas). In addition, there are four combined cycle air-cooled power plants proposed for construction in Nevada. These facilities include: Apex Generating Station (1,100 MW), Arrow Canyon (575 MW), and Silver Hawk (570 MW) facilities at the Apex Industrial Park, and the Copper Mountain Power Facility (600 MW) in Boulder City.

Dry cooling represents 69 percent of the total proposed power plant capacity in Massachusetts. Of this capacity, 525 MW are approved, 750 MW are on-line and 2,905 MW are under construction (Dougherty 2002).

Dry cooling is also considered to be a feasible technology by the New York Department of Environmental Conservation, which has recently required dry cooling to replace once-through cooling in certain applications. New York has one 1,080 MW dry cooling plant under construction and eight others with a combined total generation of 5,328 MW that are at various stages of the approval process (Radle 2002).

Energy Commission staff research indicates that the use of dry cooling technology is expanding rapidly, and the size of the plants using dry cooling is also increasing. It is estimated that there are over 2,500 MW of U.S. power generated using dry cooling, and approximately 15 to 20 GW worldwide. Roughly 15 percent of the projects under construction and in development (approximately 40,000 MW) are projected to be either 100 percent dry cooled or wet/dry hybrid cooled (Ortega 2002).

Advantages and Disadvantages of Dry Cooling

Dry cooling is the best choice of cooling technologies for a steam power plant with regard to water conservation since it conserves about 95 percent of the water otherwise demanded by wet cooled systems and minimizes the volume of wastewater. However, this technology can raise environmental and economic issues, depending on the location and specific situation (these are reviewed for the BEP II site specifically in Section 5 of this report). The following is a general list of the advantages and disadvantages of dry cooling.

Advantages of Dry Cooling Systems

- Dry cooling saves valuable fresh water for other beneficial uses.
- Dry cooling is not water dependent so plant location is not tied to a water source. It has essentially no water intake or water discharge requirements.

- Dry cooling minimizes the use of water treatment chemicals.
- Dry cooling minimizes the generation of liquid and solid wastes.
- Dry cooling does not generate visible plumes that are commonly associated with wet cooling towers.
- Dry cooling eliminates impacts to aquatic biological resources.
- Dry cooling eliminates the need for disturbance of wetland/aquatic substrate habitat.

Disadvantages of Dry Cooling Systems

- Dry cooling requires air-cooled condensers that can have negative visual effects.
- Dry cooling requires the disturbance of a larger surface area for the air-cooled condensers than is required for wet cooling towers.
- Dry cooling can have noise impacts that are greater than wet cooling systems because of the number of fans and the considerably greater total airflow rate. New quieter fans and other mitigation measures are available to reduce these impacts.
- Using dry cooling, the power plant steam cycle efficiency and output can be slightly reduced, depending on site conditions and seasonal variations in ambient conditions. Also, extra power is needed to operate the cooling fans.
- Capital costs for building air-cooled condensers are generally higher than capital costs for wet cooling or once-through cooling.

Dry cooling can also be used for gas turbine inlet air-cooling (GTIC). Mechanical refrigeration cooling design, similar to a typical room air conditioner but very much larger, is proposed by the Applicant. As in a room air conditioner, it is possible to use direct air-cooling for the heat sink rather than evaporative cooling. This option is included in the dry cooling study of applicant's AFC Appendix 6.0. For this study, the small amount of water for GTIC, 0 to 230 AFY approximately, was not separately considered, but is included as part of the overall BEP II requirements amounting to an annual average of 3300 AFY.

A.1.3 WET EVAPORATIVE COOLING

Description of the Process and Equipment Required

Wet evaporative cooling systems typically use about 5 percent to 15 percent of the water used by once-through wet cooling systems (historically used for cooling power plants located on the coast or on large water bodies). In wet evaporative cooling, water is used to remove waste heat from the system through cooling towers, and is then recirculated. In evaporative cooling systems, process heat is removed by evaporation each time the water is cycled through the system. **SOIL AND WATER RESOURCES APPENDIX Figure 2** shows how a typical evaporative cooling system operates (see Part 3 of this report).

The cooling system must be replenished with "makeup water" to replace water "lost" (or consumed by) to evaporation, blowdown[1], and drift. Evaporation removes heat, but also consumes cooling system water, and increases the concentration of impurities. Blowdown volumes are dependent on the quality of the makeup water, and the system specifications regarding the impurities that are in the makeup water.

Current Uses of Wet Cooling

Evaporative cooling is one of the most common technologies in the world for the removal of waste heat, including many applications at power plants. Evaporative cooling towers used by U.S. industries remove heat using approximately 500 billion gallons of water per day (Burger 1994).

Advantages and Disadvantages of Wet Cooling

The following is a general list of the advantages and disadvantages of evaporative wet cooling.

Advantages of Wet Cooling Systems

- Wet cooling removes heat by the evaporation of a fraction of the recirculating water. Once a wet cooling system is filled, the only water withdrawn from the environment is makeup water to replace water lost to evaporation, blowdown, and drift.
- Capital costs for a wet cooling system are less than those of dry cooling. Wet cooling can reach "wet bulb[2]" temperatures, which are generally lower than "dry bulb[3]" temperatures, thus improving cooling efficiency in comparison to dry cooling systems.
- Wet cooling can use lesser quality or degraded water such as recycled water from wastewater treatment plants, thereby avoiding the use of fresh water.

Disadvantages of Wet Cooling Systems

- Wet cooling requires a dependable source of water, and on a total plant basis, requires a volumetric factor on the order of 100's more water than dry cooling systems.
- Wet cooling requires water treatment and monitoring to control concentrations of impurities.
- Wet cooling can produce water vapor plumes that have negative aesthetic effects.

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[1] Blowdown is the bleeding off of a small percentage of the total flow, so that the new, more pure makeup water balances impurities. In this way, the water in the system stays within operational specifications as well as meeting any quality requirements for discharge.

[2] Wet bulb temperature accounts for the relative humidity in the air (the largest differences between wet and dry bulb temperatures would occur in very dry conditions).

[3] Dry bulb temperature is the temperature indicated by an ordinary thermometer that does not account for moisture in the air.

A.1.4 HYBRID (WET/DRY) COOLING

Description of the Process and Equipment Required

Hybrid cooling systems combine wet and dry cooling technologies. There is a wide range of system designs possible, covering the entire spectrum of wet versus dry depending on plant needs.

At one end of the spectrum is the "plume abatement cooling tower" design. In this case, an otherwise conventional evaporative cooling tower is designed with a small dry section. The name "plume abatement" comes from a primary purpose of this dry section: to eliminate the visible plume by cooling the circulating water/heating the air-water discharge from the cooling tower so that the discharge does not fall below the dew point and cause a visible plume. Plume abatement wet cooling typically has the ability to achieve 3 percent "dry" cooling and 97 percent "evaporative wet" cooling.

At the other end of the spectrum is "spray enhanced air dry cooling." In this design, an air-cooled condenser is "enhanced" by spraying cooling water directly into the steam before it enters the air-cooled condenser. While a range of designs is possible, a typical design would use 75 percent "dry" and 25 percent "wet" cooling (Maulbetsch 2001).

Despite the ends of the spectrum described above, a more typical hybrid cooling system would utilize both an air cooled condenser and an evaporative cooling tower within the same cooling system, and would achieve a ratio of wet to dry cooling that would be on the order of 50 percent. This is sometimes called a "water conservation design", and may also be called "parallel condensing cooling system".

The most common of the wet/dry systems is the plume abatement cooling tower. However, its usage is primarily to minimize visible plume, rather than to reduce water consumption for evaporation through full-time use of the dry section. The steam turbine exhaust is condensed simultaneously in both a surface condenser, which in turn is cooled by an evaporative cooling tower, and an air-cooled condenser. During operation, the condensing pressures in both the surface condenser and the air-cooled condenser constantly equilibrate due to the self-adjustment of steam flows entering each device. As ambient conditions, load conditions, and head rejection capability of each device vary over time, the steam flow to each will automatically adjust without active components being required on the steam side (Duke 2001a).

Current Use of Hybrid Cooling

Plume abatement wet/dry towers have been used since the 1970s with proven reliability. The parallel condensing cooling systems (with both a wet tower and a dry cooling tower) have been used since at least since the late 1980s. GEA Power Cooling Systems, Inc. (GEA) is one vendor that provides a parallel condensing system called the PAC Parallel Condensing System. This system combines reliable wet cooling and dry cooling tower technologies.

Advantages and Disadvantages of Hybrid Cooling

The following is a general list of the advantages and disadvantages of parallel condensing hybrid cooling.

Advantages of Parallel Condensing Hybrid Cooling Systems

- Water conservation hybrid systems may be designed to use anywhere from 20 percent to 80 percent of the water used in evaporative cooling tower systems. Evaporative systems require 5 percent to 15 percent of the flow required for once-through cooling systems.
- Once a parallel condensing hybrid cooling system is filled, the only water withdrawn from the environment is makeup water to replace water lost to evaporation, blowdown, and drift. Water consumption is reduced by the amount of dry cooling.
- Parallel condensing hybrid cooling can reach “wet bulb” temperatures in the wet portion of the system. These wet bulb temperatures are generally lower than “dry bulb” temperatures, thus improving cooling efficiency in comparison to an all-dry cooling systems.
- Because of the lowered water requirements, parallel condensing hybrid cooling systems can match project cooling water demands with limited quantities of fresh or recycled water that may be available.

Disadvantages of Parallel Condensing Hybrid Cooling Systems

- Parallel condensing hybrid cooling requires a dependable source of water.
- Although more efficient than dry cooling, the parallel condensing hybrid cooling system is less efficient than once-through or wet cooling.
- Parallel condensing hybrid cooling systems require water treatment and monitoring to control concentrations of impurities.
- The wet cooling side of the hybrid system can produce water vapor plumes that may have negative aesthetic effects.
- Capital and maintenance costs for hybrid systems are generally higher than once-through or wet systems since two systems are needed.
- Hybrid cooling systems can have noise impacts that are greater than wet cooling systems because of the increased number of fans and greater total airflow associated with the air cooled condensers. New quieter fans and other mitigation measures are available to reduce these impacts.

A.1.5 USE OF RECLAIMED OR DEGRADED WATER FOR POWER PLANT COOLING

Description of Water Treatment Processes

In many parts of California, treated wastewater is made available to industrial and agricultural customers for cooling or irrigation uses. Reclaimed or degraded water is generally priced at 50 to 90 percent of the cost of potable water. The use of reclaimed or degraded water at a power plant would not generally require additional equipment at the power plant itself, other than possibly increasing the capacity of water treatment systems for treating higher levels of total dissolved solids. As is typical with all power plants requiring a source of water, pipelines from a source of reclaimed or degraded water would need to be constructed and connected to power plant water intake systems.

There are two processes for treating reclaimed sewage water to an acceptable level for use in a generating facility: secondary wastewater treatment and tertiary wastewater treatment. The process for secondary wastewater treatment removes biodegradable organics and suspended solids, using chemical and/or biological processes. Tertiary treated wastewater is treated to nearly drinking water standards, requiring disinfection to kill any microorganisms that might cause disease. This can be done with chemical [e.g., chlorine] and/or physical [e.g., microfilter] processes.

The degree and type of treatment processes are determined by the proposed end use of the reclaimed or degraded water. Many large water treatment plants have a multi-user distribution system to enable unrestricted use by any customer; these wastewater treatment plants usually provide tertiary treatment followed by disinfection, because this meets the needs of California Wastewater Reclamation Criteria (Title 22). Title 22 identifies four different effluent quality levels, each matched to a set of probable uses.

Title 22 requires that any cooling system creating a mist such as those used at a power plant must use disinfected tertiary-treated reclaimed water. The requirement to use tertiary treated wastewater is due to the potential exposure to human contact from cooling tower mist or drift. Tertiary treated water is also required for unrestricted use where there is a high risk of public contact, such as landscape or food crop irrigation, and groundwater injection.

Current Uses of Reclaimed Water

The use of reclaimed water for non-potable processes and cooling tower makeup has been practiced for over half a century and is well established in California and is an integral part of most long-range water plans. SWRCB Policy 75-58 prioritizes the use of lower-grade water, such as reclaimed water over fresh inland water for power plant cooling. In addition, the California Water Code considers the use of potable-grade fresh water for non-potable uses, such as cooling tower makeup, an unreasonable use when reclaimed water is available. While irrigation is the primary use of reclaimed water in California, its seasonal nature requires seasonal storage or another method of effluent discharge during the non-irrigation season. Cooling tower makeup is the next greatest

use of California reclaimed water and its year round demand enables higher utilization of installed facilities.

The Sacramento Regional Wastewater Treatment Plant currently provides secondary effluent to SMUD for its Carson-Ice Generating facility cooling and the City of Lodi's treatment plant provides secondary effluent to two power generation facilities.

Since 1999, the Energy Commission has approved a number of combined cycled power plants utilizing tertiary treated reclaimed water for wet cooling and in some cases for process (steam) supply and landscape irrigation. Those already operational include the 555 MW Los Medanos Power Plant and the 880 MW Delta Energy Center. Power plants approved and pending construction include the 134 MW Malberg Project, 328 MW Magnolia Project, 528 MW Mountainview Project, 600 MW Metcalf Energy Center, 147 MW Pico Project, 1120 MW Tesla Project, 1100 MW East Altamont Energy Center, 600 MW Russell City Energy Center, 1087 MW San Joaquin Valley Energy Center, 670 MW Inland Empire Energy Center, and the 546 MW Palomar Energy Project. The Energy Commission is currently reviewing several more plants that propose to use reclaimed water including the conversion from an existing 180 MW simple cycle to a proposed 320 MW combined cycle Los Esteros Critical Energy Facility, and the proposed simple cycle 145 MW San Francisco Electric Reliability Project, and is very closely scrutinizing projects that have not fully considered use of reclaimed or degraded water where available.

Advantages and Disadvantages of Use of Reclaimed Water for Power Plant Cooling

The following is a general list of the advantages and disadvantages of cooling using reclaimed water.

Advantages of Cooling Using Reclaimed Water

- Reclaimed water, which may otherwise be directly discharged to surface waters or the ocean, has a beneficial use prior to discharge.
- The discharge volume of effluent pollutants is reduced.
- The water source is dependable even if a drought occurs.
- The purchase of reclaimed water stimulates local economic development.
- High-quality freshwater resources are preserved for drinking water supply, which maintains public health.
- There are no documented public health problems and the use of reclaimed water gains strong public acceptance.

Disadvantages of Cooling Using Reclaimed Water

- Reclaimed water may not always be readily available in the large quantities required.

- As is typical with all power plants requiring a source of water, pipelines from a source of reclaimed or degraded water would need to be constructed and connected to power plant water intake systems.

Additional water reclamation treatment may be necessary for unrestricted use.

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GLOSSARY

A GLOSSARY OF TERMS USED IN THIS APPENDIX A.

Gpm: Gallons per minute, a flow rate for water.

Acre foot: The volume of water stored in an acre of surface area and one foot in depth equivalent to 325,851 gallons.

AFY: Acre-Feet per year. A volume of water supplied or consumed over the course of one year;.

Mgd: Million Gallons per Day.

CFS: Commonly called "second feet", is actually cubic feet per second. This is another common measure of flow rate of water. One cfs is 448 gpm.

GTIC: Gas Turbine Inlet Cooling. Gas Turbines ingest large amounts of air to use both as working fluid and for combustion. Gas Turbines are very sensitive to the temperature of the incoming air; lower air temperature increases the capacity of a turbine as well as the efficiency to a great extent. In order to improve both capacity and efficiency, inlet air may be cooled, either by mechanical chiller or by

evaporative means such as spraying a fine mist of water directly into the air entering a turbine.

Heat of Fugacity: The additional heat required to boil water after it reaches boiling temperature.

Drift: The extremely small amount of water that leaves an evaporative cooling tower in droplets suspended in the air steam leaving the tower.

Blowdown: The water that is drained/discharged continuously from the cooling tower basin and sent to waste – the evaporation pond in the proposed project. Blowdown is necessary because the evaporation of water increases the concentration of chemicals in the basin. Total water consumption in a cooling tower is evaporation plus blowdown plus drift.

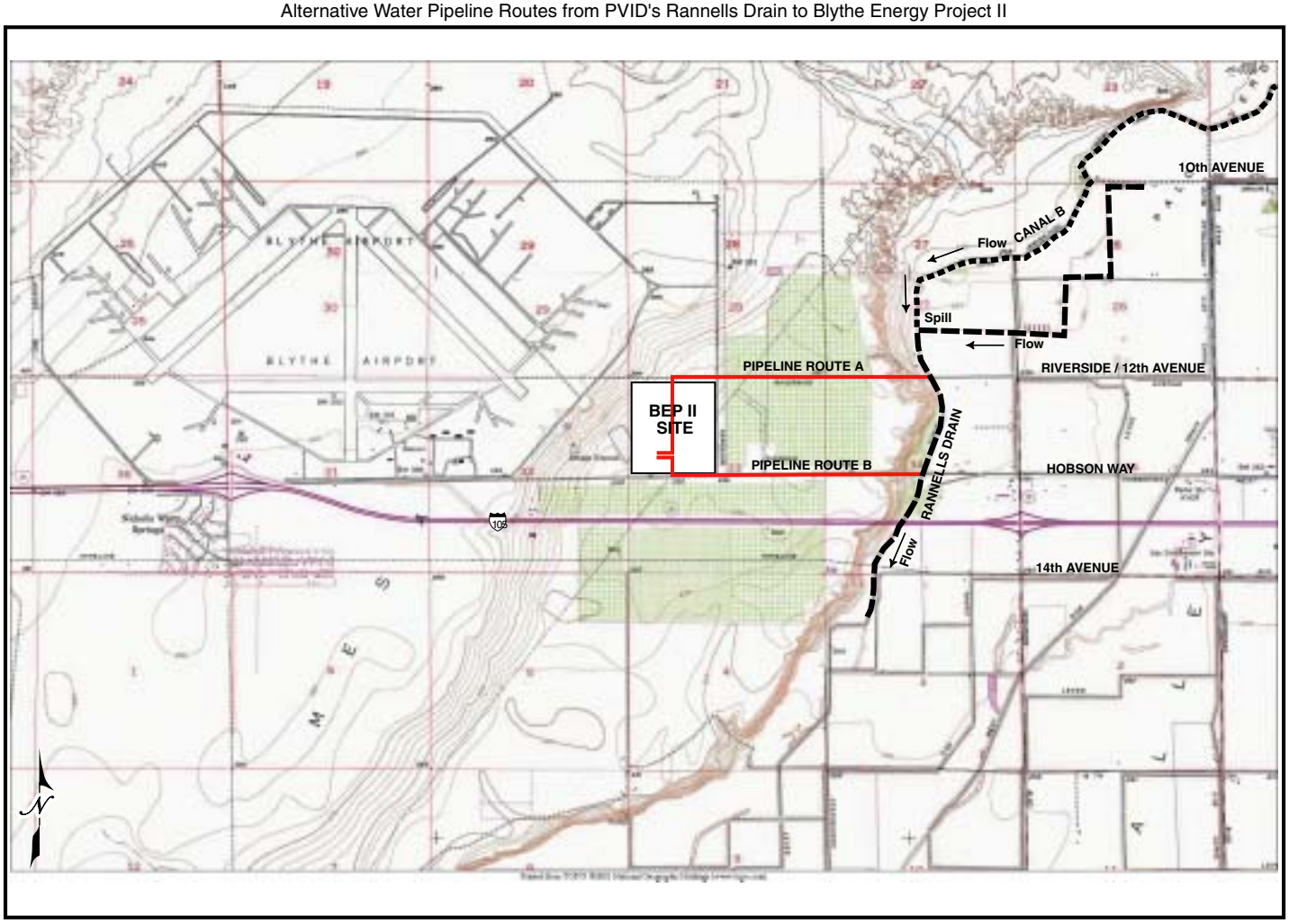
Wet bulb temperature: The temperature recorded by a thermometer in air but cooled by a packing of wet gauze on the bulb – thus the wet bulb. The thermometer without the wet gauze is said to record dry bulb temperature. Traditionally matching thermometers were built, one with a wet bulb the other dry, and the difference used as an expression of the amount of water present in the air – humidity. When the humidity in the air is enough that both bulbs read the same, it is said that dewpoint is reached; This is indicative that there is so much moisture in the air that none can be evaporated from the wet gauze and cool the wet bulb of the set, resulting in wet and dry bulbs reading the same. This condition is also 100% humidity.

WWTP: Wastewater Treatment Plant. Where effluent from public sewer system is treated prior to discharge or further use. POTW for publicly owned treatment works used interchangeably.

PVID: Palo Verde Irrigation District.

SOIL & WATER RESOURCES APPENDIX FIGURE 1

Alternative Water Pipeline Routes from PVID's Rannells Drain to Blythe Energy Project II

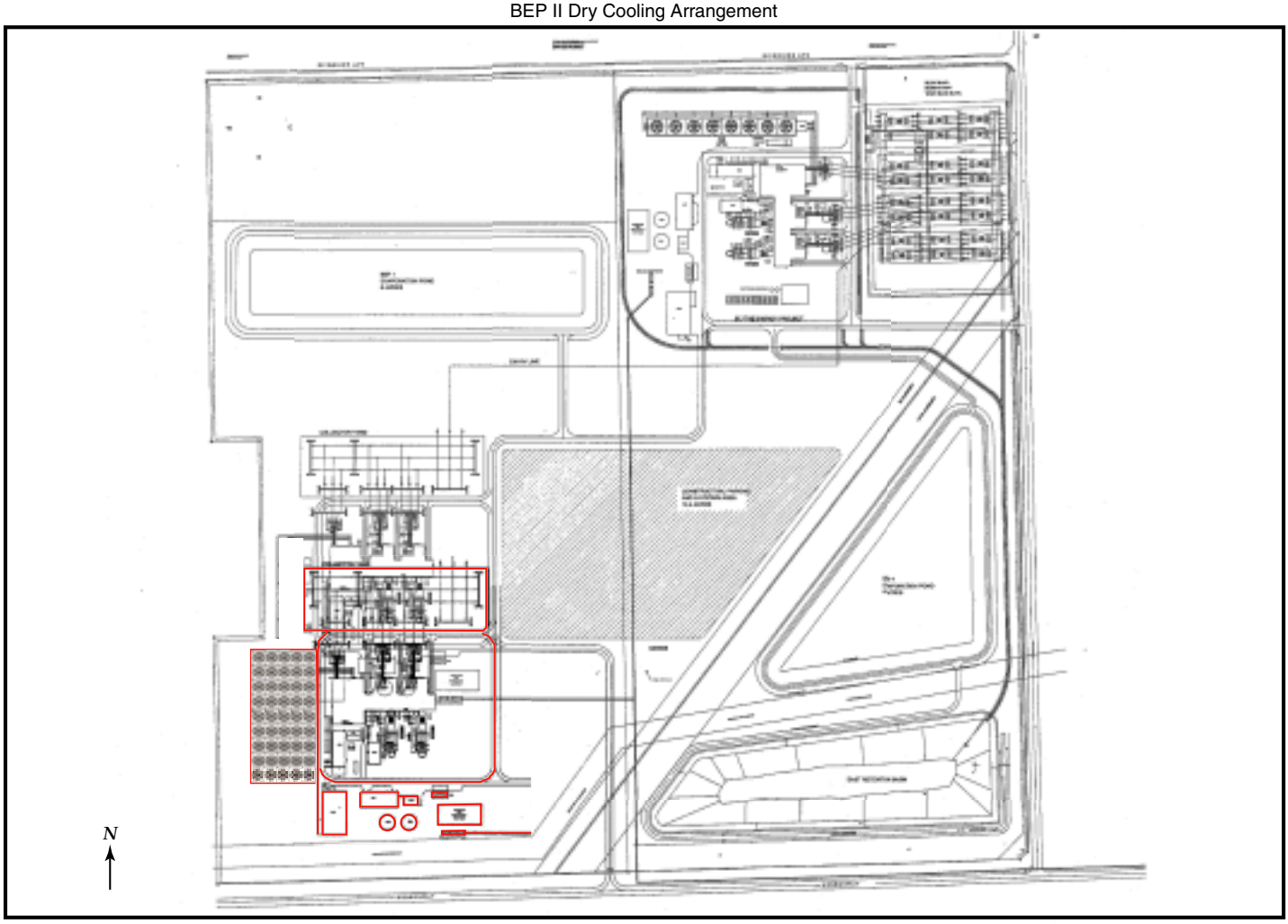


CALIFORNIA ENERGY COMMISSION, SYSTEMS ASSESSMENT & FACILITIES SITING DIVISION, APRIL 2005

SOURCE: PVID

SOIL AND WATER RESOURCES APPENDIX FIGURE 4

BEP II Dry Cooling Arrangement



CALIFORNIA ENERGY COMMISSION, SYSTEMS ASSESSMENT & FACILITIES SITING DIVISION, APRIL 2005

SOURCE: BEP II AFC Figure 2.0-24

BLYTHE II ENERGY PROJECT FSA

SOIL AND WATER RESOURCES APPENDIX B

SUPPLEMENTAL INFORMATION

Testimony of Richard Sapudar, John Kessler, Linda Bond, Mark Lindley, and Jim Schoonmaker

CALIFORNIA'S WATER SUPPLY OUTLOOK

To gain a perspective on existing and projected statewide shortages of fresh water supplies, a number of reports and publications help illustrate the challenges facing California now and in the future:

1. Department of Water Resources' (DWR) California Water Plan Update 1998 – Every five years DWR is required to prepare a statewide Water Plan addressing projected demands and supplies, and strategies to meet the State's future water needs. In the last completed Water Plan Update -1998, DWR determined that as of 1995, a 1.6-million afy shortage of water supply existed in California. In 2020, the shortage is projected to be 2.4 million afy DWR 1998).
2. DWR's California Water Plan Update 2003 – DWR has begun to update its assessment of the State's water supplies and demands with its California Water Plan Update 2003. This new plan will look more broadly than before at programs and conditions affecting the State's water resources. These programs will include evaluating the status and interaction of CALFED, the Colorado River Water Use Plan, the Central Valley Project Improvement Act (CVPIA), the State Water Resources Control Board Bay-Delta water rights hearings, hydroelectric project relicensing, and global warming, among other programs and conditions (DWR 2002b).
3. DWR's State Water Project (SWP) Delivery Reliability Report –The analyses contained in DWR's Final SWP Delivery Reliability Report conclude that the SWP, using existing facilities and operated under current regulations, can deliver an average between 70 and 75 percent of the primary contractual supply (defined as the Table A amount), now and in the future. During dry periods, deliveries are projected to be significantly lower. For example, if conditions similar to 1977 were to repeat, SWP deliveries are projected to be about 20 percent of the primary contractual supply (DWR 2002c).
4. California Colorado River Water Use Plan – California is charged with bringing its use of Colorado River Water in line with its allocation. After nearly 50 years of exceeding its normal entitlement by up to 1 MAFY and establishing its dependence on this water supply, California's normal year apportionment will be reduced to 4.4 million acre-feet/year(CRB 2000).

5. Global Warming – Scientists are recognizing changing trends in our atmospheric conditions that are already showing effects on our water supplies in California. Over the past century, land and sea temperatures have risen by about 1°F. Since 1958, carbon dioxide levels have increased from about 315 parts per million (ppm) to about 370 ppm. Water originating from mountain snowmelt has diminished by about 12 percent in the Sacramento River system over the last century. The effect is compounded by more intense and earlier snowmelt. This reduces the amount of water that can be diverted for use and storage later in the year (Knowles and Cayan 2002).

Specific to the largest population centers of Los Angeles and San Diego served by entities within Metropolitan Water District and San Diego County Water Authority, water supplies from the State Water Project and Colorado River makeup about 75% of their total collective supplies (See **SOIL AND WATER RESOURCES Table 17)**. About 50% of the total supply is provided by the State Water Project, which is subject to curtailments to 20% of normal during extreme drought years, which by itself would result in a 40% reduction in the total collective supplies to these entities.

In addition, the Colorado River supply is subject to curtailment in drought years, and collectively with the State Water Project reductions would likely reduce allocations to about 50% of the normal year supply. Compounding drought year vulnerability is the fact that these entities absorbed the majority of California's 1 million acre-feet per year (mafy) reduction in supply of Colorado River water beginning in 2003, which has had an immediate effect causing them to seek water transfers from the agricultural community at the cost of fallowing more productive lands.

Cumulatively in California, fresh water supplies for consumptive uses are diminishing while the demand for fresh water is increasing. CALFED and the CVPIA Programs have achieved significant progress in environmental protection of sensitive or endangered species and restoration of aquatic habitat in the Delta and its watershed. This has resulted in more water appropriated for environmental needs and less water available for consumptive needs.

Hydropower and water supply projects are experiencing reallocations during license renewals resulting in less water storage for future consumptive needs. On a statewide basis the DWR has determined that a 1.6-mafy shortage of water supply exists in California. North Coast and San Francisco Bay Regions are not expected to experience future shortages during average water years but are expected to see shortages in drought years. Most of the State's remaining regions experience average year and drought year shortages now, and are forecasted to experience increased shortages in 2020. The largest future shortages are forecasted for the Tulare Lake (including Kern County) and South Coast Regions, areas that rely heavily on imported water supplies. These regions of the State are also where some of the greatest increases in population are expected to occur (DWR 1998).

California's increasing population, expected to grow from 35.5 million in 2003 to 47.5 million in 2020, combined with businesses and industry, will continue to use increasing quantities of fresh water at rates that cannot be sustained. Imbalances in available

fresh water supply already results in “average year” shortages projected in every region except parts of the San Francisco Bay area and the North Coast.

Californians have experienced drought year shortages during the most recent droughts (especially in 1991 and 1992). Urban residents faced cutbacks in supply and mandatory rationing, some small rural communities saw their wells go dry, agricultural lands were fallowed, and environmental water supplies were reduced. By 2020, without additional facilities and programs, these drought year conditions will worsen (DWR 1998). Future water shortages will have direct and indirect economic consequences.

STATUS OF THE COLORADO RIVER

The Colorado River has an average annual flow greater that 17.5 mafy. More water is exported from the Colorado River basin than from any other river in the United States, and provides municipal and industrial water for a population exceeding 24 million in the seven Colorado River Basin States, which include Arizona, California, Colorado, Nevada, New Mexico, Utah and Wyoming. In addition, it provides irrigation for approximately 2 million acres of agriculture lands (Anderson 2002).

The Colorado River Compact of 1922 apportioned 7.5 mafy each to both the Upper and Lower Colorado River basin, with an additional 1 mafy allowed for the Lower Basin. Mexico is guaranteed 1.5 mafy by the Mexican Water Treaty of 1944, along with a pro rata reduction during shortage periods (Pontious 1997). California was apportioned 4.4 mafy, but has been using approximately 5.2 – 5.4 mafy over the past 20 years, about 800,000 – 1,000,000 afy more than its allocation (Anderson 2002). The Colorado River supplies approximately 14 percent of the water used for agricultural, industrial, commercial business, and residential purposes in California, and represents over 60 percent of Southern California’s water supply (LOA 1997). It was for the first time in 1990 when Arizona, California, and Nevada completely consumed the total Lower Basin's 7.5 mafy allocation (UA 1997).

Interim Surplus Guidelines and the Quantification Settlement Agreement

Interim Surplus Guidelines were developed by the Secretary of the Interior to address this overuse of Colorado River water by California. These guidelines allow for a 15-year period during which California must reduce its water use by 800,000 – 1,000,000 afy to its allotted 4.4 mafy by 2016. The guidelines are designed to allow the State to meet its municipal and industrial needs, while protecting other states from potential drought-related impacts during the 15-year reduction period by reducing the State’s municipal and industrial water demands that can be satisfied by surpluses as reservoirs are depleted during drought. The Secretary of the Interior determines how much water is available during each calendar year, and declares either a normal, surplus, or shortage water year (Anderson 2002).

The State’s earlier use of the surplus was not considered to be an issue, because the six other states entitled to Colorado River water were not using their full allotments. This is still the case for the Upper Basin States of New Mexico, Colorado, Wyoming and Utah. However, Arizona and Nevada are currently using their full entitlements. As a result, the other states requested that the federal government reduce California’s water

use to ensure the surplus does not legally become considered a permanent part of any state's entitlement (CVWD 2003). California has become more dependent than ever on surplus Colorado River water, and drew more than 5.3 mafy of water from the Colorado River In 2002 (Stapleton 2003).

The Interim Surplus Guidelines require that California determine how its 4.4 mafy share of Colorado River water will be divided among the State's users of this resource. California must reduce its use of Colorado River water by 280,000 acre-feet per year by January 1, 2006 or by another 380,000 acre-feet by January 1, 2011, or the guidelines will be suspended until the reduction goals have been met. The guidelines are set to expire on December 31, 2016.

The process by which California's is to accomplish this reduction is referred to as the "Quantification Settlement Agreement" (QSA), which is an integral part of the implementation of California's Colorado River Water Use Plan (4.4 Plan) to reduce it's Colorado River water use to 4.4 mafy. The QSA is a package of long-term Colorado River water supply agreements between four California water agencies that include Metropolitan Water District of Southern California (MWD), Imperial Irrigation District (IID), San Diego County Water Authority (SDCWA), and the Coachella Valley Water District (CVWD). Under the QSA, up to 3.6 million acre-feet of water would voluntarily shift from agricultural use to urban use, thereby reducing California's over-reliance on the Colorado River for urban uses (Stapleton 2003).

The Secretary of the Interior gave California until December 31, 2002 to execute the QSA, a deadline that the State did not meet due to internal disagreement between the water users subject to the 4.4 Plan. The QSA was not signed, and on January 1, 2003 the Secretary of the Interior immediately reduced California's Colorado River allotment to 4.4 mafy, with the State not allowed to use surplus water in 2003 under the Interim Surplus Guidelines until the 4.4 Plan/QSA issue was resolved. The amount of water California could withdraw was reduced by 650,000 acre-feet per year (212 billion gallons/year), or enough water for approximately 4.8 million people (Bulkley 2003). Due to the priority system of California's Colorado River water rights based on junior and senior rights, the MWD suffered all of the reduction (Stapleton 2003).

The swift and aggressive action by the Secretary of the Interior to abruptly terminate the excessive use of Colorado River water by California in the absence of a valid QSA, and the conflicts the shortage of Colorado River water has caused within the State are indicative of both the severity and the immediacy of the problems related to balancing the increasing demand with the decreasing supply of Colorado River water. It is also a vision of the relatively near-term future during the intervening years over which California must permanently reduce its dependence on Colorado River surplus flows by 2016. The QSA has since been signed by all parties, although it is still a subject of contention among California's Colorado River water users, and may yet be challenged in the courts.

The QSA was entered into by MWD;(also representing SDCWA), IID and CVWD, providing opportunities for water transfers between the entities. The Secretary of the Department of Interior incorporated provisions of the QSA into a Water Delivery Agreement, and approved the Agreement on October 10, 2003.

While California's Colorado River water supply can be affected by drought at any time and most likely will be at some time as it is currently, it will definitely and predictably be affected during the period from the present to 2016 when demand for water in the State can be expected to increase, and California will be reducing its use of Colorado River water in order to live within its allocation of 4.4 million acre-feet per year. A condition further exacerbating the shortage of Colorado River supply is unauthorized use. The CRB has indicated that unauthorized use of Colorado River water reduces the amount of water otherwise available to authorized users in an amount equal to the magnitude of the unauthorized use. The impacts of unauthorized use have been determined by USBR by calculating the reduction in approved diversions that must occur to offset unauthorized use. USBR estimated that during 2003, impacts to authorized users resulting from unauthorized use of Colorado River water was quantified at 6,600 AF in California. MWD and CVWD were among the authorized users impacted (CRB.2003).

The Law of the River has evolved over time in response to the many disputes over rights to the use of the Colorado River, and the QSA represents another step in that evolution. The nearly year-long dispute surrounding its signing is an indicator of not only how vital a resource it is to those who depend on it, but is also as a reflection of how severely it has been impacted in its ability to meet the increasing needs of those same dependents. This is particularly true in the case of California during this time of forced reductions in Colorado River water use extending from the present to 2016, where any unnecessary use consuming Colorado River water, such as that proposed by the BEP II project, would be considered unreasonable when state water policy is considered, and perhaps unauthorized from the CRB's, CVWD's and staff's perspectives, and a contribution to an existing and increasing significant cumulative impact.

BEP II'S EFFECTS ON OTHER COLORADO RIVER WATER USERS

The contribution to an increasing and significant cumulative impact that would result from BEP II's proposed use of Colorado River water can best be understood by looking more closely at the effects on the other users of this critical resource and their difficulty in securing adequate water supplies. Supply projections for San Diego County Water Authority (SDCWA), who is a member of, and receives some of their water supply from MWD, are presented and expressed in acre-feet/year (AFY) in **SOIL AND WATER RESOURCES Table 18** ..

San Diego County Water Authority

In reviewing SDCWA's increasing quantities and mix of water supplies projected to meet their demands through 2025, we can observe several trends that illustrate the extreme measures needed to meet rapidly increasing water demands.

1. As is expected, there are no new local surface water supplies.
2. There is a growing reliance on irrigation water transfers that will take agricultural lands out of production.

SOIL AND WATER RESOURCES Table 18
Projected Changes in San Diego County Water Authority's Water Supplies, 2005-2025 (acre-feet/year)

Water Supply Source	2005	2010	2015	2020	2025
Metropolitan Water District	526,000	345,400	343,400	290,800	310,900
Imperial Irrigation District Transfer	30,000	70,000	100,000	190,000	200,000
All American & Coachella Canal Lining Projects	0	77,700	77,700	77,700	77,700
Seawater Desalinization	0	56,000	56,000	56,000	56,000
Local Surface Water	85,600	85,600	85,600	85,600	85,600
Recycled Water	33,400	45,100	51,800	53,400	53,400
Groundwater	31,100	53,500	57,500	59,500	59,500
Total Supplies	706,100	733,300	772,000	813,000	843,123

(SDCWA. 2004)

3. Recovering water currently lost to seepage by lining portions of the All American and Coachella Canals will achieve significant conservation of existing supplies that will benefit SDCWA.

4. Seawater desalinization will be relied upon as an entirely new source of water supply, which continues to be the most costly source of water that typically ranges from $800 - $1,000 per AF to treat and distribute, compared to most other sources ranging from $200 - $600 per AF.

5. More wastewater will be treated and used as recycled water for purposes such as landscape irrigation.

6. Groundwater production is expected to nearly double, which in some areas can cause ongoing overdraft and depletion of the aquifers.

At first glance, water districts like San Diego County Water Authority appear to be adapting to secure a new combination of supplies to meet their projected water demands over the next 20 years. However when looking more closely, it is apparent from that extreme measures are needed to meet their projected demands that the consequences of any loss of supply in the existing and subsequent planning horizons are severe. In decades to follow, opportunities for securing additional water transfers and developing new supplies (except for the most costly supplies derived from seawater desalination) are expected to be most limited.

Committing water resources for power plant cooling can be a 30 to 50 year endeavor or longer; whereas, normal water supply planning horizons conducted by water districts are typically for only 20 years, which may not fully take into account and anticipate the potentially competing municipal needs for water supplies that may arise from supplies already committed to power plant cooling. Further, while water districts can control how

much water and for what beneficial use their supplies are committed within their own service areas, they may have no control of common sources of supply such as the Colorado River serving several entities. As is the case for MWD and SDCWA, greater utilization of water within PVID's service area directly results in less supply available for MWD and SDCWA, because the latter parties have a lower entitlement priority for use of the water.

Considering SDCWA's vulnerability under a more critical scenario such as if drought conditions similar to 1977 were to repeat, normal allocations from the State Water Project and Colorado River to Southern California could be curtailed on the order of 50%. As water supplies are forecasted to be inadequate for a given year, water districts and agencies are compelled to have their customers implement a range of conservation measures depending on the extent of the water shortages, starting with those that are voluntary, and usually progressing in stages to those that are mandatory, and potentially even water rationing for the most severe cases.

Another indication of water supply shortages in Southern California is the discontinuation of irrigation for agricultural production in order to serve growing municipal needs. The necessity for water transfers from irrigation to domestic uses accomplished through agricultural land fallowing is evident by existing contracts transferring water from PVID to MWD, and from Imperial Irrigation District (IID) to San Diego County Water Authority (SDCWA), encompassing the eventual fallowing of about 45,000 acres in total.

Metropolitan Water District of Southern California

It is important to appreciate the growing demands for water supply in the greater Los Angeles and San Diego region of Southern California coupled with the diminishing supply of Colorado River water to our state as noted above. We can observe projections for increasing population which will attribute to increasing water demands for MWD's member entities including San Diego County Water Authority (SDCWA), the latter whom receives about 90% of their supply from MWD. We can observe several challenges that MWD must face in trying to meet the increasing water demands including:

1. MWD and its member agencies currently serve about 18.5 million people, of which SDCWA represents about 2.8 million of the total.
2. The makeup of MWD's water supplies is in general terms normally about 1/3 Colorado River water and about 2/3 State Water Project water, both of which are subject to reductions during drought years. Shortages can be made-up to a limited extent from MWD's in-basin storage.
3. MWD's current total water use is about 4 MAF per year.
4. MWD is projecting an average annual increase in population of about 208,000 per year through 2020.
5. Population of the entire MWD service area is projected to be about 22.1 million by 2020, of which SDCWA is estimated to represent about 3.5 million of the total.

6. An average annual increase in population of 208,000 per year equates to a need to increase annual water supplies and/or accomplish new conservation measures at an approximate rate of 32,500 acre-feet/year.
7. Over a 15-year period from 2005 – 2020, new water supplies and/or water conservation measures will need to accumulate to about 487,500 acre-feet to meet the growing population in the service area of MWD's member agencies.
8. MWD is projecting that its total water use will be on the order of 4.5 MAF by 2020.
9. MWD is managing its long-term water reliability needs through a combination of water transfers including agriculture land fallowing programs, in-basin groundwater storage, outdoor conservation measures, and development of additional local resources, such as recycling, and brackish and seawater desalinization (MWD. 2003).
10. The ability for MWD to manage its long-term water reliability needs through water transfers is being facilitated as a result of the Quantification Settlement Agreement entered into by MWD, IID and CVWD, and the Water Delivery Agreement entered into between these entities and the Secretary of the Department of Interior as approved by Interior on October 10, 2003.

BLYTHE II ENERGY PROJECT FSA

SOIL AND WATER RESOURCES APPENDIX C

WATER FACT SHEET

U.S. GEOLOGICAL SURVEY, DEPARTMENTOF THE INTERIOR

DETERMINING THE SOURCE OF WATER PUMPED FROM WELLS ALONG THE LOWER COLORADO RIVER

WATER FACT SHEET

U.S. GEOLOGICAL SURVEY, DEPARTMENT OF THE INTERIOR

DETERMINING THE SOURCE OF WATER PUMPED FROM WELLS ALONG THE LOWER COLORADO RIVER

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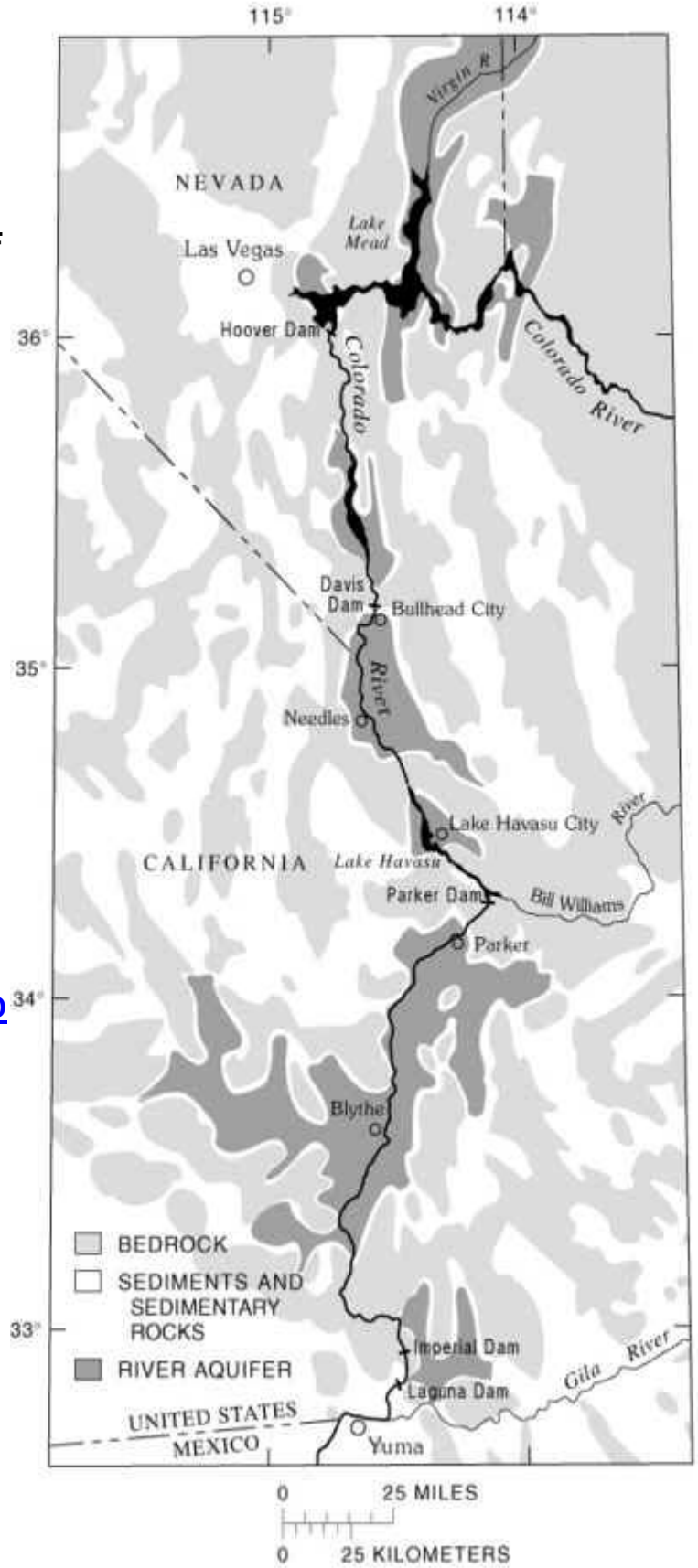

Figure 1. The lower Colorado River and areal extent of the river aquifer.

LOWER COLORADO RIVER

The lower Colorado River provides more than 97 percent of the annual water supply to the river valley from the east end of Lake Mead to Laguna Dam (fig. 1) and is the principal source of water for users. Water is stored in three surface reservoirs and in an aquifer of permeable sediments and sedimentary rocks in the river valley. Water is pumped directly from the river and from wells on the flood plain, on adjacent alluvial slopes, and in interconnected tributary valleys.

Most of the water in the aquifer originated from the river because of the hydraulic connection between the river and the aquifer and overbank flow prior to building of the dams. Unsaturated sediments and sedimentary rocks around reservoirs were saturated with water from the river as the reservoirs filled. Isotope ratios of hydrogen and oxygen in water from wells indicate that most of the water in the aquifer beneath the flood plain and in many places beneath the alluvial slopes originated from the river. Precipitation in surrounding mountains and inflow from tributary valleys contribute some water to the aquifer.

WHY ACCOUNT FOR PUMPAGE?

Water in the lower Colorado River is apportioned among the States of Arizona, California, and Nevada by the U.S. Supreme Court Decree of 1964, *Arizona v. California*. The decree is specific about the responsibility of the Secretary of the Interior to account for the consumptive use of water from the mainstream. Consumptive use is defined to include "water drawn from the mainstream by underground pumping." To aid in implementing the decree, it was necessary to develop a method to identify the source of water pumped from wells.

WHICH WELLS YIELD WATER THAT ORIGINATED FROM THE RIVER?

Water pumped from wells on the alluvial slopes adjacent to the flood plain and reservoirs and in the tributary valleys originated from the river and from precipitation in the surrounding mountains and tributary valleys. The U.S. Geological Survey, in cooperation with the Bureau of Reclamation, developed a method to identify wells that yield water that originated from the river by using an accounting surface. Use of an accounting surface provides a uniform criteria based on hydrologic principles for all users pumping water from wells. Definition of the "river" aquifer and delineation of the subsurface limits were required prior to the generation of the accounting surface in the river aquifer.

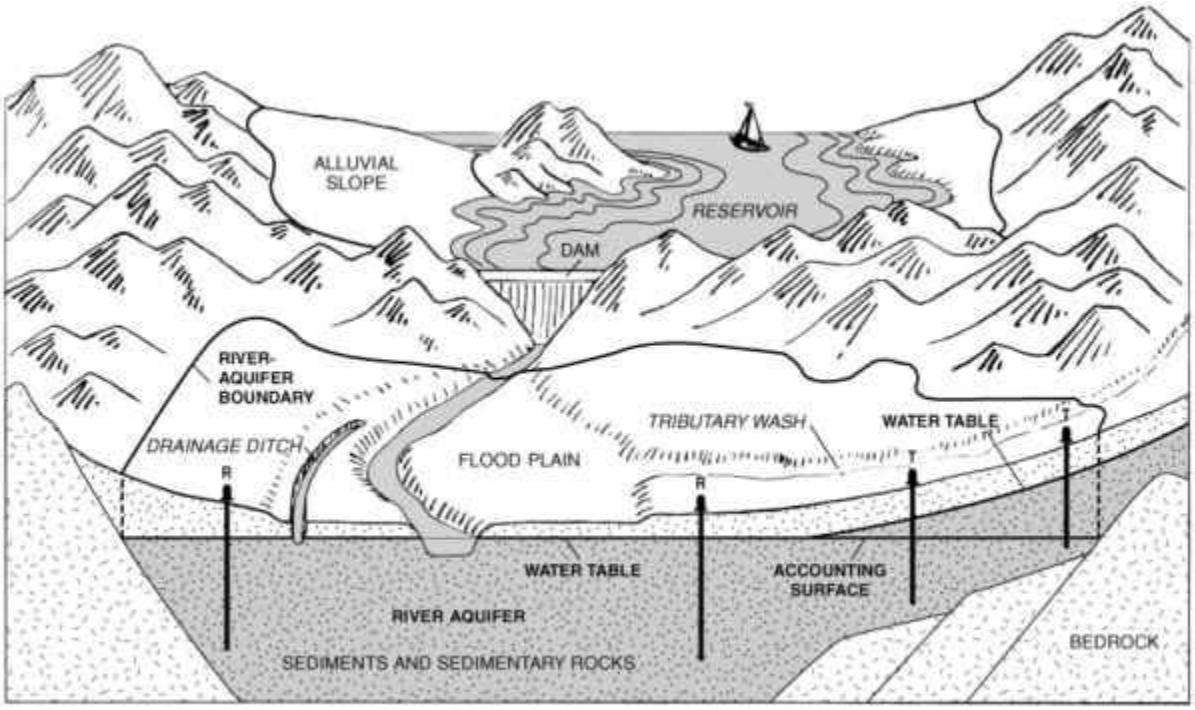

Figure 2. Schematic cross section of the river aquifer and accounting surface.

RIVER AQUIFER

Permeable sediments and sedimentary rocks that fill the structural basins of the lower Colorado River valley and adjacent tributary valleys form the river aquifer, which is saturated with water that originated from the Colorado River. Geophysical gravity studies, well logs, and previous hydrologic and geologic studies provided data on the extent and thickness of the sediments and sedimentary rocks; total thickness ranges from 0 to more than 5,000 feet. The subsurface limits of the river aquifer are the nearly impermeable bedrock of the bottom and sides of the basin. The water table of the river aquifer extends from the river, beneath the flood plain, and under the alluvial slopes until it intersects bedrock (shown in cross section, fig. 2). That intersection projected to the land surface shows the areal extent of the river aquifer (shown on the surface, fig. 2 and in fig. 1).

ACCOUNTING SURFACE

The accounting surface represents the water table of the river aquifer that would exist if the only source of water to the aquifer was the river. Wells that tap the river aquifer outside the flood plain with a static (nonpumping) water level at or below the accounting surface are presumed to yield water that originated from or will be replaced by water from the river (fig. 2, wells labeled R). Wells with a static water level above the accounting surface are presumed to yield water that originated from precipitation and inflow from tributary valleys (fig. 2, wells labeled T).

The accounting surface was generated by using river profiles of the Colorado River; water-level elevations of reservoirs, lakes, marshes, wetlands, and drainage ditches; and static-water-level elevations in wells. River profiles were computed for the highest median monthly projected discharge for the near future (1992-2001). Near reservoirs,

the elevation of the accounting surface is defined by the annual high water-surface elevation used to operate the reservoir under normal conditions.

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http://az.water.usgs.gov/factsheets/ofr_93-405.html

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