HUNTINGTON BEACH UNITS 3&4 ENTRAINMENT AND IMPINGEMENT STUDY RESULTS, MITIGATION OPTIONS, STAFF AND WORKING GROUP RECOMMENDATIONS, AND AES'S RESPONSE AND OBJECTIONS TO THE RECOMMENDATION

Dr. Noel Davis, Dr. Pete Raimondi, Rick York, and Joanna Re[illegible]

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ABSTRACT

In May 2001, the California Energy Commission (Energy Commission) published its decision granting emergency certification for the AES Huntington Beach Retool Project. The Retool Project replaced and restarted Units 3 and 4, retired in 1995, at the existing Huntington Beach Generating Station (HBGS). The Energy Commission's approval of the project included post construction and operation Conditions of Certification to identify and mitigate significant impacts that could not be effectively evaluated during the emergency certification.

By retooling and restarting Units 3 and 4, the cooling water intake flow of the HBGS would approximately double. Once-through cooling systems that use ocean water expose marine organisms to the impacts of entrainment and impingement. Because no study of the impacts of entrainment had ever been done at HBGS, staff was unable to make a finding regarding the significance of those impacts or identify appropriate mitigation to offset impacts. Therefore, as Conditions of Certification for the project, AES was required to fund a one-year study of the impacts of entrainment and impingement at HBGS (**BIO-4**) and provide mitigation funds to restore or create coastal habitat to mitigate any identified significant impacts (**BIO-5**). Condition of Certification **BIO-6** required AES to fund a study to determine whether there is a feasible methodology to reduce impingement losses at HBGS.

The entrainment and impingement study required by Condition of Certification **BIO-4** estimated that entrainment in the cooling water used for Units 3 and 4 was equivalent to the loss of productivity of 104 acres of habitat for coastal fishes and 15.35 acres for CIQ gobies. This loss of productivity represents a loss of functional value of native fish, wildlife, and plant habitat and a degradation of the foraging habitat of the endangered California least tern, endangered California brown pelican, and threatened western snowy plover. Overall, the entrainment of all the organisms in the 253.3 millions of gallons per day that AES is permitted to use to cool Units 3 and 4 represents a substantial degradation of the quality of the marine environment. Based on the significance criteria used in this analysis, staff considers entrainment losses due to water withdrawal for Units 3 and 4 to be significant. The commenting resource agencies (California Department of Fish and Game, Coastal Commission, Santa Ana Regional Water Quality Control Board, and National Marine Fisheries Service) agree with staff's determination that the losses of marine resources caused by the intake of cooling water for Units 3 and 4 are significant and require mitigation.

Capping cooling water volumes to a level below the levels used in this study, if feasible, would reduce entrainment impacts. AES may be able to cap the Units 3 and 4 cooling water flows at an annual average of 126.7 million gallons per day (mgd). Reduction of cooling water flows would reduce the impacts of entrainment to the equivalent of the productivity of 74.7 acres of coastal habitat. However, there would still be substantial losses of marine life from entrainment and impingement. Opportunities for habitat restoration in the vicinity of HBGS have been identified that, if implemented, would reduce the impacts of entrainment and impingement to insignificant levels.

BACKGROUND

In December 2000, AES Huntington Beach submitted an Application for Certification to the California Energy Commission (Energy Commission) to retool retired Units 3 and 4 of the AES Huntington Beach Generating Station (HBGS). Units 3 and 4 had been out of operation since 1995. At the time of the application, California's energy supply situation was declared an emergency (Governor's Executive Order #D-22-01).

By retooling and restarting Units 3 and 4, the cooling water intake flow of HBGS would increase to approximately twice what it was since the units were retired in 1995. Once-through cooling systems that use ocean water expose marine organisms to the impacts of entrainment and impingement. Entrainment refers to organisms being drawn into and through the cooling water system and impingement refers to the trapping of organisms on the intake screens. Because no study of the impacts of entrainment had ever been done at HBGS, staff was unable to make a finding regarding the significance of those impacts and identify appropriate mitigation. There was insufficient time to complete an entrainment impacts analysis prior to certification because of the energy crisis and the immediate need for more energy sources. For purposes of its California Environmental Quality Act (CEQA) analysis, the Energy Commission assumed there were unmitigated impacts and made findings of overriding considerations. As Conditions of Certification for the project, AES was required to fund a one-year study of the impacts of entrainment and impingement at HBGS (**BIO-4**) and provide mitigation funds to restore or create coastal habitat to offset any identified significant impacts (**BIO-5**). Finally, Condition of Certification **BIO-6** required AES to fund a study to determine whether there is a feasible methodology to reduce impingement losses at HBGS. For reference, those Conditions of Certification are reproduced in **APPENDIX 1**, located at the end of this document.

In July 2003, MBC Applied Environmental Sciences (MBC), biological consultant to AES, submitted a final study plan to conduct the entrainment and impingement study in compliance with Condition of Certification **BIO-4**. The study was overseen by a Biological Resources Research Team (BRRT) that consisted of representatives from the Energy Commission and its consultants, representatives from the applicant and its consultants, and representatives from the U.S. Fish and Wildlife Service, the National Marine Fisheries Service (NMFS), the California Department of Fish and Game (CDFG), the California Coastal Commission, and the Santa Ana Regional Water Quality Control Board (RWQCB). The BRRT provided input into the sampling design and methods for impacts analysis, and approved the final study plan. The methods used for the study were similar to those used in other recent peer-reviewed power plant studies

including entrainment studies of the Moss Landing Power Plant, Diablo Canyon Nuclear Power Plant, Morro Bay Power Plant, and Potrero Power Plant (Tenera 2000a and b, 2001). Fish and target invertebrate larvae in the vicinity of HBGS were sampled regularly over a one-year period. Monthly progress reports were submitted by MBC to keep the BRRT informed of the progress of the study. MBC submitted quarterly data reports that provided preliminary results, and a six-month interim report that summarized all data collected and analyzed up to that point. The six-month interim report also included a preliminary impact analysis. All these reports were reviewed and approved by the BRRT. Members of the BRRT provided input to each report. At the conclusion of the one-year entrainment and impingement study, MBC submitted a draft final report that was reviewed and commented on by members of the BRRT.

In April 2005, AES submitted its final report documenting the results of the entrainment and impingement study required by **BIO-4** and the study of potential methods to reduce impingement required by **BIO-6**. The final report incorporated suggestions made by members of the BRRT. The study used three approaches to estimate the impacts of entrainment losses. These approaches used models as a method of understanding what the impacts of entrainment meant to the affected populations. The approach that most fully addressed the ecological impacts of the entrainment losses used a model (Empirical Transport Model) that estimated the portion of the larvae of each target fish species at risk of entrainment by the once-through cooling system. By multiplying the mean percent of the populations at risk by the mean geographic area from which the fish larvae might be entrained, an estimate can be obtained of the amount of habitat it would take to produce the lost fish larvae. This estimate is referred to as the *area of habitat production foregone*. The other impact analysis methods used in the study expressed entrainment losses in terms of potential losses to the adult populations.

Energy Commission staff, NMFS, CDFG, RWQCB, and the California Coastal Commission used the data and impacts analysis presented in the Final Report to determine the significance of the impacts and to identify appropriate mitigation options and recommendations. The four involved agencies have written letters to the Energy Commission regarding their conclusions about the significance of the impacts identified in the study (Chambers 2005, Luster 2005, Ugoretz 2005, Theisen 2006). More recently, members of the BRRT have met on three occasions (April 27, 2006; June 27, 2006; and July 11, 2006) to discuss the results of this analysis and provide comments. However, AES disagrees with the staff analysis and submitted comments (AES 2006) that are provided following the Response to Comments section found at the end of this analysis. This report summarizes the results of the entrainment and impingement study, provides the conclusions of staff and the relevant agencies regarding the significance of entrainment and impingement, and describes options for mitigating those loses.

SETTING AND PROJECT DESCRIPTION

The HBGS site is located along the Pacific Coast Highway in the City of Huntington Beach, California. The retooling project was constructed entirely within the boundary of the HBGS site and primarily within the structures of existing Units 3 and 4. The project site is located on relatively flat terrain with little vegetation except for patches of non-native and native landscaping at the property perimeter. Areas of coastal salt marsh

dominated by pickleweed (*Salicornia virginica*) occur approximately 0.5 mile to the northwest and immediately to the southeast of the HBGS. These salt marsh areas are Orange County-protected wetland resources known as the Huntington Beach Wetlands.

Marine habitats near the HBGS consist primarily of sand substrate. A wide sandy beach, broken by various jetties and groin fields, extends from the entrance to Newport Harbor about 6.5 miles southeast of the generating station upcoast to Anaheim Bay. The intake and outfall structures for the cooling water system are located approximately 1,500 feet offshore at a water depth of approximately 27 feet Mean Lower Low Water (MLLW). The seafloor near the study area is a gently sloping sand bottom.

The state- and federal- endangered California least tern (*Sterna antillarum browni*) nests on the sandy beach a little over a mile south of HBGS adjacent to the Santa Ana River mouth. Least terns nest between April and August and winter in Central or South America. The preferred prey of California least terns is northern anchovy (*Engraulis mordax*) and topsmelt (*Atherinops affinis*). Least terns from the Huntington Beach colony use all the waters near the colony for foraging, but feed most frequently in shallow nearshore waters within 2 miles of the colony (Atwood and Minsky 1983).

The western snowy plover (*Charadrius alexandrinus nivosus*) is a federal threatened species and a California Species of Special Concern. The closest currently used snowy plover nesting site to HBGS is in the Bolsa Chica Wetlands approximately 4.5 miles northwest of the power plant. Snowy plovers nested within the Huntington Beach California least tern colony near the mouth of the Santa Ana River in 1993. Wintering snowy plovers have been observed to forage along the sandy intertidal zone in the vicinity of the HBGS (MEC 1991). Bolsa Chica State Beach and the Santa Ana River mouth recently have been designated as Critical Habitat for the western snowy plover (USFWS 2005). Snowy plovers forage for insects and amphipods along the upper beach and in the wet sand of the lower tidal zones for young sand crabs (Zeiner et al 1990).

The state- and federal- endangered California brown pelican (*Pelecanus occidentalis*) nests on Anacapa and Santa Barbara Islands off southern California, on islands off the Pacific Coast of Baja California, Mexico, and in the Gulf of California, Mexico. California brown pelicans are common in the waters offshore from the HBGS especially during the non-breeding season of July through December. They feed primarily on northern anchovy.

Several marine bird species that are California Species of Special Concern are fairly common in the nearshore waters offshore from the HBGS. These species include the common loon (*Gavia immer*), double-crested cormorant (*Phalacrocorax auritus*), California gull (*Larus californicus*), and elegant tern (*Sterna elegans*). With the exception of the California gull, which feeds mostly on garbage and invertebrates, these species feed primarily on fish (Zeiner et al 1990).

The AES Huntington Beach Retool Project replaced and restarted Units 3 and 4 at the existing HBGS. Units 3 and 4 were retired in 1995 because of limited use. Retooled Unit 3 restarted operation in spring 2004 and Unit 4 in summer 2004. Only Units 1, 2 and 5 had been operated for the last several years prior to the Retool Project. The

HBGS Retool Project would be expected to increase cooling water intake flow rates similar to pre-1994 levels when all units were operating. Mean daily flow between 1979 and 1993 ranged between 134.6 and 476.2 mgd compared to between 144.1 and 163.8 mgd after 1994. Between January 1, 2003 and the present, the average daily cooling water flow at HBGS has been 330 mgd (P. Hurt, AES, personal communication, 2006).

The HBGS Retool Project uses the HBGS existing cooling water intake system. Cooling water for Units 1 – 4 is withdrawn from the ocean via an intake structure located 1,500 feet offshore in a water depth of approximately 27 feet MLLW. The intake structure rises about 15 feet off the bottom and is fitted with a velocity cap to reduce impingement. Seawater is drawn into the power plant by up to eight circulating water pumps, each capable of delivering about 63.4 mgd for a total permitted maximum of 507 mgd. Units 1 and 2 have a maximum flow of 253.5 mgd. Units 3 and 4 also have a maximum flow of 253.5 mgd. Therefore, restarting of Units 3 and 4 has the potential to double the cooling water flow at HBGS. The flow is directed to an open rectangular forebay and screening facility within the plant. The screen system is composed of vertical bar racks and vertical traveling screens with 3/8 inch mesh designed to remove trash, algae, marine life, and other debris that comes in with the cooling water. After flowing through the screen system, the cooling water is pumped to steam condensers, one per turbine generator. At full load, the temperature increase through the condensers is approximately 18 degrees Fahrenheit. After passing through the condensers the heated water is directed to a single concrete discharge pipe, which extends approximately 1,200 feet offshore. The discharge structure resembles the intake structure, except there is no velocity cap. Discharged water is directed vertically to the surface for dilution and atmospheric cooling.

ASSESSMENT OF IMPACTS AND DISCUSSION OF MITIGATION

METHOD AND THRESHOLD FOR DETERMINING SIGNIFICANCE

Significant biological resource impacts would occur if state- or federal-listed species, state Fully Protected species, candidates for state or federal listing and/or Species of Concern are likely to be impacted. Interruption of species migration, reduction of native fish, wildlife and plant habitat, causing a fish or wildlife population to drop below self-sustaining levels, and disturbance of wetlands, marshes, riparian areas or other wildlife habitat would also be considered significant impacts. These are Mandatory Findings of Significance under the CEQA (CEQA Guidelines Section 16065(a)(1)). Substantial degradation of the quality of the environment is also a Mandatory Finding of Significance under CEQA (CEQA Guidelines Section 16065(a)(1)). Finally, CEQA Guidelines specify a Mandatory Finding of Significance if the project has possible environmental effects that are individually limited but cumulatively considerable (CEQA Guidelines Section 16065(a)(3)).

ENTRAINMENT AND IMPINGEMENT IMPACTS AND MITIGATION

Results of the Entrainment Study

The entrainment and impingement study was designed to estimate losses of fishes and target invertebrates to the AES HBGS cooling water system. The sampling and analysis methodologies were similar to those used for recent peer-reviewed entrainment

and impingement studies conducted for the Diablo Canyon Nuclear Power Plant, Morro Bay Power Plant, and Moss Landing Power Plant (Tenera 2000a and b, 2001). The small organisms at risk of entrainment by HBGS are members of the plankton community. Plankton are plants and animals that float more or less passively with the currents and include organisms that spend their whole lives in the plankton as well as the larvae of fishes and invertebrates. Because the effort and cost to collect and identify *all* of the organisms in the water column that may be entrained at HBGS would be prohibitive, emphasis was placed on collecting and identifying fish larvae as well as the larvae of several target invertebrate species. The target invertebrate larvae were rock crab (*Cancer* spp.), market squid (*Loligo opalescens*), California spiny lobster (*Panulirus interruptus*), ridgeback shrimp (*Sicyonia ingentis*), and sand crabs (*Emerita analoga*). Samples were collected between September 2003 and August 2004. The final report detailing the results of that study was submitted in April 2005 (MBC 2005).

Source Water Sampling

Source water sampling was conducted to determine the numbers of target taxa in the source water potentially at risk of entrainment. Samples collected at the entrainment station and at six other stations extending 2.5 miles (4 km) upcoast, downcoast, and offshore from the intake structures were used to estimate the source water populations at risk of entrainment. To determine composition and abundance of fish and target invertebrate larvae in the HBGS source water, sampling at these seven stations surrounding HBGS was conducted monthly in September and October 2003, twice per month in November 2003 through July 2004 (during the peak spawning period for fishes in late winter and spring) and once in August 2004. During each sampling event, two replicate tows with a plankton net were made four times per 24-hour period - once every six hours. Sampling cycles were initiated at approximately 1200, 1800, 2400, and 0600.

Entrainment Sampling

To determine composition and abundance of fish and target invertebrate larvae entrained by the generating station, sampling in the immediate proximity of the cooling water intake was conducted twice as frequently as source water sampling. Entrainment sampling was done monthly in September and October 2003, weekly from November 2003 through July 2004, and twice during August 2004. Plankton tows were performed in the same manner as for the source water samples and were done every six hours. Samples taken at the entrainment station in the vicinity of the intake were assumed to be representative of the number of each species that would pass into the intake with the cooling water.

Survey Results

Estimates of daily larval entrainment for the year of sampling were calculated from data collected at the entrainment station. Assessment of entrainment effects were limited to the most abundant fish taxa that together comprised 90 percent of all larvae identified in the entrainment samples and/or juveniles and adults impinged by the cooling water system. Fish larvae from 57 different taxonomic groups were collected during the entrainment sampling surveys. However, many of these taxa were represented by only one or two individuals. Unidentifiable CIQ gobies (gobies of the genera *Clevelandia, Ilypnus,* and *Quietula*) were the most abundant fishes in the entrainment samples, comprising 37 percent of the total entrained individuals. The CIQ gobies complex is

used to indicate one or more of several species of nearshore gobies whose larvae cannot be distinguished from each other. The gobies of the CIQ complex include arrow goby (*Clevelandia ios*), cheekspot goby (*Ilypnus gilberti*), and shadow goby (*Quietula y-cauda*). Other larval fish taxa that were abundant in entrainment samples included northern anchovy (18 percent), spotfin croaker (*Roncador stearnsii,* 14 percent), white croaker (*Genyonemus lineatus*, 7 percent), and queenfish (*Seriphus politus,* 5 percent). **BIOLOGY Table 1** compares the percentage of various fish taxa collected in the entrainment and source water samples.

BIOLOGY Table 1
Percentage of Fish Taxa Accounting for More than 1 Percent of the Total Individuals in the Entrainment and Source Water Samples

Fish Taxon	Common Name	Percent of Individuals in Entrainment Samples	Percent of Individuals in Source Water Samples
Gobiidae (CIQ Complex)	gobies	36.95	36.82
Engraulidae	anchovies	17.98	17.62
Roncador stearnsi	spotfin croaker	13.57	0.37
Genyonemus lineatus	white croaker	6.53	8.65
Seriphus politus	queenfish	4.55	9.90
Sciaenidae	unidentified croakers	3.63	3.78
Hysoblennius spp.	blennies	2.47	3.06
Xenistius californiensis	salema	2.28	0.35
Paralichthys californicus	California halibut	1.46	2.78
Atherinopsidae	silversides	1.44	2.32
Cheilotrema saturnum	black croaker	1.43	0.43
Hypsopsetta guttulata	diamond turbot	1.29	0.85
Paralabrax spp.	kelp/sand bass	0.71	2.85
Chromis punctipinnis	blacksmith	0	1.16
Sardinops sagax	Pacific sardine	0.06	1.03
Sphyraena argentea	California barracuda	0.21	1.01

Six taxa comprised 80 percent of the total fish larvae collected from the *source water* samples: CIQ gobies (37 percent), northern anchovy (18 percent), queenfish (10 percent), white croaker (9 percent), unidentified croakers (4 percent), and combtooth blennies (*Hypsoblennius* spp.) (3 percent).

Five invertebrate taxa were selected for analysis, but only two (sand crab and rock crab) were collected in entrainment samples. Sand crab larvae accounted for nearly 99 percent of the entrained target invertebrate density.

Entrainment Impact Analysis

Because Units 3 and 4 were retired in 1995, entrainment losses incurred as a result of refurbishing the units represent a new source of entrainment. Units 3 and 4 were not operational at the time the application for the HBGS Retool Project was filed. Units 3 and 4 are permitted for the same amount of cooling water withdrawal as Units 1 and 2. Therefore, for the purposes of the impact analysis, Units 3 and 4 account for approximately half of the total cooling water flow and associated entrainment at HBGS.

Three approaches were used to estimate the impacts of entrainment. All approaches assumed 100 percent mortality of organisms entrained in the HBGS cooling water system. Given the uncertainty and the lack of evidence indicating otherwise, 100 percent mortality has been assumed in recent entrainment studies in California (e.g. Tenera 2000a). The BRRT agreed that 100 percent mortality would be assumed in the impact analysis and this assumption was part of the final study plan.

The first two approaches, adult equivalent loss (AEL) and fecundity hindcasting (FH), use demographic data to express entrainment losses in terms of adult fish. The third approach, the empirical transport model (ETM), provides the most comprehensive method to understanding ecosystem impacts of entrainment. It was the results from ETM that were relied upon by staff and the commenting agencies to determine the significance of entrainment impacts. This approach is based on the estimation of larvae lost relative to the number at risk. The ETM model calculates the proportion of the population of target species at risk of entrainment (P_m) within the geographic area (source water body) from which they could be entrained.

Unlike the AEL and FH models, which only estimate losses to a few target taxa and only express those losses in terms of adult fishes, the ETM model provides an estimate of the proportion of larvae lost over the area from which they are at risk of entrainment. The mean P_m of the target fish taxa is considered to be representative of the proportion of larvae lost of non-targeted fish species and also a reasonable estimate of the proportionate loss of all the organisms that are entrained assuming that life histories of targeted species are broad enough to encompass the breadth of species possibly entrained. If the proportion of organisms entrained is multiplied by the area over which they are at risk of entrainment, then one can estimate the equivalent amount of ocean habitat it would take to produce those lost resources. This area is referred to as the area of habitat production foregone (APF) (Stratus Consulting 2004). As an example, if an average of 10 percent of the targeted fish larvae (considered representative of all the planktonic organisms) is entrained in a source water body of 1,000 acres, then those losses are equivalent to the productivity of approximately 100 acres of coastal water.

The source water shoreline distance was determined by the length of time each target taxon is vulnerable to entrainment and available data on current movements in the project area. Because each taxon has a different period of vulnerability to entrainment, shoreline distances used in the analysis are different for each taxon. An estimate of the area of larval production lost due to entrainment (APF) was estimated by multiplying the P_m estimates by the alongshore source water length ($1/P_s$) and width of the source water area sampled (3 miles). Although the Final Entrainment and Impingement Study calculated APF using all the taxa that were abundant in the samples, the APF was

recalculated based on comments received during an April 27, 2006, BRRT meeting. The APF for nearshore sandy habitat was calculated using all of the taxa in the assessment except for gobies that do not occur in the nearshore areas around HBGS as adults and northern anchovies that occur over a much larger area than the nearshore source water (Tenera Environmental 2006a). As described below an APF for CIQ copies was calculated separately.

Estimates of APF ranged from 0.04 to 1.17 square miles and averaged 0.3 square miles or 208 acres. This average APF for the target taxa is considered representative of all of the plankton lost to the HBGS intake. The impact analysis in the entrainment and impingement study was based on the permitted volume of water withdrawn by all four units. **BIOLOGY Table 2** summarizes these results for target taxa. Because the permitted withdrawal for Units 3 and 4 is half that of Units 1-4, the average area of habitat production foregone due to the HBGS Retool Project is half of 208 acres or 104 acres.

The ETM calculations for gobies were revised from those in the Final Entrainment and Impingement Study by using Proportional Entrainment estimates that incorporated both nearshore and estuarine larvae (Tenera Environmental 2006). The estimate of APF for CIQ gobies was based on adult habitat in three Orange County estuarine areas: Anaheim Bay/Huntington Beach Wetlands, Santa Ana River/Talbert Marsh, and Newport Bay. A conservative estimate of APF for CIQ gobies based on the total estuarine areas in these wetlands is 30.69 acres. For Units 3 and 4, the APF for CIQ gobies would be 15.35 acres.

This loss of habitat productivity represents a loss of functional value of native fish, wildlife, and plant habitat and a degradation of the foraging habitat of the endangered California least tern, endangered California brown pelican, and threatened western snowy plover. Up to 253.5 mgd of seawater is drawn into the HBGS cooling water system each day to cool Units 3 and 4. This seawater is not just water, it is habitat. A great diversity and abundance of plants and animals live in the water entrained to cool Units 3 and 4. These organisms include the small plants and animals that provide the base of the marine food chain as well as the young of many fish and invertebrate species. The large volume of seawater that is drawn into the power plant on a daily basis is full of living organisms. When the water is discharged back into the ocean, for all practical purposes, everything living in it is killed. The loss of planktonic organisms in hundreds of millions of gallons of seawater every day represents a substantial degradation of the marine environment. Although the water itself may not be physically lost, everything that lives in it is. An analogy would be clearing all the vegetation from a patch of ground and leaving the bare ground remaining or cutting off tidal flow from an estuary. The State Water Resources Control Board in its recent proposed statewide policy on 316(b) regulations compared entrainment and impingement impacts to marine and estuarine wastewater discharges (SWRCB 2006). Effluent limitations on discharges are designed to prevent acute and chronic toxicity to aquatic life. When fish kills occur as a result of spills or discharges, enforcement actions usually are taken. The HBGS cooling water intake kills billions of organisms a year. If a discharge with similar impacts were proposed, it probably would not be allowed let alone declared insignificant with no mitigation required. Therefore, based on the significance criteria

used in this analysis, staff considers entrainment losses due to water withdrawal for Units 3 and 4 to be significant.

The reduction in productivity, including the loss of fish and invertebrate larvae, will occur every day of every year that the HBGS is operating its cooling water system. Because of a lack of knowledge of fish demographics and a lack of understanding of the various factors affecting fish populations, it is not possible to know whether these ongoing entrainment losses, coupled with other environmental stressors, would cause any coastal population to drop below self-sustaining levels. However, some of the species with larvae entrained in greatest numbers have been declining in recent years. For example, Herbinson et al. (2001) showed by analyzing power plant impingement data that the populations of six croaker species (white croaker, yellowfin croaker (*Umbrina roncador*), black croaker (*Cheilotrema saturnum*), California corbina (*Menticirrhus undulatus*), white sea bass (*Atractoscion nobilis*), and spotfin croaker), have declined in Southern California since 1977. Spotfin croaker and white croaker are among the species whose larvae are entrained in greatest number at HBGS. Therefore, entrainment losses at HBGS are affecting species currently in decline and contributing to cumulative impacts on these species.

BIOLOGY Table 2
Summary of Entrainment Modeling Estimates For Target Taxa and Estimation of Area of Production Foregone*

Taxon	Estimated Annual Entrainment	P_m Alongshore Extrapolation	Area of Production Foregone (mi^2)
spotfin croaker	69,701,589	0.3% (10.1 mi)	0.085
queenfish	17,809,864	0.6% (50.9 mi)	0.911
white croaker	17,625,263	0.7% (28.7 mi)	0.583
black croaker	7,128,127	0.1% (11.6 mi)	0.039
salema	11,696,960	NA**	NA**
blennies	7,165,513	0.8% (7.7 mi)	0.170
diamond turbot	5,443,118	0.6% (10.1 mi)	0.170
California halibut	5,021,168	0.3% (18.5 mi)	0.131
rock crab	6,411,171	1.1% (15.9 mi)	0.486

*The along shore displacement (mi) used in the alongshore extrapolation of P_m is presented in parentheses next to the P_m estimate.
**Estimate not available due to low abundance in entrainment samples
Source: MBC 2005

One point to make clear about P_m values is that they are essentially meaningless without the context of the source water body. It is simply not informative to indicate that because P_m values are small the impact is small and not significant. Consider the extreme case of species A and B. The estimated P_m and source water bodies for these two species are 50 percent and 100 square meters, and 1 percent and 2,766,280,000

square meters (e.g., the CIQ Gobies). The argument that 50 percent is high and 1 percent is low makes no sense. This is precisely the reason APF estimates were developed. APF estimates for the two species are 50 meters square and 2,764,800 meters square respectively. Clearly, the impact to Species B is worse than that to Species A even though by P_m estimates the reverse would have been claimed. Indeed in this case the impact to B is approximately 55,000 times that to A (even though the P_m of A is 50 times that of B).

The two other models, AEL and FH, used in the impact analysis expressed entrainment losses in terms of numbers of adult fishes. The AEL model calculates the number of adults that would have been produced from the entrained larvae by using available estimates of larval mortality rates applied to various life stages. The FH model is similar to the AEL model except that it is used to estimate the number of adult females that would have produced the number of larvae entrained.

Because of a lack of demographic data for many of the target entrained species, AEL and FH could only be assessed for a few taxa. AEL estimates were 304,125 individuals for northern anchovy and 147,493 individuals for CIQ gobies. FH estimates were 3,233 adult females for combtooth blennies, 26,745 adult females for northern anchovy, and 101,269 adult females for CIQ gobies. These numbers are for the year during which the entrainment study was conducted.

There is often a temptation to use FH and AEL models to assess impacts because both models yield adult fish lost, a straightforward concept to grasp. When life history data are available, AEL and FH models only provide insight into the entrainment impacts of certain species. Too often, particularly along the west coast, such data are lacking. Even when there are some survivorship data, variability in those estimates leads to very broad ranges in the estimates of impact (this broad range also occurs in ETM estimates) (Raimondi 2005). Mathematically we assume that our estimate of impact becomes more reliable with increasing sample size (meaning the number of species we are able to evaluate) and this underlies the primacy of ETM estimation for all recent entrainment assessments in California.

In addition, AEL and FH generally provide no means of estimating the losses of fish eggs, non-targeted fish larvae, non-targeted invertebrate larvae, phytoplankton, algal spores, and zooplankton species that spend their entire lives in the plankton. Furthermore, AEL and FH do not address the implications to the ecosystem from entrainment losses. The small organisms that are entrained in the once-through cooling system form the base of the coastal food chain. Therefore, entrainment losses represent not only the losses of the planktonic organisms themselves but loss of the food base for much of the nearshore ecosystem. For these reasons, ETM provides a much better estimate of the true impacts of entrainment.

As discussed previously, the entrainment losses represent a loss not only of target species but also of all planktonic organisms. Therefore, the entrainment losses not only represent fish larvae that will be lost from the adult populations, but losses to all levels of the coastal food chain. Organisms lost to entrainment include species such as northern anchovy that are an important prey species for endangered birds such as the California brown pelican and the California least tern. The Federal Threatened western

snowy plover, which forages on beaches near the HBGS, eats young sand crabs, and frequently entrained invertebrates include sand crab larvae. Although entrainment losses do not directly affect sensitive bird species, they represent a degradation of the sensitive species' foraging habitat.

The losses of marine organisms to the HBGS cooling water system are occurring in coastal southern California where the marine environment has been degraded by multiple stresses including impaired water quality, over fishing, and loss of tidal wetlands. Considerable effort, such as improvement in the quality of point and non-point source discharges, fisheries management, and wetlands restoration is being expended to reverse those trends. These efforts include the development of total maximum daily loads (TMDLs) of pollutants and the implementation of various methods to meet those limits, moratoriums on various fisheries as well as the establishment of marine life preserves, and restoration of tidal wetlands including the Bolsa Chica Wetlands in Huntington Beach. Thus, the loss of marine resources to the HBGS cooling water system represents a source of degradation to an environment that a variety of state, federal, and local agencies are trying to maintain and restore.

The commenting resource agencies have concurred with staff's determination that the losses of marine resources caused by the intake of cooling water for Units 3 and 4 is a significant impact that requires mitigation. Section 395 (b)(4)(A) of the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1801 *et seq.*) specifies that if NMFS determines that any action undertaken by any state or federal agency would affect any Essential Fish Habitat (EFH), it shall recommend measures that can be taken by such agency to conserve such habitat. NMFS has concluded that an adverse effect to EFH is currently occurring from the entrainment and impingement of fishes by the HBGS cooling water system (Chambers 2005). NMFS also stated that it believes AES is contributing to a cumulative marine fishery loss caused by coastal power generation in southern California. NMFS recommended mitigation, particularly wetland restoration and artificial reef construction, to offset those impacts.

CDFG is a commenting agency regarding the assessment of impacts to California fish and wildlife. CDFG stated, "The Department believes the estimated annual impingement and entrainment losses of juvenile and adult fishes resulting from the operation of the AES meets the criteria as significant. As such, mitigation to offset these losses should be required for the continued operation of the AES" (Ugoretz 2005).

The RWQCB also is a commenting agency on the Energy Commission analysis. The RWQCB stated in an email to the BRRT: "Regional Board staff supports your finding of significance and proposed mitigation" (Theisen 2006).

The California Coastal Commission is charged with determining whether proposed coastal projects are in conformance with the California Coastal Act. Policy 30230 of the California Coastal Act states that marine resources shall be maintained, enhanced, and where feasible, restored and that special protection shall be given to areas and species of special biological or economic significance. This policy specifies also that uses of the marine environment be carried out in a manner that will sustain the biological productivity of coastal waters and that will maintain healthy populations of all species of marine organisms. Policy 30231 states that biological productivity and the quality of

coastal waters, streams, wetlands, estuaries, and lakes appropriate to maintain optimum populations of marine organisms and for the protection of human health shall be maintained and, where feasible, restored through, among other means, minimizing adverse effects of wastewater discharges and entrainment, controlling runoff, preventing depletion of groundwater supplies and substantial interference with surface water flow, encouraging wastewater reclamation, maintaining natural vegetation buffer areas that protect riparian habitats, and minimizing alteration of natural streams. The California Coastal Commission has concluded that the HBGS cooling water intake causes a significant environmental impact, which, if left unmitigated, would be inconsistent with Coastal Act Policies expressed in Public Resources Code Sections 30230 and 30231 (Luster 2005). Thus, based on the findings of the resource agencies, mitigation is required to provide compliance with Laws, Ordinances, Regulations, and Standards.

Results of the Impingement Study

For the impingement study, samples were collected from the screening facility within the generating station. Samples collected weekly during normal operations were used to characterize fish losses from the day-to-day operation of the generating station. Normal operations samples were collected over a 24-hour period. Samples also were collected during heat treatments, when waters within the cooling water intake structure were heated and essentially all fishes and invertebrates succumbed to the high temperatures. Heat treatment procedures were carried out at approximately eight-week intervals to control biofouling. Combined normal operation and heat treatment samples were used to estimate the annual loss of fishes and invertebrates due to impingement.

A total of 52 normal operation impingement surveys and 6 heat treatment surveys were conducted between July 2003 and July 2004. A total of 51,082 fishes representing 57 species were impinged during this period with most (75 percent) of the losses occurring during heat treatments. The biomass of fishes lost to impingement was estimated to be 1,292 kg. The fish species impinged in greatest numbers was queenfish, accounting for 70 percent of the impinged fishes. Other fish species impinged in high numbers were white croaker, shiner perch (*Cymatogaster aggregata*), and northern anchovy. A total of 70,638 macroinvertebrates of 37 species were impinged with most (98 percent) of the losses attributable to normal operations. The impinged invertebrates weigh a total of 168 kg. The invertebrate species impinged in the greatest numbers were the nudibranch *Dendronotus frondosus,* yellow rock crab (*Cancer anthonyi*), slender rock crab (*C. gracilis*), and brown rock crab (*C. antennarius*). These impingement losses, although not large, add to the impacts of entrainment because they affect the same ecosystem and many of the same species.

Mitigation Options for Entrainment and Impingement Impacts

Capping cooling water volumes at a level lower than the permitted maximum used in the entrainment analysis would reduce the impacts of entrainment. Since Units 3 and 4 were brought on-line, the average daily cooling water flow of Units 1-4 has been 330 mgd or approximately 65 percent of the permitted flow for all 4 units. AES is considering (but has not committed to) capping cooling water volumes at an annual average flow of 126.7 mgd for Units 3 and 4, or half their permitted flow of 253.5 mgd. The APF was recalculated based on this volume (Tenera 2006b). AES provided three

likely scenarios of seasonal reductions of the 253.5 mgd permitted flow of Units 3 and 4 that were used in the calculations (**BIOLOGY Table 3**).

BIOLOGY Table 3
Flow Reduction Scenarios for Units 3 and 4

Scenario	1st Quarter Percent of Maximum	2nd Quarter Percent of Maximum	3rd Quarter Percent of Maximum	4th Quarter Percent of Maximum	Calculated APF
1	25	50	80	45	66.8
2	30	40	90	40	69.5
3	20	40	100	40	74.7

The recalculation took into consideration the monthly variability of larval abundance. With the lower intake volumes, the APF was 66.8 acres for Scenario 1 to 74.7 acres for Scenario 3. If AES does agree to a reduced flow volume for Units 3 and 4, a method would have to be agreed upon to track the flow to these units so compliance with the reduced flow could be verified. Although the reduced cooling water flow would result in a reduction in entrainment, substantial losses of marine life from entrainment and impingement would still occur.

The analysis of potential methods to reduce entrapment of larger organisms and subsequent impingement at HBGS included technologies, such as behavioral barriers, screening options, fish return systems, and operational measures such as intake relocation and flow reduction. The HBGS intake already is equipped with a velocity cap that reduces fish entrapment and subsequent impingement by up to 90 percent. Although the velocity cap greatly reduces impingement, tens of thousands of fishes and invertebrates are still impinged at HBGS. No practical method was identified that would further reduce entrapment and impingement at HBGS. There are no known applications of behavioral barriers or devices including sonic stimuli, lights, and bubble curtains that have been proven successful in an offshore marine environment. Offshore screening devices such as barrier nets or aquatic filter barriers are unlikely to be feasible in the open ocean coastal environment of HBGS. Fish return systems have been reasonably successful at other power plants, but a fish return structure at HBGS is complicated by the fact that the structure would need to be directed underground beneath the Pacific Coast Highway and Huntington State Beach and likely would incur substantial mortality of target fish species. Intake relocation and flow reduction have not been demonstrated to reduce impingement. Several of the potential methodologies, such as modified screens and intake redesign and/or relocation, not only have not been demonstrated to be effective, but also are likely to be prohibitively expensive.

Even if entrainment impacts are reduced by restricting cooling water volume, entrainment impacts would still occur and impingement cannot be reduced much below existing levels. Therefore, habitat restoration of a sufficient amount of coastal habitat near HBGS is recommended as the most appropriate mitigation to offset the loss of habitat productivity due to entrainment and impingement. Restoration of coastal habitat to mitigate entrainment and impingement losses is consistent with other recent Energy

Commission siting cases such as the Moss Landing Power Plant. In California, there is a history of using restoration of tidal wetlands to mitigate for impacts to coastal species. For example, restoration of the San Dieguito Wetlands was part of the mitigation for entrainment and impingement losses at San Onofre Nuclear Generating Station (SONGS). Tidal wetlands provide nursery habitat for many nearshore species and export organic matter that enhances coastal food chains.

In recent power plant cases, tidal wetlands restoration proposed to compensate for the loss of productivity due to entrainment and impingement has been at a ratio of 1:1 or 1 acre of wetlands restored for 1 acre of habitat production foregone. These cases have been for power plants that have intakes in wetland or harbor areas. Huntington Beach has a coastal intake. In most instances where mitigation is done in an out-of-kind habitat, the mitigation ratio is greater than 1:1. However, open coast habitats are believed to be less productive than estuarine habitats, although insufficient data exist to make a direct quantitative comparison. For SONGS, wetland restoration was used to compensate for the effects of a coastal intake and in that case resource value resulting from habitat creation was used in the estimation of wetland area to be created. Note that no formal algorithm was used to come up with the mitigation area for SONGS, and that the impacts due to entrainment were assessed using AEL estimation for a small set of species. Tidal wetland restoration has been considered appropriate because tidal wetlands have been found to be productive and provide other benefits to coastal waters in addition to compensating directly for lost productivity. These benefits include cleansing pollutants from run-off before it enters the ocean, providing foraging and resting areas for seabirds such as terns, gulls, and pelicans that may be affected by diminishment of food resources due to impingement and entrainment, and increasing the diversity of coastal habitats. Furthermore, previous wetlands restoration projects in southern California, such as restoration of Batiquitos Lagoon to compensate for fill in the Ports of Los Angeles and Long Beach, have been extremely successful in providing the targeted ecological benefits. Thus, there is an acceptable level of certainty that a tidal wetlands restoration will be successful.

Coastal wetlands restoration costs typically range between $20,000 and $100,000 per acre when easy fixes are available, such as removal of dikes and berms, or when projects are based on enhancement of existing wetlands rather than on creation of new wetlands. Wetland restoration costs may significantly exceed that range. Restoration of the Bolsa Chica Wetlands in Huntington Beach (not including acquisition costs) exceeded $250,000 per acre (B. Hoffman, NOAA Fisheries, personal communication, 2006). Based on the assumption that most wetland mitigation opportunities in southern California are likely to be enhancement, not creation (unlike SONGS), the cost estimate to restore an amount of tidal wetlands equivalent to the mean area of habitat production foregone of 104 acres due to operation of Units 3 and 4 would cost anywhere between $2,080,000 and $26,000,000. Under a reasonable worst case scenario (scenario 3, **BIOLOGY Table 3**), restoration of 74.7 acres would cost between $1,494,000 and $18,675,000. Because of the number of constraints encountered in restoring tidal flow to coastal wetlands in highly urbanized southern California, restoration costs for southern California tidal wetlands would be expected to be at the higher end of that range. The cost would be much more if wetlands were created (note that the gain in resources per acre would be much higher also). The reason it is more expensive to restore tidal wetlands in urban areas is because when tidal flows are increased,

considerable engineering is usually involved to make sure that the introduction of greater volumes of water does not flood roads, buildings, and other structures. In addition, many southern California wetlands were used for oil and gas development and have contaminants that must be removed.

Restoration of habitat to restore lost habitat productivity is most appropriate if the restoration site is in close proximity to the location of the impacts. This is because a habitat restoration project near the area of habitat loss will directly compensate the area that is suffering the loss. A more distant restoration project may benefit some of the affected resources, but it may not directly benefit the impacted ecosystem. Although a restoration project in the immediate vicinity of HBGS would subject organisms produced within the restored wetlands to risk of entrainment, only a portion of these organisms will be lost while many will survive to repopulate the ecosystem. In addition coastal wetlands provide many benefits that will not be affected by entrainment. These benefits include the export of nutrients to coastal waters, the production of forage fish such as topsmelt within the estuary to feed species such as least terns, nursery habitats for flatfish, the creation of habitat for sensitive species such as the western snowy plover, and the cleansing of runoff before it enters the ocean. Opportunities have been identified to restore tidal habitat in the immediate vicinity of HBGS.

Huntington Beach Wetlands

The Huntington Beach Wetlands Conservancy recently finalized a plan for restoration of the Huntington Beach Wetlands, which are located immediately down coast and to the northwest of HBGS (Moffatt & Nichol 2006). These wetlands collectively total 191 acres. The restoration plan includes two subtidal basins designed to provide habitat (and nursery habitats) for coastal fishes. The restoration is planned for three phases. The first phase would consist of restoration of 27-acre Talbert Marsh and 43-acre Magnolia Marsh for an estimated cost of about $5.46 million. The second phase is restoration of 67-acre Brookhurst Marsh for an estimated cost of $6.05 million. The third phase would be restoration of the 54-acre Newland Marshes, which are in three separate parcels, for a total estimated cost of $2.75 million. Conceptual restoration alternatives have already been developed by the Huntington Beach Wetlands Conservancy, but no funding source for the restoration has been identified. Preliminary cost estimates to implement Phases 1 through 3 of the Huntington Beach Wetlands restoration plan is approximately $14.26 million (Moffatt & Nichol 2006). Once the initial restoration of the wetlands is implemented, operation, monitoring and maintenance costs would be $149,767 per year (Gorman 2006).

Restoration of all or part of the Huntington Beach Wetlands would enhance coastal habitat in the immediate vicinity of HGBS and would benefit either directly or indirectly species entrained and impinged on the HBGS intake. For example, the proposed wetlands restoration would enhance existing tidal basins and create new basins that would provide habitat for fish species that are directly impacted by the HBGS intake. The wetlands would provide foraging and resting habitat for California least terns, western snowy plovers, California brown pelicans and other species whose ecosystem has been degraded by entrainment and impingement losses due to operation of Units 3 and 4.

Compensation must include an understanding of the level of restoration. Wetlands restoration enhances the value of degraded wetlands but does not create new wetlands. For the SONGS wetland restoration, models suggested that the enhancement of existing wetlands would increase their habitat value by about 25 percent. The Huntington Beach Wetlands already have certain wetlands functional values and, therefore, like the SONGS wetlands restoration, enhancement would increase their value by less than 100 percent. The Huntington Beach Wetlands vary in their existing value to species impacted by the HBGS intake so the level of enhancement would vary depending on the area. Talbert Marsh already has tidal flow. Therefore, improvement of this part of the wetlands (by dredging sediment and improving subtidal habitat) would result in a relatively small gain in benefits for coastal species. On the other hand, Magnolia, Brookhurst, and Newland Marshes are currently isolated from tidal flow so the gain would be relatively great although less than the 100 percent benefit of creation. Determination of the proper ratio of enhancement to mitigate for HBGS losses should also consider resources values conferred by the restoration that are in addition to those lost due to entrainment. The highly productive tidal wetlands would export organic material that would stimulate the coastal food chain and compensate for the loss in productivity to entrainment. The wetlands would remove pollutants from urban run-off and, thus, improve the health of the nearshore ocean ecosystem in the vicinity of HBGS. Furthermore, restoration of the Huntington Beach Wetlands has the advantage that restoration plans have already been developed.

In summary, determining the ratio of wetlands restoration to APF for entrainment impacts at Units 3 and 4 must consider several factors. First, the mitigation is out-of-kind. The habitat directly affected by HBGS entrainment would not be created or restored and some impacted species would benefit more than others. However, tidal wetlands probably are more productive than nearshore soft bottom habitat and, also, provide more benefits than subtidal sand bottom habitat. Finally, the proposed restoration would restore degraded habitat rather than create new habitat. Taking all of these factors into consideration, a ratio of one acre of wetlands restoration at Huntington Beach is proposed for one acre of production foregone due to entrainment by Units 3 and 4.

Based on a total wetlands restoration cost of $14.26 million, the initial costs to restore the Huntington Beach Wetlands is $74,660 per acre. The cost to operate and maintain the wetlands is $149,767 per year or $784 per acre per year. Therefore, the cost to restore the 104 acres of wetlands habitat that would replace the loss of productivity due to entrainment in the cooling water system for Units 3 and 4 and maintain those wetlands for the 10-year life of the AES license for Units 3 and 4 would be $7,956,000. The cost to restore 74.7 acres and maintain them for 10 years if flow to cool Units 3 and 4 is reduced by half would be $6,162,750.

Santa Ana River

There is degraded wetlands habitat near the Santa Ana River mouth approximately 2 miles southeast of HBGS that could be restored to tidal flow. However, no plan has been developed for restoration of these wetlands, and the property is privately owned and would need to be purchased.

Artificial Reefs

Creation of artificial reefs near HBGS might increase coastal fish productivity and mitigate for entrainment and impingement losses at HBGS. Again, however, no plans have been developed for artificial reef construction near HBGS. Furthermore, construction of artificial reefs benefit species associated with hard bottom habitat. The species most affected by the HBGS intake are either estuarine species (CIQ gobies), water column species (anchovies), or species associated with soft bottom habitat (spotfin croaker, white croaker, queenfish).

Because of the lack of restoration plans, Santa Ana River Wetlands restoration or artificial reef construction would take longer to implement than restoration of the Huntington Beach Wetlands.

BIOLOGY Table 4 summarizes each mitigation option.

BIOLOGY Table 4
Summary of Mitigation Options

Project Name	Acres	Advantages	Disadvantages
Huntington Beach Wetlands • Phase I Talbert & Magnolia (70 acres) • Phase II Brookhurst (67 acres) • Phase III Newland (54 acres)	191 (total)	• close proximity to HBGS • benefits species affected by HBGS • restoration plans already developed • restoration can be done in phases	• high total restoration cost for entire wetlands
Santa Ana River Mouth	n/a	• restore degraded wetland habitat to tidal flow • close proximity to HBGS	• no restoration plans in place • property must be purchased
Artificial Reefs	n/a	• potential to increase coastal fish productivity	• more beneficial to species less affected by HBGS • no planning has been done for design or siting of reefs

CUMULATIVE IMPACTS AND MITIGATION

Cumulative impacts refers to two or more individual and similar effects which, when considered together, are considerable or which compound or increase other environmental impacts. Entrainment and impingement impacts of HBGS will act in a cumulative fashion with entrainment and impingement at other coastal power plants in southern California. A first-order analysis of cumulative entrainment and impingement

impacts from 12 coastal power plants in southern California was performed as part of the HBGS entrainment and impingement study (MBC 2005). Modeling results showed that the average entrainment mortality was 1.4 percent for a larval duration of 40 days using a source water volume out to the 75 meter isobath. Restricting the source water to the 35 meter isobath increased the average estimated mortality to 4.4 percent. HBGS mortality rates were calculated to be between 5.4 and 5.6 percent of the cumulative mortality from the 12 intake locations.

Southern California fish impingement was estimated at nearly 3.7 million fishes weighing over 26,400 kg (58,000 lbs) in 2003, with impingement at the SONGS representing 97 percent of impingement abundance and 83 percent of biomass. Cumulative macroinvertebrate impingement was estimated at over 77,600 individuals with a weight of 1,366 kg (3,005 lbs) in 2003 with HBGS representing 91 percent of the macroinvertebrate impingement but only 12 percent of the biomass. Although macroinvertebrate abundance was highest at HBGS, biomass was not that high compared to other power plants, because the species impinged in greatest numbers at HBGS was a small nudibranch.

In addition to acting cumulatively with entrainment and impingement at other coastal power plants, entrainment and impingement at HBGS acts cumulatively on marine resources with other natural and human stresses to the marine environment. These impacting agents include climate shifts, loss of tidal wetlands, point and non-point source pollution, and fishing.

This preliminary study did not specifically determine the significance of these cumulative losses. However, because entrainment and impingement losses at individual power plants have been found to be significant in recent studies, it can be inferred that cumulative losses also would be significant especially in places where several power plants are located in close proximity to each other. Furthermore, the declining health of California's ocean waters, due to multiple factors, has been the cause of much recent concern (CRA/USEPA 2004). The loss of marine organisms due to the intake of cooling water for Units 3 and 4 of HBGS contributes to this significant degradation. Therefore, once-through cooling of Units 3 and 4 contribute to significant cumulative impacts on the nearshore environment. Restoration of tidal wetlands as identified in this analysis would mitigate the loss of productivity from once-through cooling of Units 3 and 4. The proposed mitigation, thus, would offset Units 3 and 4 contribution to cumulative degradation of the southern California marine environment.

CONCLUSIONS

The entrainment and impingement study required by Condition of Certification **BIO-4** estimated that entrainment by the HBGS cooling water system was equivalent to a mean APF of 208 acres for coastal fish species and 30.69 acres for CIQ gobies (Tenera Environmental 2006). Of this habitat production foregone, entrainment at the restarted HBGS Units 3 and 4 accounts for half of the total, or 104 acres for coastal fishes and 15.35 acres for CIQ gobies.

To determine the significance of these impacts, staff used Mandatory Findings of Significance under CEQA (CEQA Guidelines Section 1605 (a)(1)). An impact to biological resources is considered significant:

- if state- or federal-listed species, state Fully Protected species, candidates for state or federal listing and/or Species of Concern are impacted;
- if migration of a species is interrupted;
- if there is a reduction of native fish, wildlife and plant habitat;
- if a fish or wildlife population is caused to drop below self-sustaining levels;
- if a wetlands, marsh, riparian area or other wildlife habitat is disturbed;
- if there is substantial degradation in the quality of the environment.

In addition, CEQA Guidelines specify a Mandatory Finding of Significance if the project has possible environmental effects that are individually limited but cumulatively considerable (CEQA Guidelines Section 16065(a)(3)).

This loss of habitat productivity represents a loss of functional value of native fish, wildlife, and plant habitat, a disturbance to wildlife habitat, and an overall substantial degradation of the coastal environment in the vicinity of HBGS. Although entrainment losses do not directly affect sensitive bird species, they represent a degradation of the foraging habitat of the endangered California least tern, endangered California brown pelican, and threatened western snowy plover. Therefore, based on CEQA Mandatory Findings of Significance, the entrainment impacts of the cooling water intake for Units 3 and 4 are significant. Furthermore, once-through cooling of Units 3 and 4 contributes to significant cumulative impacts on the nearshore environment. Impingement impacts are relatively small but contribute to the impacts of entrainment because many of the same species are affected. Condition of Certification **BIO-5** requires that if the study determines that significant impacts are occurring, the project owner will provide funds for mitigation/compensation for impacts to Southern California Bight aquatic resources. Restricting water intake to a level below the permitted amount, if feasible, would reduce entrainment impacts, although even with reduced flow there would still be a substantial loss of marine life to entrainment and additional losses to impingement. Several opportunities for habitat restoration in the vicinity of HBGS have been identified that, if implemented, would reduce the impacts of entrainment and impingement to insignificant.

Condition of Certification **BIO-6** required that the project owner conduct a study to determine if there is a feasible methodology that would greatly reduce the number of fishes trapped in the intake forebay. The study was conducted as required. Staff agreed with the conclusions of the study that there was no feasible method proven to be effective in the southern California coastal environment that would reduce impingement losses at HBGS. The HBGS intake already has a velocity cap, which is estimated to reduce entrapment and subsequent impingement by up to 90 percent.

The impacts of cooling water intake for Units 3 and 4 would be fully mitigated by restoring 104 acres of the Huntington Beach Wetlands. The cost to restore the 104 acres of wetlands and maintain those wetlands for the 10-year life of the AES license for Units 3 and 4 would be $7,956,000.

AES may agree to cap the Units 3 and 4 cooling water flows at an annual average of 126.7 mgd. Reduction of cooling water flows would reduce the impacts of entrainment to a reasonable annual worst case scenario of the productivity of 74.7 acres of coastal habitat. Restoration of 74.7 acres of the Huntington Beach Wetlands and maintenance of those wetlands for the 10-year license of Units 3 and 4 would be $6,162,750.

Therefore, staff recommends that AES contribute $6,162,750 to the Huntington Beach Wetlands Conservancy for restoration of the Huntington Beach Wetlands if cooling water flows for Units 3 and 4 are capped at an annual average of 126.7 mgd. If AES cannot agree to a cap on Units 3 and 4, staff recommends that AES contribute $7,956,000 to the Huntington Beach Wetlands Conservancy to restore wetlands habitat equivalent to an APF of 104 acres. This recommendation will satisfy Condition of Certification **BIO-5**; no amendment to the condition of certification will be required unless an annual flow cap is agreed upon.

RESPONSE TO COMMENTS ON APRIL 27, 2006 DRAFT ANALYSIS

AES HUNTINGTON BEACH, L.L.C.

AES-1: The results of the IM&E Study do not support a finding of significant impacts, even applying the staff's criteria. The methodology applied by staff seeks to rely on an evaluation (that includes unsubstantiated assumptions) and incorporates considerations outside the scope of the study as required by Condition of Certification BIO-5. Moreover, it appears staff is interpreting all entrainment losses as a significant impact requiring mitigation.

Response: The Staff Analysis is a CEQA equivalent process and, therefore, uses significance criteria defined by CEQA. By those criteria, the losses of the planktonic organisms in the hundreds of millions of gallons a day that is entrained to cool Units 3 and 4 is a significant impact. Although entrainment does not result in a physical loss of habitat, it results in the loss of virtually all of the organisms that are small enough to be entrained in the large volumes of cooling water that are used on a daily basis. The physical, chemical, and biological interactions within a habitat define the habitat's functions. Biological functions include providing habitat for reproduction, feeding, and resting. When plankton in a large volume of water are killed by entrainment, that water will have lost part of its function as reproductive habitat by killing the output of reproduction (i.e. larvae and spores) and part of its function as feeding habitat because the small planktonic organisms that form the base of the food chain are killed. Hence, that water will have suffered a functional loss. Loss of native fish habitat is a mandatory finding of significance under CEQA. Under CEQA, loss can include functional as well as physical loss. Secondly, although direct impacts to listed species attributable to the power plant are not occurring, the AES intake is killing fishes and invertebrates on which listed species feed. In some years, the Huntington Beach colony of the state- and federal-listed California least tern has failed because of inadequate food supplies. Therefore, the entrainment and impingement of fishes and invertebrates at AES is contributing to the degradation of foraging habitat for listed species. Thirdly, the intake of hundreds of millions of gallons a day of seawater and the killing of virtually everything

that lives in that water clearly are a substantial degradation of the environment, a mandatory finding of significance under CEQA. Finally, the health of coastal ecosystems and many fish species is a cause of extreme concern. The entrainment of marine organisms in power plants is contributing to significant cumulative effects on coastal species, also a finding of significance under CEQA.

AES-2: Staff should take the following factors into consideration: (1) incorporate demographics into the analysis; (2) recognize habitat differences between the nearshore coastal waters and the wetlands recommended for restoration; and (3) utilize correct APF estimates and actual flow from Units 3 & 4; and (4) consider the life of the project.

Response: As explained in the analysis, demographics, although considered, were not relied upon as heavily as the ETM approach in determining impact significance and identifying mitigation requirements because the information needed for demographic models is only available for a few fish species and because demographic analyses do not address the ecological losses to fish habitat incurred by entrainment. The analysis does recognize the habitat differences between nearshore coastal waters and the wetlands recommended for restoration. The APF estimates have been revised, but are still based on permitted flow. It was agreed in the approved study plan that permitted flow would be used. Because AES has been permitted to take up to 253.5 mgd to cool Units 3 and 4, that is the appropriate volume to use unless AES is willing to commit to a lower daily maximum. Unless impacts can be characterized as temporary, Findings of Significance under CEQA do not consider the life of a project. The impacts of Units 3 and 4 have been occurring for several years and will occur for at least several more years; they are not temporary. Based on Mandatory Findings of Significance under CEQA, these impacts have been determined to be significant, and therefore, mitigation is required.

AES-3: We do not believe that the evidence presented in the staff report supports the finding of significant impacts. Condition of Certification BIO-4 required a one-year study of entrainment and impingement at the AES Huntington Beach Generating Station. Condition of Certification BIO-5 required AES Huntington Beach to provide funds for mitigation/compensation for impacts to Southern California Bight fish populations " *if the entrainment and impingement study determines that significant impacts to one or more species of coastal fish is occurring".*

Response: Please see the response to Comment **AES-1**. The Staff Analysis is the Energy Commission's CEQA-equivalent impact analysis and as such, must use significance criteria that are consistent with the CEQA guidelines. By those guidelines, substantial degradation of the environment and loss of the planktonic organisms in the seawater that is entrained to cool Units 3 and 4 is a significant impact. Loss of the entrained plankton constitutes a loss to the food web and a loss of reproductive output, hence, a functional loss of the seawater habitat that is entrained. The fishes and invertebrates that are lost to entrainment are part of the food base for endangered and threatened bird species and, thus, the operation of Units 3 and 4 is degrading their foraging habitat. Indirect effects on other species are an appropriate measure of the significance of a direct effect on a target species. Clearly, entrainment of organisms in

coastal power plants is contributing to cumulative degradation of the California coastal environment and, as such, meets the Mandatory Findings of Significance under CEQA.

The commenter's contention that entrainment impacts are not significant is inconsistent with current thinking about entrainment and impingement impacts. Under the new rules for Section 316(b) of the Clean Water Act, the Environmental Protection Agency (EPA) recognizes the adverse impacts of once-through cooling by effectively prohibiting new power plants from using once-through cooling systems and by requiring existing facilities to reduce entrainment by 60 to 90 percent. Similarly, on April 13, 2006, the California State Lands Commission proposed a resolution discouraging once-through cooling in coastal power plants because "once-through cooling significantly harms the environment by killing large numbers of fish and other wildlife, larvae and eggs as they are drawn through the screens and other parts of the power plant cooling system." (California State Lands Commission 2006).

AES-4: Commission staff did not define "functional value", nor did they present the line of logic that led to the conclusion that functional value is being lost due to entrainment. Furthermore, foraging habitat could not be significantly impacted when estimated losses to the source population of larvae due to entrainment averaged less than one percent.

Response: Please see the response to Comments **AES-1** and **AES-3** above for an explanation of functional value. The AES intake entrains the larvae of fish species that are eaten by listed bird species and impinges adults of these species. The intake also entrains the food of the fishes that are eaten by listed bird species. The loss of prey organisms is a degradation of the foraging habitat. As discussed in the revised staff document, the assertion that a low P_m means a low level of impact is deceptive. P_m values are essentially meaningless without the context of the source water body. It is simply not informative to indicate that because P_m values are small the impact is small and not significant. Consider the extreme case of species A and B. The estimated P_m and source water bodies for these two species are 50 percent and 100 meters square, and 1 percent and 2,766,280,000 square meters (e.g., the CIQ Gobies). The argument that 50 percent is high and 1 percent is low makes no sense. This is precisely the reason APF estimates were developed. APF estimates for the two species are 50 meters square and 2,764,800 meters square respectively. Clearly, the impact to Species B is worse than that to Species A even though by P_m estimates the reverse would have been claimed. Indeed in this case the impact to B is approximately 55,000 times that to A (even though the P_m of A is 50 times that of B).

AES-5: The current Empirical Transport Model (ETM) calculations do not include adjustments for compensation. It is difficult to perceive a situation where there would be absolutely no compensation for a mortality source that occurs during the larval stage when the processes of natural mortality are so high. This is especially true when the estimated mortality is so low relative to the variation in the natural sources of mortality.

Response: The concept of increased reproduction or survival to "compensate" for the losses incurred by entrainment and impingement has been raised and rejected many times, for example by the EPA in its formulation of new rules for power plant cooling water intakes under 316(b) (USEPA 2001, 2004). Nisbet et al (1996) concluded, "Optimistic outcomes (of compensation) all appear to demand mechanisms that have

not been proved in *any* marine fish *anywhere*." The USEPA (2004) reviewed compensation as it might apply to entrainment and impingement impacts, and concluded that the potential for compensation may, in conjunction with other impacts such as fishing, be compromised by once-through cooling systems. With multiple impacts including entrainment and impingement, "depensation," the opposite of compensation, may occur reducing the ability of populations to recover after their abundance has been reduced. In addition, recruitment of coastal marine fishes and invertebrates is highly variable, but once-through cooling systems operate without any consideration of variations in larval recruitment. Cooling-water volumes do not "compensate" by reducing flows when natural larval survival is low.

AES-6: During the one-year Entrainment and Impingement Study, an insignificant number of sand crab megalopae were collected in entrainment samples (during one survey in April 2004). Direct effects on juvenile/adult sand crabs could not be estimated based on the lack of necessary life history information. Therefore, there is no basis for asserting effects on bird populations and this should not be the subject of staff's analysis."

Response: Prey items of listed bird populations are killed by the intake of seawater to cool Units 3 and 4. Loss of food resources is degradation of foraging habitat. Whether loss of some portion of the prey population would have any measurable effects on the bird populations probably depends on multiple factors and varies from year to year. However, food resources are critical to these bird species and often are in short supply. Although only two sand crab megalops were collected during the entrainment and impingement study, many Stage 1 sand crab zoea were collected. The entrainment estimate for the study period was 465,806,877 zoea. What this means to the foraging base of the threatened western snowy plover is unknown, but, clearly, large numbers of sand crab larvae are being lost to entrainment.

AES-7: The IM&E Study did not demonstrate that any of these criteria were met. For all of the reasons above, a finding of significant impact to coastal fish or any other habitat is not justified.

Response: Please see the responses to Comments **AES-1** and **AES-3**.

AES-8: It is inappropriate to scale a coastal wetland restoration project based on nearshore sampling assuming a 1:1 replacement ratio....If restoration is required for the HBGS, a similar Habitat Equivalency Approach (HEA) should be used.

Response: The HEA approach was never discussed by the BRRT and was not part of the final study plan. A HEA was done for the Morro Bay Power Plant, but the results were not relied upon in the decision making process. The analyses done here are consistent with what was done at the Moss Landing Power Plant.

AES-9: Commission staff should not ignore the results of the demographic modeling, which was required by the Commission. The results for omitting these estimates from the mitigation recommendations should be explained.

Response: Please see the response to Comment **AES-2**. Also, as explained in the revised analysis, AEL and FH models only provide insight into the entrainment impacts of certain species. Too often, particularly along the west coast, such data are lacking. Even when there are some survivorship data, variability in the estimates lead to very broad ranges in the estimates of impact (this broad range also occurs in ETM estimates). Mathematically we assume that our estimate of impact becomes more reliable with increasing sample size (meaning the number of species we are able to evaluate) and this underlies the advantage of ETM estimation, which can be done for many more species. Analysis using AEL and/or FH was only done for three species in the HBGS study. ETM has been the primary tool for assessing impacts and determining mitigation for all recent entrainment assessments in California.

In addition, AEL and FH generally provide no means of estimating the losses of fish eggs, non-targeted fish larvae, non-targeted invertebrate larvae, phytoplankton, algal spores, and zooplankton species that spend their entire lives in the plankton. Furthermore, AEL and FH do not address the implications to the ecosystem from entrainment losses. The small organisms that are entrained in the once-through cooling system form the base of the coastal food chain. Therefore, entrainment losses represent not only the losses of the planktonic organisms themselves, but loss of the food base for much of the nearshore ecosystem. For these reasons, ETM provides a much better estimate of the true impacts of entrainment.

AES-10: The APF estimates presented in the Entrainment and Impingement Study Final report averaged 1.5 km^2, which is equivalent to 370.6 acres not 384 acres. This average includes values for CIQ gobies and northern anchovy whose spawning habitat lies outside the nearshore source water areas used in the APF estimates.

Response: The APF estimates in the document have been revised to address these comments.

AES-11: The entrainment estimates were also derived using a conservative set of assumptions, including maximum cooling water flow and 0% survival on passage through the cooling water system. Recent entrainment survival data indicate there is some survival of larval fishes on passage through the cooling water system.

Response: Those assumptions were agreed upon by the BRRT in the study plan. Those assumptions also are standard in all recent entrainment studies in California. Although some studies have indicated that some entrained organisms are alive when they exit the cooling water system, there are no studies of the subsequent survivorship and reproduction of these individuals in nature versus the survivorship and fecundity of similar individuals that are not entrained. Because of this uncertainty and the lack of evidence indicating that entrained organisms survive to reproduce, 100 percent mortality has been assumed in all recent California entrainment studies, and was agreed upon by the BRRT for this study plan.

AES-12: Units 3 and 4 account for one-half of the maximum flow permitted at AES Huntington Beach. However, it is incorrect to assume that repowered Units 3 and 4 account for one-half of the actual cooling water flow.

Response: The assumption that the maximum cooling water flow would be used in the Impingement and Entrainment Study was agreed upon by the BRRT. Because AES has the authority to use up to the permitted volume to cool these units, it is the appropriate volume to use for the analysis.

AES-13: The value of APF is that it converts the somewhat abstract concept of larval mortality into the more tangible concept of habitat. Although APF may be a useful model for conceptualizing the magnitude of the impact implied by ETM it should *not* be interpreted literally. The APF estimate is the size of an area that would be impacted if all effects were concentrated into a single site that received 100 percent larval loss. First, there is no such area where all the larval fish died or where there is no recruitment. The effects of entrainment are widespread and diluted over a large area.

Response: While the APF does not represent a physical loss of habitat, it provides a context for the losses by identifying the amount of habitat it would take to replace those losses. Whether the losses are concentrated in one area or spread out over a larger area, the losses to the populations still occur.

AES-14: Second, after HBGS entrainment ceases the effects will diminish over time at a rate dependent upon the species life history (i.e., age of maturity, fecundity).... Populations can recoup from the loss of individuals, while habitat loss is much more difficult to recover. The APF concept has the tendency to equate individual loss with habitat loss, and this is a misperception.

Response: Consideration for the limited license for Units 3 and 4 was addressed in response to Comment **AES-2**. CEQA does not consider project life in determining significance. A finding of significance was made using CEQA criteria and because impacts were determined to be significant, mitigation is required. Populations may or may not recover from losses of individuals. At this time, the losses are occurring on a daily basis. Every day all the small organisms in hundreds of millions of gallons of seawater are being killed to cool Units 3 and 4. This is not a one-time scattered loss but an ongoing degradation of the environment. The APF, although not a physical loss, helps to visualize the magnitude of those losses, and, most importantly, the amount of area that is needed to compensate for the losses.

AES-15: Third, any reasonable model of zoogeography would suggest a low-grade larval mortality over a wide region would have less of a population effect than a complete decimation of a specific subpopulation as suggested by this approach. The migration of individuals within a population will more readily fill the open niches left by scattered individuals than it will complete voids left by decimated subpopulations.

Response: Losses of organisms are losses of organisms no matter how the losses are distributed. The point of the APF is that it scales the losses to an area equivalent to 100 percent loss, and provides an indication of the equivalent amount of habitat that suffered that loss and that would need to be created to compensate for the loss. Although entrainment may not have literally caused a loss of habitat, it was responsible for a loss of *function* equivalent to the APF. Because an impact is spread over a larger area, does not mean that the impact is small. Furthermore, the commenter does not consider the entrainment losses of all of the organisms that were not counted (in fact

most of them). The use of APF allows for estimation of both the direct and indirect consequences of entrainment and provides an understanding of the amount of habitat that would be needed to offset this impact. The assertion that losses over a larger area are greater than losses concentrated within a small area would only be true if there were no other impacts to the species, which is clearly wrong. The truth is that the larger the source water body the more likely it is that there are other impacts to the species. For a small area there may be only a few sources of impact but as the area gets larger the number of impacts increases.

AES-16: Fourth, APF implies absolutely no compensatory mortality associated with larval entrainment when the actual model of Production Foregone (Rago 1984) uses estimates of larval survival and adult fecundity that are derived from real field data that incorporate compensatory mechanisms that may be operating on the subject populations.

Response: Please see response to Comment **AES-5**.

AES-17: Fifth, the AES Huntington Beach Retool Project has a limited project timeline. The project was certified for a total of ten years, five of which have already passed.

Response: Please see response to Comment **AES-2**.

AES-18: We believe the recommended mitigation is not only unjustified, but was calculated incorrectly by staff. If Commission staff continues to recommend mitigation, the analysis needs to be done fairly and take the following factors into consideration; (1) incorporate demographics into the analysis; (2) recognize habitat differences between the nearshore coastal waters and the wetlands recommended for restoration; and (3) utilize correct APF estimates and actual flow from Units 3 and 4 and consider the life of the project.

Response: (1) For the consideration of demographics, please see the response to Comment **AES-9**. FH and AEL models rely on estimates of survivorship rates between early life history stages. These estimates often vary among studies. Furthermore, FH and AEL do not address impacts to any species but a very few target species and, thus, do not address the full extent of ecological impacts; (2) the analysis does recognize the difference between nearshore coastal waters and wetlands. The greater value of wetlands compared to nearshore coastal habitat is the reason that a mitigation ratio of 1:1 is recommended. Although wetlands are more valuable than nearshore soft bottom, the wetlands that would be restored already have considerable functional value. If wetlands were being created from uplands a ratio of fewer wetlands acres per acre of production foregone would be justified. However, the proposed mitigation would be to enhance and restore existing wetlands; and (3) the APF estimates have been corrected in the revised documents but permitted flow is still used as agreed in the Study Plan. Energy Commission staff has completed its analysis and does not find it necessary to undertake a HEA or any other additional analysis. This analysis is consistent with what was done for the Moss Landing Power Plant.

AES-19: As a start, the staff should acknowledge that one-third of an APF of 370.6 acres is 123 acres and assuming a scaling of 20:1 (approximately one-half of the range

documented at Morro Bay) results in a 6-acre restoration project to coastal wetlands. A scaling of 20:1 is at the conservative end of the actual results from Morro Bay, and based on the results of the demographic modeling, this would be a more accurate restoration area to account for entrainment losses. In addition, if restoration is required, the staff should maintain consistency with other CEC-required restoration projects and follow the HEA approach, which factors in services and functions of different habitat types, which would further reduce the restoration area.

Response: Permitted flow, not actual flow, is the correct volume to use in the assessment as agreed to in the study plan. Using the ratio of larval fish densities in Morro Bay to larval fish densities along the Morro Bay open coast is not a valid scaling factor for Huntington Beach mitigation. This scaling fails to account for the fact that wetlands that would be restored for mitigation are not starting from a value of 0 but already have functional value. For the reasons for not doing a HEA, please see the response to Comment **AES-8**.

AES-20: Finally, AES Huntington Beach submitted its 316(b) Proposal for Information Collection to the Santa Ana Regional Water Quality Control Board in July 2005, and is currently preparing the necessary studies to submit the Comprehensive Demonstration Study as soon as possible....A final determination on mitigation for Units 3 and 4, if any is required, should not be made until the legal process is concluded.

Response: The Energy Commission process is separate from the 316(b) process. AES was granted an expedited certification because of emergency energy conditions at the time. Under normal circumstances, the entrainment and impingement study, impacts analysis, and mitigation determination would have been required *before* AES would have been permitted to construct Units 3 and 4. Therefore, the Energy Commission's process already has been delayed much longer than usual.

NOAA FISHERIES

NOAA-1: The only potential impact to 'plant habitat' would be to kelp or other algae, assuming they were present. Since they are not, I would suggest eliminating that specific functional loss from the statement.

Response: Phytoplankton and, probably, algal spores are entrained with water used to cool Units 3 and 4.

NOAA-2: Pete Raimondi is cited as indicating wetland restoration costs range between $20K and $100K per acre. I believe that is on the low end.

Response: The document has been revised to explain that the lower costs are for wetlands where easy fixes are available. The Bolsa Chica costs are added to the range.

SANTA ANA REGIONAL WATER QUALITY CONTROL BOARD

RWQCB-1: AES would like to address mitigation for CEQA under your process and the CWA Section 316b with one proposed mitigation plan that meets both requirements. This may not be possible because AES claims that the CEC only

requires mitigation for impacts to Coastal Fish, while 316b does not make such a distinction. Section 316b may require mitigation for all aquatic life impacts.

Response: The intent of the Energy Commission Condition of Certification was to include aquatic life in general not just fishes. However, the Energy Commission process is different from the 316(b) process. Therefore, mitigation requirements potentially could be different.

RWQCB-2: The AES proposal to claim only 10 acres of impacts and propose 10 acres of mitigation does not adequately mitigate the loss of the millions of aquatic organisms killed by the AES intake every year. AES has not proposed a reasonable alternative to the foregone habitat acreage methodology. Claiming that the killed fish only have a market value of $2000 is not a very scientifically rigorous method, when compared to the method used by the CEC's consultants, because it only places value on commercially fished species and ignores the beneficial uses of all the other species.

Response: The Energy Commission requires mitigation for all of the significant ecosystem losses, not just losses to commercially important fish species.

RWQCB-3: While the CEC can only address environmental impacts caused by the re-powering of 2 units, 316b requires mitigation for the impacts of the existing units as well.

Response: The comment is correct. The Energy Commission can only require mitigation for the impacts of the repowered units.

RWQCB-4: If AES has to mitigate between 192 and 384 acres, and the costs of the mitigation is $100k to $200k per acre, then they will have to spend almost as much as it would cost to replace the once through system with cooling towers. While AES claims the City would not allow them to build these cooling towers, the City must also consider the destruction of aquatic life and balance that impact with aesthetic impacts. Has anyone asked the City?

Response: Because the Energy Commission licensed Units 3 and 4 with once-through cooling, it cannot go back now and require another cooling system. The mitigation specified in the conditions of certification is for habitat restoration to offset significant impacts of once-through cooling. The City does not have permitting jurisdiction over Units 3 and 4.

CALIFORNIA COASTAL COMMISSION - PRE-MEETING COMMENTS

CCC-1: The AFC review for this project did not include the analysis necessary to make findings regarding the feasibility of alternative cooling methods, and that analysis has not been done as part of any more recent review. Absent that analysis, we recommend that statement be deleted from the report and that alternative forms of cooling be kept as part of the potential mitigation options.

Response: The discussion of alternative cooling as a mitigation option has been deleted from the revised analysis.

CCC-2: For any of those restoration options, however, we will need more information about what functions are intended to be restored and more details about the existing habitat, the measures needed to complete the restoration success criteria and the likelihood of success, proposed monitoring measures, etc. Additionally, the mitigation discussion in the report appears to be based more on project costs rather than on ensuring that the mitigation is adequate to replace the ecosystem functions lost due to entrainment. Similar to the issue above, determining a maximum cost for mitigation requires a feasibility study that for this project has not yet been completed, so it is not yet appropriate to establish a mitigation cap based on cost.

Response: A feasibility study with preliminary engineering and costs has been completed for the restoration of the Huntington Beach wetlands. The fact that such a study, which answers questions posed by the CCC in its comments, has been completed is one of the reasons that the Energy Commission staff feels restoration of the Huntington Beach wetlands would be appropriate for the entrainment impacts of Units 3 and 4. For other potential mitigation options, the information is not yet available to determine to what extent potential restoration would address the impacts of cooling Units 3 and 4.

CALIFORNIA COASTAL COMMISSION - POST-MEETING COMMENTS

CCC-3: Regarding alternative cooling methods and feasibility: As noted previously, I recommend the report not weigh in on this issue, as there is insufficient site-specific data on which to develop the necessary analysis.

Response: Please see response to **CCC-1**.

CCC-4: Re: determining "significance" in the entrainment/impingement study: Given the difficulties expressed with defining "significance" on a numerical or statistical basis, I recommend either or both of the following approaches:

- First, if any sensitive species are entrained or impinged, the impacts should be considered significant.
- Second, any impacts to fish that result in non-compliance with applicable l laws and regulations should be considered a significant impact. By definition, non-compliance with a requirement meant to avoid significant impacts is in itself a significant impact.

These policy-based determinations of significance are reasonable and provide more clarity than trying to determine, for instance, that an 11% loss of a species is significant while a 9% loss is not.

Response: Impingement or entrainment of a listed species would be consistent with the significance criteria used. The only marine listed species with larvae is the white abalone. Because of the dearth of rocky habitat in the project area, entrainment of abalone larvae is unlikely. Because abalone larvae were not a target species, if any were entrained, the impact would not appear in the Entrainment and Impingement Study. No listed species were impinged during the one-year impingement and entrainment study. It is possible that a sea turtle could be impinged, but we do not have the information to know if that has ever occurred at Huntington Beach. The Energy

Commission does include an analysis of compliance with laws, ordinances, regulations, and standards (LORS), although it is not a CEQA-mandated threshold of significance. Based on agency comments, mitigation for impingement and entrainment impacts is required to comply with LORS.

CCC-5: Re: definition of "fish": Since the CEC does not have its own definition of "fish" or "coastal fish", I concur with the recommendation to use the DFG definition.

Response: Energy Commission staff concurs with the DFG and CCC recommendation that the word fish in the Conditions of Certification be inclusive to include marine life in general. Impacts to the marine ecosystem and not just the targeted fish species was always the intent of the Energy Commission in drafting this Condition of Certification.

CCC-5: Re: mitigation: It is appropriate to use conservative (i.e., more protective) assumptions in coming up with necessary levels of mitigation, given that the study identifies only some of the likely adverse effects caused by the once-through cooling system. For example, it measures losses of only some of the many species subject to entrainment, and it does not identify any of the cascading effects to the local marine community that may be due to entrainment mortality. One of the appropriate assumptions to use is that mitigation should be no less than 1:1 replacement, as determined using the appropriate ETM and HPF numbers.

Response: For those reasons and also the fact that the mitigation would restore wetlands that already have some functional value, Energy Commission staff believes that the 1:1 habitat restoration mitigation ratio is appropriate.

STATEMENT BY AES HUNTINGTON BEACH, L.L.C (AES 2006)

It should be noted that members of the AES Huntington Beach Generating Station Entrainment and Impingement Study Biological Resources Research Team, including Shane Beck, MBC Applied Environmental Sciences, John Steinbeck, Tenera Environmental, and Paul Hurt, AES Huntington Beach, are in substantial disagreement with the methods and findings of significance reported by the CEC staff. The following concerns were raised but inadequately addressed and/or largely ignored:

- The interpretation of Condition of Certification BIO-5
    - There is insufficient evidence to support the finding of significant impacts to coastal fish or any other habitat. To the contrary, the data supports a finding that coastal fish are not significantly impacted.
    - The Entrainment and Impingement Study was designed to provide the data necessary to make a finding of significant/insignificant impacts to populations of fishes and invertebrates. The results do not support the CEC staff's determination that HBGS once-through cooling impacts are significant due to habitat degradation. The study was not designed to assess habitat degradation and cannot be interpreted to have done so, much less provide the basis for conclusions regarding habitat degradation.
- The criteria used for determining significance stated in BIO-5 are misapplied.

- The levels of entrainment mortality for HBGS were very small (an average of <0.2% with expected rather than maximum cooling water flow) relative to the size of the source water populations used in the calculations. There is no scientific validity to the argument that this level of mortality to larval populations is significant. Much higher levels of CWIS at other facilities have been shown to result in no adverse effects on adult fish populations, and there is no direct evidence from any power plant in California that larval mortality due to CWIS entrainment has resulted in changes in adult fish populations.
- The hypothetical indirect effect of entrainment on the foraging habitat of listed bird species could have been studied as part of this project. It was not. It is inappropriate to use this hypothetical effect as a point of uncertainty to arrive at a finding of significance.
- CEQA requires an analysis of "direct physical change in the environment which is caused by and immediately related to the project." To this end, the CEC should look at the historical operations and a reasonable forecast of our expected run profile over the next 5 years to determine expected impacts.

- The Area of Production Foregone (APF) is misapplied.
  - This approach for scaling restoration projects to help compensate for entrainment mortality has only been applied to estuarine and rocky nearshore reef habitats where the area estimate from APF can be translated into adult habitat. It should not be applied to open coastal habitats where the primary habitat is the water column.

- Demographic modeling estimates were ignored
  - The AEL and FH estimates should be used to put the APF estimates in context. While these estimates could only be calculated for CIQ gobies and northern anchovies, these were the most abundant species found in the source water and represent over 50 percent of the fishes collected.

- The AES Huntington Beach Retool Project has a limited project timeline.
  - The project was only certified for a total of ten years. Typical power plant permits do not have an expiration date, and it is inappropriate, if not arbitrary, to require HBGS to provide the same relative level of mitigation as facilities that will operate three to four times longer than this project. The relatively short duration of the permit must be considered as to any proposed restoration approach.

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BIO-4 The project owner will provide a check for $1,500,000 (One million and five hundred thousand) to the Center for Natural Lands Management to establish the Huntington Beach Generating Station Trust Account to be used to fund the project's impingement, entrainment, and source water sampling studies. The CEC will authorize the project owner's expenditures from the fund for the field study protocol development and implementation (impingement, entrainment and source water sampling), data analysis, draft and final report preparation, and implementation of mitigation measures.

Verification: No later than 30 days prior to the start of commercial operation, the project owner will provide written verification to the CEC CPM that 1) a check for $1,500,000 has been provided to the Center for Natural Lands Management and 2) that the Huntington Beach Generating Station Trust Account has been established. Any unspent funds, plus all accumulated interest, will be returned to the project owner upon completion of the studies.

[With the submittal of the Final Report in April 2005, **BIO-4** was completed.]

BIO-5 If the entrainment and impingement study determines that significant impacts to one or more species of coastal fish is occurring, the project owner will provide funds for mitigation/compensation for impacts to Southern California Bight fish populations. In consultation with the project owner, those funds should be used for such things as tidal wetlands restoration, creation of artificial reefs, or some other form of habitat compensation that is sufficient to fully address the species impacts identified in the final report required by Condition of Certification **BIO-4**, above. The CEC CPM in consultation with the project owner and state, federal and local resource agencies will determine the amount and final application of those funds. When appropriate mitigation is determined, a Memorandum of Understanding (MOU) will be prepared by the project owner and signed with the entity that will receive the compensation funds. The MOU will clearly identify acceptable uses of the funds, including an accounting of how the funds will be spent.

Verification: The CPM will review the draft MOU to ensure the wording is clear, meets the terms of the mitigation, and that it is enforceable. The CPM will ensure the MOU is completed within 120 days of determination of the need for mitigation/compensation. The project owner will provide written verification to the CEC CPM that the mitigation/compensation funds have been paid within 30 days after signing the MOU for the disposition of required compensation funds.

[In approving the project, the Energy Commission adopted findings of overriding considerations to the effect that the benefits of the project outweighed the potential harm to marine life.

Staff was also concerned about the number of adult and juvenile fishes trapped in the forebay of the cooling water intake system and whether there was a feasible method

available to reduce those losses. In response, the Commission imposed the following Condition of Certification.]

BIO-6 The project owner shall conduct a study to determine if there is a feasible methodology that would greatly reduce the number of fishes trapped in the intake forebay. If the study determines that a feasible method(s) exists to reduce the number of fishes trapped in the cooling water system the project owner shall implement those methods.

Verification: The project owner will submit a draft study plan to the CEC CPM and resources agencies within 60 days of the date of certification for review and approval. CEC and resource agency staff will provide comments on the draft study plan, and within 90 days of project certification a CEC and resource agency approved final study plan will be provided to the CEC CPM. The project owner will submit an interim report on the progress of the study within 90 days following commencement of the study.

The project owner will submit a draft report that discusses the results of the study within 45 days following completion of the study and will submit a final report within 3 months of completion of the study. If the study determines that a feasible method(s) exists to greatly reduce fish losses in the intake, the project owner will implement the selected methodology upon CEC Huntington Beach Generating Station Project long-term operation reassessment and/or NPDES permit renewal June 30, 2005, and provide verification to the CEC CPM that the agreed to improvements have been implemented.