Duke Energy Morro Bay LLC

Morro Bay Power Plant

Modernization Project

Habitat Enhancement Program

8/30/2002

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GLOSSARY

AEL	Adult Equivalent Loss
AFB	Aquatic Filter Barrier
BMPWP	Biological Monitoring Work Plan
BTA	Best technology available
CAPE	Coastal Alliance on Plant Expansion
CCC	California Coastal Commission
CCMP	Comprehensive Conservation and Management Plan
CDFG, DFG	California Department of Fish and Game
CDP	Coastal Development Permit
CEC	California Energy Commission
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CG&S	Campbell George & Strong, L.L.P.
COE	US Army Corps of Engineers
CVM	Contingent Valuation Methodology
CWA	Clean Water Act
CWIS	Cooling Water Intake System
DELEP	Delaware Estuary Program
DNREC	Delaware Department of Natural Resources and Environmental Control
DOI, USDOI	United States Department of the Interior
DSAY	Discounted Service Acre Year
EDP	Effective Date of Permit

EEP	Estuary Enhancement Program
EIR	Environmental Information Resources
EPA	The U.S. Environmental Protection Agency
ETM	Empirical Transport Model
FH	Fecundity Hindcasting
FSA	Final Staff Assessment
HCP	Habitat Conservation Plan
HEA	Habitat Equivalency Analysis
HEP	Habitat Enhancement Program
JPA	San Dieguito River Park Join Powers Authority
LDEQ	Louisiana Department of Environmental Quality
LDNR	Louisiana Department of Natural Resources
LDWF	Louisiana Department of Wildlife and Fisheries
LOSCO	Louisiana Oil Spill Coordinators Office
MAC	Monitoring Advisory Committee
MBPP	Morro Bay Power Plant
MDE	Maryland Department of the Environment
MDNR	Maryland Department of Natural Resources
MGD	Million gallons per day
MPAC	Management Plan Advisory Committee
MW	Megawatts
NEP	Morro Bay National Estuary Program
NEPA	National Environmental Policy Act
NGVD	National Geodetic Vertical Datum

NJDEP	New Jersey Department of Environmental Protection
NMFS	National Marines Fishery Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRD	Natural Resources Damage
NRDA	Natural Resource Damage Assessment
OPA	Oil Pollution Act of 1990
PAR	Photosynthetically active radiation
PEPCO	Potomac Electric Power Company
PM	Proportional mortality
PRP	Potentially Responsible Party(s)
PSE&G	Pacific Service Electric and Gas
PSEG	Public Service Energy Group
PWA	Philip Williams and Associates, Ltd.
RCD	Resource Conservation District
RP	Representative Party(s)
CCRWQCB	Central Coast Regional Water Quality Control Board
SAY	Service Acre Year
SCE	Southern California Edison
SONGS	San Onofre Nuclear Generating Station
T & E	Threatened and endangered
TGLO	Texas General Land Office
TMDL	Total Maximum Daily Load
TNC	The Nature Conservancy

TNRCC	Texas Natural Resources Conservation Commission
TPL	Trust for Public Lands
TWG	Technical Working Group
USFWS	United States Fish and Wildlife Service

EXECUTIVE SUMMARY

Duke Energy Morro Bay LLC (Duke) has submitted an Application for Certification to the California Energy Commission (CEC) to modernize the existing Morro Bay Power Plant (MBPP). As part of the modernization Project, Duke intends to replace the existing 1960's-era electric generating units with state-of-the-art combined-cycle units. The Project will greatly increase the efficiency of the existing plant, while significantly reducing its visual and other environmental impacts. Most notably, the existing plant's landmark 450-foot tall stacks will be demolished, and the tank farm and power building will be removed. The modernized plant will be resituated on the site, will have a lower visual profile, and will be set further back from the shoreline. The modernized plant will continue to withdraw cooling water from Morro Bay through the existing cooling water intake structure, and will discharge water, after cooling, to Estero Bay through the existing discharge tunnels.

The Comprehensive Conservation & Management Plan (CCMP) prepared by the National Estuary Program (NEP) for Morro Bay identifies a number of natural and anthropogenic causes that have impacted the quality and quantity of aquatic habitat in the Morro Bay Estuary. The Estuary is a highly altered environment that has supported a wide variety of coastal-dependent uses for over five decades. Significant ecological stressors continue to operate on the Estuary. Sedimentation from upland watersheds, transport of sand from Estero Bay, and degradation of water quality by heavy metals, nutrient loading, and other pollutants are the primary ecological stressors in the bay. There is also an active dredging program in the bay. The CCMP does not attribute any of these impacts to the MBPP.

The plant is subject to the National Pollutant Discharge Elimination System (NPDES) permitting requirements of the Clean Water Act, including the requirement that cooling water intake structures utilize best technology available to minimize entrainment and impingement of aquatic life. This is known as the Section 316(b) or BTA determination. Under applicable federal precedent, alternative cooling technologies whose costs are "wholly disproportionate" to the environmental benefit to be gained, or which would cause other unacceptable non-water quality related impacts, are not considered BTA. In such circumstances, restoration measures may be implemented to offset entrainment and/or impingement effects. On a parallel path, the CEC must make a determination under the Warren-Alquist Act that the modernized plant will comply with all applicable laws, and must conduct an environmental review of the Project pursuant to the requirements of the California Environmental Quality Act (CEQA). Because the modernized plant will use significantly less cooling water than the existing plant, with commensurate reductions in the amount of impingement and entrainment, the Project will not have a significant impact on marine biological resources as defined under CEQA.

This Habitat Enhancement Program (HEP) is proposed to assure compliance with the BTA requirements of the Clean Water Act and as such to address the Central Coast Regional Water Quality Control Board (Regional Board) and CEC requirements related to this statute. The Regional Board and CEC are working collaboratively to assess the HEP presented in this document. It is critical that the Regional Board and the CEC understand that data and modeling limitations and other uncertainties inherent in this process do ***not*** undermine the viability and efficacy of habitat enhancement and restoration programs as a means of offsetting entrainment losses. The U.S. Environmental Protection Agency (EPA) recognizes that, due to data and modeling limitations, as well as the inherent uncertainties associated with habitat enhancement programs and other types of restoration measures, it may be difficult to establish quantitatively that certain restoration measures adequately compensate for entrainment and impingement losses. Nevertheless the EPA continues to support the use of these programs as BTA given the superior ecological benefits that may result from them. In fact, these added benefits are viewed as a principal way of counteracting the inherent uncertainties in this type of project.

CEC staff has stated that it is essential for Duke to provide a single document that summarizes the justification (scientific basis of the approach), goals, objectives, model, model parameters, decision tree, and monitoring and evaluation endpoints for the HEP. Accordingly, the purpose of this submittal is to pull together and supplement all of Duke's earlier discussions into a comprehensive presentation that clearly explains the proposed habitat enhancement measures, the scientific rationale for these measures, and how they will offset entrainment mortality associated with the modernized plant.

Although Duke believes that the modernized plant, as designed, represents BTA, it has committed to the funding of this HEP in order to provide the Regional Board, the CEC, and other interested stakeholders with assurance that the entrainment effects of the modernized plant are offset. The HEP addresses entrainment effects only, as impingement effects have been determined by the Technical Working Group and Regional Board staff to be insignificant. The principal objectives of the HEP are to:

1. Offset and minimize the effects of entrainment of the modernized plant.

2. Improve the quality and quantity of aquatic habitat in Morro Bay.

3. Reduce sediment transport into Morro Bay.

4. Complement ongoing bay protection and enhancement programs overseen by the Regional Board, the NEP, and the Army Corps of Engineers (COE).

The HEP consists of a series of integrated actions and project design features (designated as NPDES building blocks) that will offset the entrainment effects of the modernized MBPP and provide additional ecological benefits and services that will enhance the quality and quantity of habitat in the Morro Bay Estuary. These include:

- A variety of technical upgrades to plant equipment.

- Acceptance of permit limits restricting flow.

- Identification, analysis, and funding of a set of representative habitat enhancement projects in Morro Bay and the upland watersheds of Los Osos and

Chorro Creeks. Total HEP funding in the amount of $12.5 million will be paid in accordance with the schedule set forth herein.

- Further study of the emerging AFB technology to minimize or avoid entrainment.

- Incorporation of various safety factors and credit considerations.

Duke and Regional Board staff concur that implementation of a habitat enhancement program in Morro Bay will provide greater ecological benefits to the bay than closed-cycle cooling.

The program has been developed in consideration of the Regional Board's methodology for assessing entrainment effects and mitigation requirements, and has been validated using scientific models developed by the National Oceanic & Atmospheric Administration (NOAA) and used by governmental resource agencies for many years. Most notably, the methodologies employed by the Regional Board and Duke yield comparable results when adjusted for the relative productivity of the different habitat types found in the Morro Bay Estuary. Further, the HEP has been conservatively designed to provide a high level of assurance, or safety margin, that the required level of ecological benefits will occur. This safety margin is comprised of a number of safety factors and credit considerations relating to reductions in water usage, use of conservative assumptions to assess entrainment losses and offsets, conservative cost estimates, potential for leveraged funds, and others.

The success of the HEP will be measured by a combination of project-level success factors and global performance metrics. Project-level success factors include specific performance criteria and monitoring requirements that will be developed during the design and planning stage of a particular project, when the detailed information needed to complete these tasks is available. General parameters for the development of these performance measures, however, are described in this document. The global performance metrics include the collective success of the individual projects and the extent to which the HEP is able to achieves synergies with ongoing programs of the Regional Board, the NEP, the COE, and others.

Finally, Duke is proposing that the HEP be administered through a non-profit organization that would function through an Executive Board consisting of representatives of the Regional Board, the CEC, the NEP, the City of Morro Bay, and other selected agencies. The Regional Board would serve as Chair of the Executive Board. Duke and other members of the public would have an advisory role in the process. Duke will provide full control over the HEP funds to the Regional Board, with the expectation that the funds will be used to implement the representative projects discussed in this proposal (projects that have been demonstrated to offset power plant entrainment effects) or comparable projects of the agencies' choosing.

This document covers following:

- Revised NPDES building blocks that collectively constitute Duke's HEP.
- The goals and objectives of the HEP program.
- The basic parameters or design criteria of the HEP and the scientific methodologies used to validate the HEP benefits.
- Monitoring programs that will be developed to demonstrate the success of individual habitat enhancement projects, as well as a baseline monitoring program for Morro Bay.
- Funding levels, timing of release of funds, and potential for leveraging of HEP funds.
- The criteria, or performance metrics, against which the HEP as a whole will be judged.
- Other related issues including the conservative design of the program, the factors contributing to the safety margin, and governance.

SECTION 1: OVERVIEW

1.1 Project Overview

Duke Energy Morro Bay LLC (Duke) has submitted an Application for Certification to the California Energy Commission for modernization of its power plant in Morro Bay, California (Project). The Morro Bay Power Plant (MBPP) is located 14 miles northwest of San Luis Obispo, California, in San Luis Obispo County in the City of Morro Bay. MBPP is situated west of Highway 1, near Morro Bay Harbor and east of Estero Bay. The plant withdraws cooling water from Morro Bay, and discharges the water, after cooling, to Estero Bay pursuant to a National Pollutant Discharge Elimination System (NPDES) permit issued by the Central Coast Regional Water Quality Control Board (Regional Board) under the federal Clean Water Act. Land uses in the vicinity of the plant include light industry, commercial operations, and marine, recreational, and residential uses. The majority of the MBPP site is developed with roads, buildings, storage tanks, and other plant structures, and has been in industrial use for the generation of electrical power for almost 50 years. Prior to construction of the existing plant, the site was used as a U.S. Navy base.

The Project involves the modernization of electric generating facilities that have been in near continuous service for over 50 years. The Project is designed as a modernization project, rather than a green fields project, in order to optimize the use of the existing power plant and appurtenant structures, including the cooling water intake and outfall structures, existing transmission lines, and utilities. The Project also involves the replacement of the four existing 1960's era generating units with two new, state-of-the-art, natural gas-fired, combined-cycle units. Due to the increased efficiency of the new units, the generating capacity of the plant will slightly increase from 1002 MW to 1200 MW. The existing fuel oil storage tank farm, the three 450-foot tall stacks, and the existing power building will be demolished. The modernized plant will thus have a lower profile, will be set back farther from the shoreline, and will be oriented differently on the site. These improvements in design and siting, coupled with the demolition of existing structures, will yield significant improvements in the overall appearance of the plant and will significantly reduce its visual impact on the surrounding community. In addition, due to the increased efficiency of the modernized plant, actual cooling water usage will be reduced by at least 20% when compared to the maximum design flow of the existing plant.[1]

The proposed modernization will include two power blocks, each consisting of two gas turbines and one steam turbine, for a total of four gas turbines and two steam turbines. The steam that is created in the steam cycle and that powers the steam turbines circulates in a closed system that includes a condensing cycle. Water is withdrawn from Morro Bay in an open system and is passed through the condenser to cool the steam in the closed system.

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[1] As a result of lower pumping capabilities and permit conditions that will limit water usage, the maximum possible daily water usage will be reduced by 29% and the maximum possible annual daily average water usage will be reduced by 45%. The actual water usage is projected to decrease from the most recent five-year (1997-2001) average of 437 MGD by 25% or more, to 328 MGD or less.

Heated water is then returned to Estero Bay. The modernized plant will be capable of withdrawing 475 MGD at full output, but based on air permit limitations, the maximum annual weighted daily average flow will be limited to 413 MGD.[2] Duke has further proposed an NPDES permit limitation of 370 MGD as an annual average daily limit. The current facility's withdrawal at full output is 668 MGD.

As demonstrated by both specific election results and official statements of City representatives, the City of Morro Bay and local residents are supportive of the modernization Project. Local land use policies and plans encourage on-site development, particularly in the case of the MBPP. The plant qualifies as a "coastal dependent facility" under the California Coastal Act because it requires access to seawater for cooling purposes. The Coastal Act recognizes expansion of coastal-dependent, electrical generating facilities as a preferred land use, provided certain conditions are met. The modernized plant will serve as a major source of employment and revenue for the City, and will produce more electricity more efficiently and more cleanly, with greatly reduced visual and environmental impacts, when compared to the existing plant.

1.2 Ecological Context of Project

Morro Bay is a highly altered ecosystem which has deteriorated over the past century due to a number of natural and anthropogenic factors that have caused historical changes in its habitats and water circulation patterns. The bay is a shallow, seasonally hyper-saline, bar-built estuary situated behind a barrier sandspit formed by littoral transport from the vicinity of Pt. Buchon. The total surface area of Morro Bay is approximately 2,300 acres (3.3 square miles), with much of the bay being intertidal in nature. Like most estuaries, Morro Bay is a transient feature in geological terms, and its physical form and ecosystem function are especially vulnerable to sedimentation from tributary creeks and migration of the sandspit, resulting in the gradual infilling of the bay and loss of habitat. The primary freshwater sources to Morro Bay (Chorro and Los Osos Creeks) enter at the middle of the bay, and the backbay areas are typified by weak tidal currents and long flushing times. Large volumes of sediment are carried into Morro Bay from the Chorro and Los Osos watersheds and accumulate in the delta areas due to the lack of net fluvial flows.

Morro Bay has been designated a State and National Estuary and became part of the National Estuary Program (NEP) in 1995. The purpose of the NEP is to identify, restore, and protect nationally significant estuaries of the United States. The NEP has prepared a Comprehensive Conservation and Management Plan (CCMP) for the Estuary that identifies sedimentation as the primary ecological stressor affecting the bay.[3] Duke's Habitat Enhancement Program (HEP) identifies a number of representative projects and other mitigation measures to offset entrainment effects of the modernized plant. While this is its primary purpose, successful implementation of the HEP will complement the purposes of the

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[2] This represents Duke's best effort to define the baseline for the modernized plant. This figure tracks the flow rate used in Duke's 316(b) assessment report and is consistent with the value used by Regional Board staff and the TWG.

[3] NEP (July 2002).

Morro Bay NEP, and support implementation of some of the action items identified in the CCMP.

1.3 Best Technology Available

While NPDES permits focus primarily on discharges to the waters of the United States, section 316(b) of the Clean Water Act imposes additional requirements on facilities that utilize cooling water intake structures. Specifically, section 316(b) requires that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available (BTA) for minimizing adverse environmental impact, i.e., entrainment and impingement. The U.S. Environmental Protection Agency (EPA) and case law interpreting section 316(b) have long interpreted this statutory requirement to require consideration of both technological and economic feasibility, as well as non-water quality-related impacts, of alternative technologies in determining BTA for a given facility. Alternatives whose costs are "wholly disproportionate" to the environmental benefits to be gained, or whose non-water quality-related impacts cannot adequately be addressed, are considered "infeasible" or "not available" and thus do not qualify as BTA. In such cases, EPA has allowed facility operators to satisfy BTA requirements by implementing habitat restoration programs that offset entrainment and impingement losses. EPA is also strengthening the role of HEP in its proposed new rule for existing facilities. The most notable example of the use of restoration measures to satisfy BTA requirements is the PSE&G Salem Nuclear Generating Station on Delaware bay. This and other examples are discussed in more detail in Appendix A.

BTA determinations are site-specific; what is considered feasible at one facility may not be feasible at another. The administrative record in this proceeding demonstrates unequivocally that the alternative cooling methods recommended by CEC staff in the Final Staff Assessment (FSA) (dry cooling and hybrid cooling) are not feasible for the MBPP modernization Project. Consequently, they do not qualify as BTA.

In issuing past NPDES permits for the existing MBPP, the Regional Board has found that the plant's cooling water intake structure represents BTA. Even though the cooling water intake structure will continue to be used and the modernized plant will use less water, these prior BTA determinations must be revisited in conjunction with issuance of an NPDES permit for the modernized plant. As discussed throughout this proceeding, Duke believes that the modernized plant, as designed, with its lower-capacity pumps, significantly reduced water usage, and other improved design features, represents BTA. Pursuant to its authority under the Clean Water Act, the Regional Board has the primary responsibility to determine whether the modernized plant will satisfy BTA requirements. As of the date of this submittal, the Regional Board has not made a determination regarding BTA. However, at its meeting on May 30, 2002, the Regional Board instructed its staff to prepare a draft NPDES permit for the modernized plant in which BTA requirements would be addressed through a HEP.

Whether or not the Regional Board ultimately agrees with Duke that the plant as designed is BTA, Duke recognizes the desirability of minimizing environmental impacts associated with the operation of the cooling water intake structure to the extent reasonably possible. To that end, Duke is willing, on a voluntary basis,[4] to design and fund a HEP. Implementation of the HEP will offset any potential effects of entrainment on aquatic species, and in the words of Regional Board staff:

> *"[T]he watershed and Estuary would realize a greater long-term benefit through habitat enhancement [than through implementation of other cooling alternatives]."* Regional Board Staff Report, p. 2, dated May 9, 2002

The outline and basic methodology of the HEP have been described in a number of previous submittals to the Regional Board and the CEC. Given that the MBPP modernization Project will not have a significant environmental impact on marine biological resources, as defined under the California Environmental Quality Act (CEQA), there is no basis under that law for requiring a HEP or other mitigation. Accordingly, the appropriate criteria for design of the HEP lie principally within the ambit of the Clean Water Act guidelines as administered by the Regional Board. The CEC has a substantial role in the review process to ensure compliance with LORS, but that role is more generalized than the Regional Board's role.

As requested by the June 27, 2002 Scheduling Order, the purpose of this submittal is to pull together and supplement all of Duke's earlier discussions into a comprehensive presentation that clearly explains the proposed habitat enhancement measures, the scientific rationale for these measures, and how they will offset entrainment mortality associated with the modernized plant.[5] Monitoring programs will be specifically designed to measure the success of the selected mitigation measures and will be developed in conjunction with each project in accordance with the general principles outlined in Section 3.1. This submittal also addresses the administrative elements of the HEP relating to funding and governance.

1.4 Key HEP Design Considerations

In its June 27, 2002 Scheduling Order, the CEC Committee identified a number of factors which it believes should be included in an adequate HEP proposal. These include:

1. A description of the HEP, which must be adequate to actually compensate for the environmental impact, if feasible, and which satisfies nexus and proportionality requirements.

2. Identification of the goals and objectives to be achieved by the HEP.

3. Performance standards for accomplishing the goals and objectives.

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4 Consistent with the Regional Board's authority under the Porter Cologne Water Quality Act and the Clean Water Act, this submittal is being made on a voluntary basis. Assuming Regional Board approves the HEP, Duke understands that it will be incorporated in the operative provisions of the NPDES permit for the modernized plant, and that Duke will be legally obligated to provide the HEP funding described herein.

5 The TWG found that impingement impacts of the modernized plant are not significant. As such, impingement does not rise to the level of an "adverse environmental impact" under the Clean Water Act and no mitigation is required.

4. Identification of how the HEP will be enforced through permit conditions or other measures.

5. A reporting and monitoring program to ensure that the specific elements of the HEP are met.

6. Contingency plans that may be implemented if performance standards are not met.

7. Substantiated cost estimates and an enforceable payment schedule.

As can be seen from a review of Duke's May 1, 2002 letter to the Regional Board and the CEC, Duke and the Committee share a similar perspective on the basic components of a habitat enhancement program. To facilitate the Regional Board's and the Committee's review of this submittal, we have created Table 1 below, which cross-references the CEC's HEP factors with appropriate sections of this report.

Table 1: Cross Reference of CEC HEP Factors

CEC Factor	Section Number(s)
1. Compensation for environmental impact; nexus to project impacts	1.4, 1.5, 3.2, 4.0, 5.0, Appendices A, D, E and F
2. Goals and objectives	1.4, 1.5, 3.1, 3.3, 3.4, 3.5
3. Performance standards	2.0, 3.5, Appendix C
4. Enforcement	1.4, 7.4, 8.0
5. Reporting and monitoring	3.3.3, 3.3.4, 8.2.4, 8.2.5, Appendix B
6. Contingency plans	3.4, 3.6
7. Cost estimates and payment schedule	1.5, 7.0

The HEP addresses many additional issues besides those identified by the CEC. Duke believes that this document, in conjunction with the testimony, the Data Responses, and the existing record, satisfies the CEC Scheduling Order and Duke's own stated program design considerations.

Because the HEP is submitted to address the BTA requirements of the Clean Water Act, Duke believes the CEC should, and may properly, defer to the Regional Board's technical expertise on the detailed aspects of the HEP. Assuming the HEP proposal is accepted by the Regional Board, Duke anticipates that it will be incorporated by reference into, and made an enforceable provision of, the NPDES permit for the modernized plant. Similarly, the CEC's conditions of certification would require that Duke comply with all provisions of the NPDES permit, including those relating to the HEP.

1.5 NPDES Building Blocks

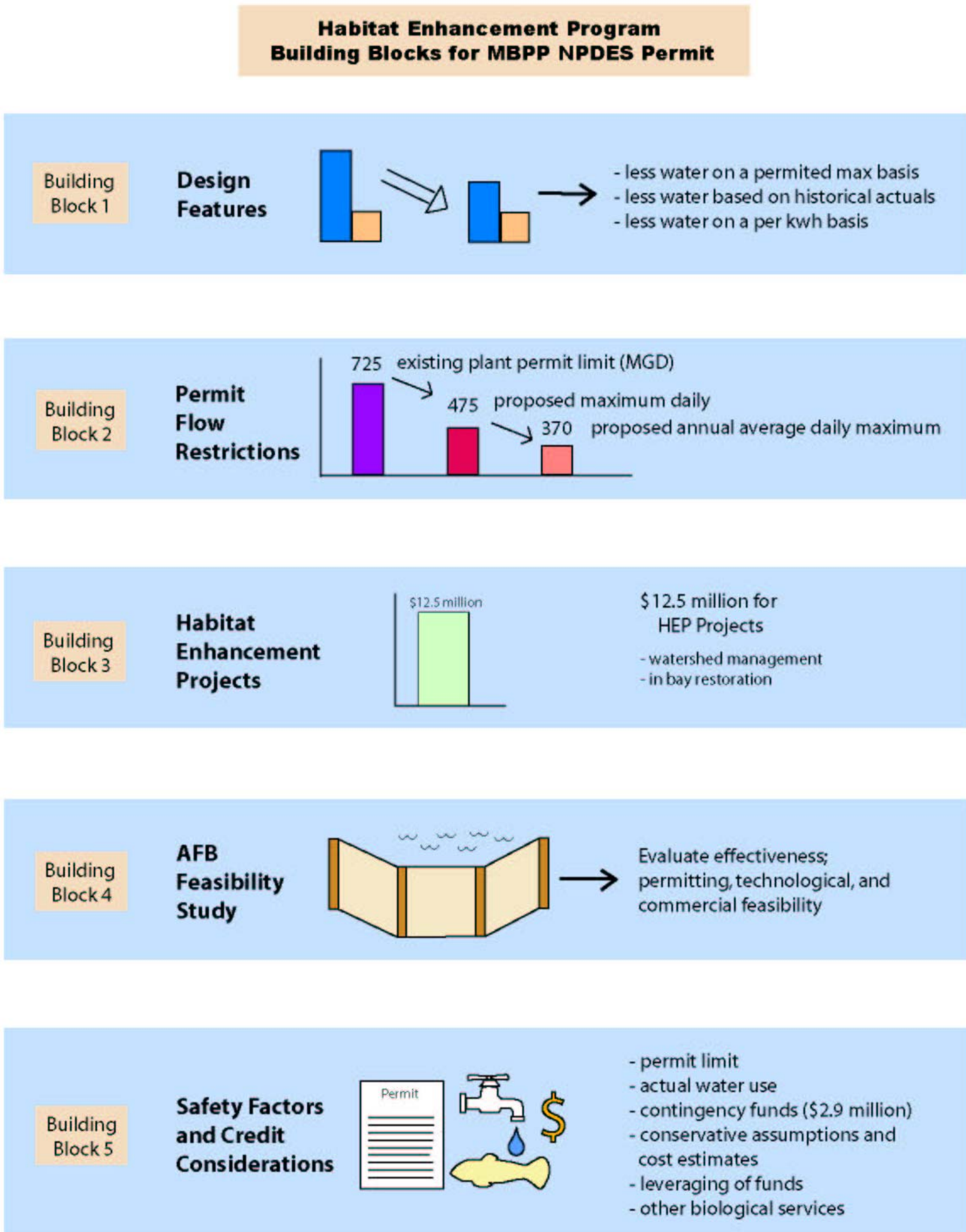
The BTA determination for the MBPP involves several components built around the HEP. These "building blocks" were originally outlined in Attachment A to Duke's May 23, 2002 letter to the Regional Board, and have been further refined as Duke's work on the proposal has evolved. As depicted in Figure 1, the Project building blocks are now configured as follows:

- **1** Block #1: Design features of the modernized plant
- **2** Block #2: Permit flow restrictions
- **3** Block #3: Implementation of representative habitat enhancement projects
- **4** Block #4: Aquatic Filter Barrier (AFB) feasibility study
- **5** Block #5: Safety factors and credit considerations

Duke has made several modifications to the proposed building blocks. Funding provisions have been clarified and incorporated into building block #3, eliminating the need for a separate building block addressing supplemental HEP funding. Also, previous building block #6 (actual flow-related adjustments) has been enlarged into a broader concept called "Safety Factors and Credit Considerations" that explain the conservative nature of Duke's HEP.

The NPDES building blocks function as an integrated collection of mitigation measures and are directly tied to overall program goals and performance measures. While building block #3 (implementation of representative habitat enhancement projects) represents the core of the program, the other building blocks have a direct and material role in reducing entrainment impacts and factor into overall program performance. *In reviewing this proposal, it is important to understand that the HEP includes all of the NPDES building blocks, not just the habitat enhancement projects.*

Figure 1: Building Blocks



Block #1: Design features of the modernized plant

The modernized plant will be capable of withdrawing 475 MGD at full output. However, based on limitations contained in the modernized plant's air permit, the annual average daily flow is effectively limited to 413 MGD. Duke has further proposed an NPDES permit limitation of 370 MGD as an average daily limit, thus further reducing the plant's water usage rate. The current facility's withdrawal at full output is 668 MGD.

The modernized plant will have new lower-capacity pumps and control systems, will be more efficient than the existing facility, and will reduce maximum permitted flows, total actual flows, and flows on a "per kWhr basis." In addition, the pumps can be operated individually such that intake flow will be variable with plant output to a greater degree than at the existing facility.

The ability to operate the new combined-cycle plants with lower-capacity pumps and reduced cooling water flows at less than maximum loads will significantly reduce the intake structure approach velocities. Thermal loads will also decrease since, in a combined-cycle plant, only a portion of the total electricity generated is produced in the steam cycle. The cooling water flow rates and heat loads for the new plant will be dramatically reduced as compared to the 100% steam cycle design of the existing units. All of these changes will provide water quality improvement in the Morro Bay Estuary and in Estero Bay.

By itself, the increased efficiency of the modernized plant will yield substantial reductions in entrainment, especially when viewed on a per kWhr basis and when compared to total entrainment associated with the existing facility.

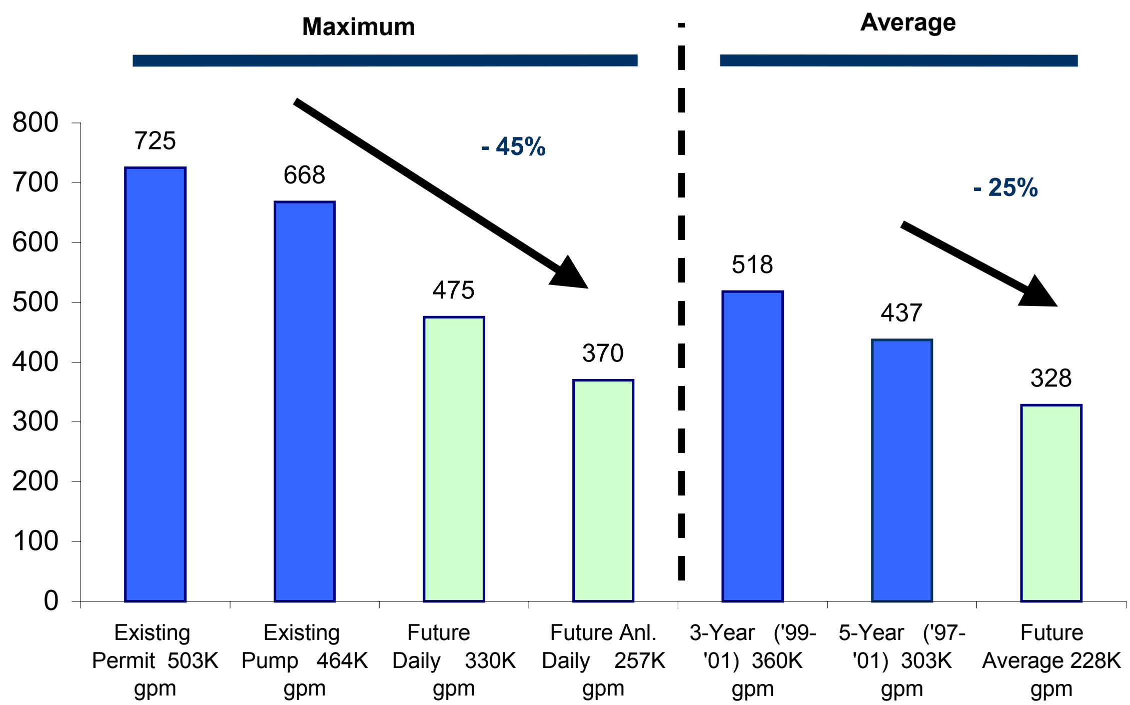
Block #2: Permit flow restrictions

As noted above, Duke has voluntarily agreed to accept a permit limitation that will restrict maximum daily and annual daily average flows to 475 MGD and 370 MGD, respectively. This reduces the maximum possible daily flow rate by 29%, and the maximum possible annual daily average flow rate by 45%, as compared to maximum possible cooling water usage for the existing plant.[6] Figure 2 compares the maximum and average cooling water usages of the existing plant and those of the modernized plant.

For the purposes of evaluating the effectiveness of the HEP, "baseline" entrainment has been established based on the assumed maximum average daily flows of 413 MGD in the 316(b) report. Use of this baseline assumption represents the first major element of conservatism (or safety factor) in the HEP, given that the modernized plant will be limited to a maximum annual daily average flow rate of 370 MGD and actual (vs. permitted) flows are expected to be even less (approximately 328 MGD or less). The 413 MGD baseline is slightly lower than the flow rate used by the TWG (427 MGD) to assess entrainment, the latter having been based on then anticipated air permit limitations for the modernized plant.

6 Existing pump capacity (668 MGD) compared to new pump capacity (475 MGD) equals a 29% reduction. Existing pump capacity (668 MGD) compared to new annual daily average limit (370 MGD) equals 45% reduction.

Figure 2: Morro Bay Power Plant Flow Comparisons (MGD)[7]



In accordance with EPA's guidance on 316(b) assessment reports and as agreed by Duke and the TWG, larval entrainment is assumed to be proportional to water usage. Reduction in water usage will therefore result in a commensurate reduction in the number of larvae entrained by the plant. Using any reasonable historical water use comparison, these permit limits ensure that there are no CEQA-based marine biology impacts. However, because the water use comparisons have been the subject of considerable debate, Duke voluntarily agreed to accept an annual daily average flow limit of 370 MGD to eliminate questions over the existence of significant impacts under CEQA. Because the entrainment calculations were based on an anticipated 413 MGD average daily flow limit, the 370 MGD permit flow restriction yields an immediate 10% reduction in entrainment for purposes of HEP targets and performance evaluation.

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7 This Figure was originally presented as Exhibit 186 in the March 13, 2002 Soil and Water hearings, and has been updated to reflect the NPDES permit limit Duke has agreed to accept.

Block #3: Habitat enhancement projects

<u>Representative Projects</u>

In addition to the improvements in plant design and operation, Duke's HEP includes a set of representative habitat enhancement projects that, upon implementation, will offset entrainment associated with continued use of once-through cooling at the MBPP and improve the overall quality and quantity of specific aquatic habitats in the Morro Bay Estuary. The species that are entrained by the plant are not limited by the number of larvae available, but rather by the quality and quantity of habitat available for their settlement, recruitment, and survival as adults. Thus, projects that restore or enhance habitat will be the most ecologically effective mitigation for any impacts to larvae in Morro Bay when compared to alternatives including closed-cycle cooling. It should be noted that installation of dry cooling would provide none of the ecological benefits offered through Duke's voluntary HEP. With dry cooling, cessation of entrainment would be the only benefit to be gained. Since the entrained species are not constrained by larval production in the first place, the ecological "scorecard" for dry cooling pales in comparison to the HEP.

Habitat enhancement projects include those projects that will result in the preservation of existing habitat, or the restoration or enhancement of existing habitat. Duke agrees that the specific habitat enhancement projects that are selected must have a clear and reasonable nexus (i.e., offset) to the entrainment effects of the power plant. At the suggestion of the Regional Board staff, and with their cooperation, Duke is proposing a variety of projects that fall into two basic categories:

a) Projects that restore in-bay habitat directly, and

b) Projects that preserve in-bay habitat through watershed management.

For example, Duke is proposing representative projects that involve of the removal of accumulated sediment in Chorro delta that can be delineated by the invasion of hoary cress, a type of uplands transitional vegetation, thus restoring the area to a coastal salt marsh. This is an example of a direct in-bay restoration project and the creation of additional habitat that will increase the bay's biological productivity. Other projects involve watershed management that reduces in-bay sedimentation and thus preserves existing in-bay habitat. Because entrainment represents a loss of biological production (biomass) in Morro Bay, projects that preserve existing habitat through reduction of sedimentation in the bay will extend the life of the bay and thereby preserve its existing biological productivity. Thus, while the power plant does not contribute to sediment buildup in the bay, controlling, removing, and/or reducing the amount of sediment that finds its way into the bay, and thus preserving and/or improving habitat, provides a legitimate means of addressing any entrainment effects of the plant.

A more detailed discussion of these general project categories is included in Section 3.3.1 of this submittal. Representative projects are described in Section 5. The "value" of the ecological services or benefits that will result from implementation of these restoration projects has been assessed using the Habitat Equivalency Analysis (HEA) model originally developed by the NOAA in the 1990's and utilized and refined since then by resource agencies in a variety of contexts. Application of the HEA model to Duke's HEP demonstrates that the ecological "credits" that will accrue far outweigh the ecological "debits" caused by entrainment. A detailed explanation of the HEA model and its application to Morro Bay is presented in Section 4.

HEP Funding

Duke has revised its funding proposal based on an evaluation of the estimated costs of the representative projects discussed in Section 5. Duke has also revised the building blocks by subsuming "additional HEP funding" within the guaranteed funding level.

Duke will contribute a total of $12.5 million in HEP funding. This funding is guaranteed and is based on the cost (using highly conservative assumptions) of implementing the representative (or equivalent) projects, plus an amount to provide an additional margin of safety for program performance. The amount necessary to implement the set of representative projects is $9.7 million. The additional amount for the safety margin is $2.8 million, for a total of $12.5 million.

Based on the HEA presented in Section 4 of this submittal, Duke is confident that the entrainment effects of MBPP can be addressed with this level of funding. The initial funds ($9.7 million) will be contributed in accordance with the following schedule: 25% when the foundations for the modernized plant are poured; 50% upon commencement of commercial operations; and 25% two years after commencement of commercial operations. The remaining funds ($2.8 million) would be contributed, on an as-needed basis as determined by the Regional Board, beginning five years after the first disbursement of initial funding. As discussed in Section 8.2, a non-profit entity will be established to administer the HEP. Funding and governance are discussed in detail in Sections 7 and 8 of this submittal.

The total funding package of $12.5 million will provide significant benefit to the Regional Board's total maximum daily load (TMDL) programs and the NEP's CCMP for Morro Bay because of the synergies that exist between the HEP and these programs. Moreover, the funding will enable additional funding to be secured through matching grants and similar programs, thus greatly multiplying the effects of Duke's contribution. A leverage factor of 3 to 5 times is not unreasonable based on precedent. Were this the case here, Duke's $12.5 million could generate as much as $38 to $63 million in additional funding. Leveraging of funds is discussed in more detail in Section 7.7.

Block #4: Aquatic Filter Barrier (AFB) feasibility study

As part of the HEP, Duke intends to study the feasibility of installing a pilot-scale AFB in Morro Bay near the MBPP's intake structure. An AFB is a form of physical barrier (usually a fine mat or mesh) which essentially prevents larval (as well as larger) forms of marine life from being drawn into the cooling water intake structure. The feasibility study will include:

1. A review of AFB technology as applied in Morro Bay.
2. An analysis of the commercial requirements and economic viability for such a project (e.g., local land use entitlements).
3. An evaluation of the governmental permits that would need to be obtained, including the timing and complexity of those permit processes.

As explained in Duke's July 1, 2002 submittal to the CEC, the AFB building block will ***not*** involve any physical construction activities in the water body, nor does it require any regulatory or other local government approvals. Duke is interested in AFB technology because it has the potential to enhance the "avoidance" aspects of its overall "BTA package," and has shown considerable promise at other power plant sites around the country. However, the feasibility of deploying this technology successfully at MBPP has not been adequately demonstrated, and Duke is not seeking any conditions of certification approving or relating to the physical installation of a pilot-scale AFB at this time. Upon completion of the feasibility study, Duke will determine whether to initiate a permitting process for a pilot-scale AFB, and will consult with the Regional Board, the COE, the CEC and other resource and regulatory agencies as appropriate.

While Duke's proposed AFB study does not involve any physical construction activities in the water body, Duke continues to advance the AFB as a part of the NPDES framework because of the potential for this technology to be an effective means of reducing entrainment over the medium to long term. Were the AFB to be permitted, Duke proposes that its effectiveness in reducing entrainment be considered a credit mechanism in the overall program performance evaluation, but it would not lower Duke's financial commitment of $12.5 million for the HEP. The AFB credit mechanism is similar to the credit mechanism proposed for actual reductions in water, both of which will achieve corresponding reductions in entrainment. See discussion under building block #5 below.

Block #5: Safety factors and credit considerations

In designing the HEP, Duke incorporated many built-in safety factors and credit considerations.[8] Similarly, the HEA model demonstrates through well-accepted scientific principles that the ecological benefits or "services" that will flow from the HEP are much greater than what is required to offset power plant entrainment, whether entrainment is pegged at 17%-33% (as calculated by Regional Board staff) or at less than 10% (as calculated by Duke). See Section 4 for a full description of the HEA model.

The inherent conservatism of the HEP and adequacy of the funding level established by Duke are reflected in the following considerations:

- Duke has designed the HEP with a set of representative projects that will offset the entrainment effects of the power plant as considered against the entrainment levels associated with the 413 MGD flow level. This flow level is the basis of the Regional Board staff's analysis of entrainment levels.
- The HEP is based on entrainment levels consistent with the Regional Board staff's estimate of PM ranging from 17% to 33%.[9]
- Duke is proposing a voluntary flow restriction of 370 MGD that reduces entrainment by 10%, as measured against the 413 MGD baseline.
- Actual water usage will be measured over time, and will most likely be well under 370 MGD; this will further reduce entrainment.[10]
- The initial project funding ($9.7 million) is based on conservative engineering estimates that have effectively doubled the expected cost of implementation.
- Duke's total funding of $12.5 million includes a 30% funding reserve ($2.8 million) to be used to provide additional funds, if necessary, to complete the original projects or to initiate new projects.
- Duke's funding can be leveraged to obtain additional funding which can be used to further implement programs that improve the quality and quantity of habitat in the bay.

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8 As explained by Duke's experts during the evidentiary hearings on marine biology, the entrainment effects of MBPP are not ecologically significant, and the number of larvae entrained by the plant does not impair the productivity (defined in ecological terms as reproductive capacity) of these species.

9 The conservatism of the Regional Board's proportional mortality calculation lies in the fact that it does not account for advective losses that naturally occur irrespective of the power plant and because it assumes 100% mortality of larvae passing through the cooling water intake structure (CWIS). A detailed discussion of this issue is contained in Section 3.4.

10 The required level of entrainment reduction may properly be based on actual water use, given that 316(b) evaluations assume that entrainment is proportional to the level of water use.

- Duke may elect to proceed with the AFB if it proves feasible; the deployment of this system would further reduce entrainment.

All of these factors add up to a substantial safety margin which must be taken into account when evaluating the overall adequacy of the HEP. Thus, Duke is proposing that it receive "performance credits" for reductions in entrainment attributable to these measures. A more detailed discussion of safety factors and credit considerations can be found in Section 3.4.

1.6 Continuing Roles of the Regional Board and the CEC

This submittal represents the culmination of over a year's work to develop a HEP that meets the needs of Regional Board and CEC and other interested resource agencies and stakeholders. The development of the HEP has been an iterative process, and the proposal has been revised and refined over the course of the last year to take into account feedback received from Regional Board members and staff, the CEC Committee and staff, other agency staff, the public, Duke's own evolving understanding of the issues, and the realities of Project financing and schedule. This submittal provides as much detail as possible at this stage of the proceeding to facilitate the Regional Board's and CEC Committee's understanding of and confidence in the HEP, and provides an adequate record for decision makers.

The Regional Board and CEC will have important ongoing roles to play in accomplishing the following:

- Planning and designing the implementation of the representative projects identified in Section 5 or other projects that will provide comparable benefits.

- Refining the governance structure and other administrative aspects of the program.

- Overseeing actual project implementation.

- Tracking the performance of these projects over time.

- Seeking opportunities for coordination with other existing bay protection and enhancement programs.

SECTION 2: LEGAL FRAMEWORK

2.1 Clean Water Act Section 316(b)

2.1.1 Best Technology Available for Minimizing Adverse Environmental Impact

Clean Water Act section 316(b) requires that the location, design, construction and capacity of cooling water intake structures reflect "the best technology available for minimizing adverse environmental impact." The starting point in any BTA analysis is whether the cooling water intake structure at a particular facility is causing an "adverse environmental impact". If not, the cooling water system can be said to represent BTA as presently designed and operated, and no upgrades or other modifications are necessary. If the permitting agency believes that the cooling water intake structure is causing an adverse environmental impact, the analysis must proceed to the next stage, i.e., whether the facility is using best technology available to minimize these impacts.

Under section 316(b), "adverse environmental impact" has principally been considered to be that which results from impingement and entrainment of fish and shellfish. Marine plant life and other aquatic organisms present in the water column have not generally been considered in this evaluation. Generally speaking, adverse environmental impact determinations are made on a case-by-case basis using best professional judgment, and are based on the magnitude of impingement and entrainment that is occurring. Factors relevant to this consideration include the absolute number of organisms lost, percentage (or proportional) losses, population level impacts, ecosystem level impacts, and losses of threatened, endangered, recreational, or commercially important species. The magnitude of impact is evaluated independently, without reference to an existing baseline. In this case, Regional Board staff and the Regional Board's independent scientist believe that once-through cooling by the modernized MBPP will result in 17%-33% proportional mortality of entrained bay species, and that this level of entrainment is significant.[11] Impingement levels are not considered to be significant.

EPA has long interpreted section 316(b) to require consideration of both technological and economic feasibility, as well as non-water quality-related impacts, in determining BTA for a given facility. Alternatives whose costs are "wholly disproportionate" to the environmental benefits to be gained, or whose non-water quality-related impacts cannot adequately be addressed, are considered "infeasible" or "not available" and thus do not qualify as BTA.[12] The kinds of non-water quality-related factors that are required to be

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[11] Based on the opinions of its biological experts and other available public information, Duke continues to believe that the MBPP (including the existing plant) is not causing an "adverse environmental impact" as that term is used in section 316(b). Duke continues to believe that this term requires evidence of at least localized population-level impacts caused by impingement or entrainment. The NEP's CCMP for the Morro Bay Estuary identifies a number of factors that are adversely affecting the Estuary, including sedimentation, nutrients, and heavy metals, and does not even mention the power plant as a stressor in the estuary.

[12] Development Document for Best Technology Available for the Location, Design, Construction and Capacity of Cooling Water Intake Structures for Minimizing Adverse Entrainment Impacts (EPA 1996); Hudson Riverkeeper Fund v. Orange & Rockland Utils. (835 F. Supp. 160 (S.D.N.Y. 1993)).

considered include air quality, noise, visual impacts, compatibility with local land uses, constructability, and energy requirements. BTA determinations are site-specific, and what may be feasible for one facility may not be feasible for another facility. The administrative record in this case demonstrates unequivocally that the alternative cooling methods recommended by CEC staff in the FSA (dry cooling and hybrid cooling) are not feasible for the Morro Bay Project.

2.1.2 Role of Restoration Measures in Section 316(b) Determinations

Under the case-by-case approach to section 316(b) that has been followed for the past 25 years, EPA has allowed the use of restoration projects as an innovative approach to minimizing adverse environmental impacts at existing facilities where the cost of alternative cooling technologies is determined to be wholly disproportionate to the environmental benefits to be gained. EPA's thinking on this issue has evolved over time, and EPA now believes that restoration measures may be considered BTA, or a component of BTA, irrespective of the cost or feasibility of alternative cooling technologies. This policy shift is reflected in both EPA's final 316(b) rules for new facilities (Phase I rules) and in the proposed rules for existing facilities (Phase II rules), as discussed below.

It should be noted in passing that neither the Phase I nor the proposed Phase II rules are legally applicable to the MBPP modernization Project. The Phase I rules are applicable only to "new facilities" (MBPP is not a "new facility" as that term is defined in the regulations), and the Phase II rules, although intended to apply to "existing facilities," are still in proposed form only and are not even to be used as guidance until formally promulgated.[13] Nevertheless, the preamble discussions in both of the final and proposed rules contain extensive discussion about certain benchmark principles under section 316(b) which provides useful and instructive insight into EPA's interpretation of this statutory requirement.

While there are many cases in which project-related impacts have been offset through habitat enhancement or other in-lieu mitigation programs, there are several cases in which habitat enhancement and restoration programs have been incorporated into recently-issued NPDES permits for power plants that utilize once-through cooling. These include:

1. The Salem Nuclear Generating Station in Lower Alloway Township, Salem County, New Jersey, that withdraws once-through cooling water from Delaware bay.

2. The San Onofre Nuclear Generating Station near San Clemente (San Diego County), California, that withdraws cooling water from the Pacific Ocean.

3. Mirant Delta, LLC's Contra Costa and Pittsburg Power Plants that withdraw cooling water from the Sacramento-San Joaquin River Delta.

Each of these cases provides sound legal and technical precedent for Duke's HEP. Summaries of the relevant aspects of these cases are presented in Appendix A.

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[13] 67 Fed. Reg. 17124 (April 9, 2002).

2.1.2.1 Legal Standard for Restoration Measures

On December 18, 2001, EPA adopted Phase I regulations for implementing section 316(b) for "new facilities."[14] These regulations allow NPDES permit writers to accept voluntary restoration measures in lieu of alternative cooling technologies or other operational changes when it is determined that such measures will maintain fish and shellfish in the water-body in an appropriate manner.[15] The term "restoration" in the federal regulations includes habitat enhancement.[16] Restoration programs are reviewed and approved on a case-by-case basis as a means of minimizing adverse environmental impacts from cooling water intake structures. Significantly, EPA has indicated that the success of restoration programs may be evaluated using either qualitative or quantitative criteria.[17]

On April 9, 2002, EPA issued proposed Phase II regulations implementing section 316(b) for "existing facilities." Newly constructed facilities that replace existing facilities (i.e., repowering projects) are considered "existing facilities" under the proposed regulations so long as they use an existing cooling water intake structure and the design intake flow is not increased. Since the design intake flow for the modernized MBPP will not increase and the modernized plant will utilize less cooling water than the existing facility, the modernized MBPP is an "existing facility" under the proposed regulations.

The Phase II rule proposes to establish as a national performance standard that existing facilities located in estuaries must reduce entrainment of fish and shellfish by 60% to 90 %. Facilities would be allowed to meet this performance range through the use of technology, operational measures, and/or restoration measures, or a combination thereof. The baseline against which compliance with the performance standard would be measured is the existing facility's intake structure, at its present capacity, but without any entrainment controls. EPA is proposing a performance range rather than a single standard to account for "the uncertainty inherent in predicting the efficacy of a technology on a site-specific basis."[18]

The proposed Phase II regulations contain an extensive discussion of restoration measures and the circumstances under which such measures constitute, or contribute to, a finding of BTA. For purposes of section 316(b) determinations, restoration measures include practices that seek to conserve fish or shellfish, compensate for lost fish or shellfish, or increase or enhance available aquatic habitat used by any life stages of entrained or impinged species. Essentially, EPA concludes that restoration measures which maintain fish and shellfish in the water body, including the community structure and function, at a comparable ***or substantially similar*** level to that which would be achieved through implementation of closed cycle recirculating cooling system technology (the so-called "Track I" option), may be

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[14] 66 Fed. Reg. 65280 (December 18, 2001).

[15] Under well established principles of statutory construction and U.S. Supreme Court precedent, EPA has authority to interpret the Clean Water Act in a manner that allows impingement and/or entrainment effects to be offset in this manner.

[16] 66 Fed. Reg. 65280 (December 18, 2001).

[17] 66 Fed. Reg. 65315 (December 18, 2001).

[18] 67 Fed. Reg. 17141 (April 9, 2002).

considered BTA. The focus of such measures should be on identification of appropriate restoration measures that will compensate for losses in biological production associated with cooling water withdrawal (e.g., creation of new wetlands, restoration of degraded habitat, fish stocking).

In addition, EPA states that restoration measures can actually provide environmental benefits above and beyond those that would be provided by design and construction technologies and operational measures that focus solely on reducing impingement and entrainment.[19] For example, habitat restoration may provide important ecological benefits beyond direct effects on fish and shellfish numbers, such as flood control, reduction in sedimentation, habitat for other wildlife species, and pollution reduction. As discussed below, Duke's HEP, as documented through the HEA element of the HEP (see Section 4), will contribute ecological benefits substantially beyond what is necessary to compensate for actual entrainment losses.

2.1.2.2 Dealing with Data Inadequacies and Uncertainties

It is critical that the Regional Board and the CEC understand that the data and modeling limitations and other uncertainties discussed above do ***not*** undermine the viability and efficacy of habitat enhancement and restoration programs as a means of offsetting entrainment losses. EPA recognizes that, due to data and modeling limitations, as well as the inherent uncertainties associated with habitat enhancement programs and other types of restoration measures, it may be difficult to establish quantitatively that certain restoration measures adequately compensate for entrainment and impingement losses. EPA explicitly recognizes these limitations in the Phase I and Phase II rules, but nevertheless continues to support the use of these programs as BTA given the superior ecological benefits that may results from them. In fact, these added benefits are viewed as a principal way of counteracting the inherent uncertainties in this type of project. Habitat restoration is not like emissions regulation of an industrial facility, where specific pollutants can be measured and controlled down to parts per million or parts per billion. Rather, restoration programs are more qualitative in nature, and produce ecological gains that may be difficult to measure in precise quantitative terms. This fact does not alter the basic value of these programs.

As discussed extensively in Duke's testimony and briefs in the CEC proceeding, the same data and modeling issues exist in establishing any impact from entrainment on species or the health of the Estuary. CEC and Regional Board staff have resolved these uncertainties by adopting very conservative assumptions that, when taken together, significantly overstate actual impacts and provide a very substantial safety margin to compensate for such uncertainties.

In many instances (although not all) Duke has supported this approach in order to provide an appropriate safety margin. However, it is important to keep this approach (i.e., the use of conservative assumptions to offset uncertainty) in mind when considering any data and modeling uncertainties related to the HEP. It is neither scientifically valid nor legally

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[19] 67 Fed. Reg. 17148 (April 9, 2002).

appropriate to overstate impacts to account for data and modeling uncertainties, while at the same time requiring that mitigation measures either be immune from such uncertainties or laden with safety margins that are redundant of those already factored into determining impacts. Simply put, there must be fairness and consistency with respect to how uncertainties are addressed in estimating impacts and assessing mitigation.

The Phase I and Phase II rules discuss several ways in which the uncertainties inherent in restoration measures may be compensated for. For example, under the Phase I rule, the facility must provide a list of the types of restoration measures it plans to implement, demonstrate that it has consulted and coordinated with the appropriate fisheries management agencies, and develop a monitoring plan that will verify that the restoration measures will maintain fish and shellfish in the waterbody to a substantially similar level as would be achieved under the "Track I" option. Verification monitoring must start during the first year of operation and must continue for a sufficient time to demonstrate through qualitative and/or quantitative results that the restoration measures are meeting appropriate performance levels. Likewise, under the Phase II rule, restoration plans must include provisions for monitoring and evaluating the performance of restoration measures to allow for mid-course corrections as may be necessary or to respond to unexpected natural forces.

Uncertainty can also be compensated for in the design of the restoration measures themselves (e.g., through detailed planning prior to initiation of restoration efforts such as was done in Duke's 316(b) Study Plan prepared in consultation with the Technical Working Group (TWG)). If a high level of data uncertainty exists regarding the efficacy of the restoration measures, a large margin of safety may be built into the restoration measure. In situations where there is insufficient information about the factors required for survival of certain organisms, replicating their habitat or conserving such habitat ensures that the intake losses are compensated.

2.2 California Environmental Quality Act

It is important to distinguish between the requirements of Clean Water Act section 316(b) and the CEQA in evaluating Duke's HEP. Under CEQA, public agencies are required to evaluate whether projects over which they have discretionary approval authority — such as the MBPP modernization Project — may have a "significant impact" on the environment. Under CEQA, "significant impacts" are defined by reference to a baseline representing existing environmental conditions in the area of the project. This is ***not*** the same baseline that is used for 316(b) purposes. Only significant adverse impacts are required to be mitigated under CEQA (or subject to a finding of overriding considerations). Projects that result in an ***improvement*** in the environment as compared to the baseline are not subject to evaluation or mitigation under CEQA. On the other hand, if an adverse impact is identified, the permitting agency is required to consider a range of reasonable alternatives to the project and to identify feasible mitigation measures that may be implemented to offset project impacts.

In contrast, section 316(b) requires that "adverse environmental impact" associated with operation of cooling water intake structures must be "minimized" to the extent feasible. These impacts are assessed by reference to the modernized plant's anticipated operations, not by reference to the existing environment or to a historical baseline. Thus, while the Regional

Board must make a finding in the NPDES permit that BTA is satisfied (i.e., that the entrainment effects of the modernized plant will be minimized), the Regional Board is not constrained by CEQA in its assessment of how this should be accomplished.

Similarly, the CEC's review of the HEP need not be guided by CEQA for the simple reason that the MBPP modernization Project will not have any potential to cause a significant environmental impact to marine biological resources as defined under CEQA. This conclusion is based on the following incontrovertible facts: (1) regardless of which historical time period is used for purposes of comparing the operations of the modernized plant with the operations of the existing plant, ***the modernized plant will use significantly less cooling water than the existing plant*** under any reasonable operating scenario, and (2) Duke has voluntarily agreed to accept permit conditions limiting its maximum daily and annual average daily flows to 475 MGD and 370 MGD, respectively. Since entrainment is directly related to the amount of cooling water used by the plant, the modernized plant will result in an ***improvement*** over the baseline condition. Consequently, mitigation is not required under CEQA, and the CEC should defer to the Regional Board with respect to the technical adequacy of the HEP.[20]

2.3 Respective Roles of the Regional Board and the CEC in the Review and Approval of the HEP

Duke is submitting the HEP in order to address the BTA requirements of section 316(b) of the Clean Water Act, as administered by the Regional Board. Consistent with the Regional Board's authority under the Porter Cologne Water Quality Control Act and the Clean Water Act, this submittal is being made on a voluntary basis. Assuming the Regional Board approves the HEP, Duke understands that it will be incorporated into the operative provisions of the NPDES permit for the modernized plant, and that Duke will be legally obligated to provide the HEP funding described herein. Once the funds have been provided, Duke's legal obligations under the HEP will be deemed fully satisfied, and actual implementation of the habitat restoration projects will reside with the Administering NGO.

While Duke agrees that the CEC has an obligation to make a determination that the Project complies with all applicable laws, including the federal Clean Water Act, the Regional Board has a statutory obligation to determine whether the HEP meets the requirements of section 316(b) irrespective of the nature of the CEC's role in this process. In other words, the Regional Board has an obligation to make its own BTA determination under section 316(b) of the Clean Water Act. Given the voluntary nature of the HEP, and its relationship to section 316(b) of the Clean Water Act, it is imperative that Duke work closely with Regional Board

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[20] The CEC's June 27, 2002 Scheduling Order states that:

> "[S]ince Applicant's proposals may also be evaluated as mitigation of a significant environmental impact under the California Environmental Quality Act (CEQA), the Committee expects the parties to examine Applicant's proposals according to the standards and guidelines of CEQA."

Duke does not agree with this statement and has filed a Motion for Order of Intended Decision with the CEC Committee with respect to this issue.

staff to ensure the Board's satisfaction with all elements of the HEP and implementation of BTA as it relates to 316(b). Consistent with the Memorandum of Agreement between the Regional Board and the CEC, the process is a collaborative one (involving Duke, the Regional Board, CEC, and others), and the details of the HEP will continue to be refined as technical and other information becomes available through the Regional Board and CEC processes.

On the other hand, the CEC has a primary role with respect to CEQA. Duke agrees that for CEQA purposes, the CEC is the lead agency and must identify and evaluate all potentially significant environmental impacts of the "project" (i.e., the modernization of MBPP). However, because the modernized plant will use less water than the existing plant, coupled with the fact that Duke has agreed to accept a flow restriction in its NPDES permit, the discharge from and entrainment impacts of the modernized plant (however they may be quantified) will ***decrease*** relative to the existing plant. When analyzed against the required CEQA baseline (the existing intake and discharge), there are no significant water quality-related impacts of the MBPP that require evaluation or mitigation under CEQA. This conclusion removes the need for the CEC to consider CEQA in its evaluation of the HEP.

SECTION 3: HABITAT ENHANCEMENT PROGRAM

3.1 HEP Objectives

Duke's primary objective is to minimize and offset entrainment effects of the modernized MBPP through implementation of the five building blocks (See Figure 1) that make up the HEP. As part and parcel of this objective, other ecological benefits will accrue to the Morro Bay Estuary. Providing these additional benefits is a secondary, though still important, objective of the HEP. These objectives are discussed in more detail below.

1. ***Minimize adverse environmental impact (entrainment mortality) associated with the modernized MBPP.***

This is the basic requirement needed to satisfy Clean Water Act section 316(b). The purposes of the HEP are to reduce water use, create a level of compensatory reserve for the species in Morro Bay that are at risk to MBPP entrainment, and look at potential technologies that will reduce entrainment.

2. ***Increase the quality, quantity, and variety of aquatic habitat in the Morro Bay Estuary.***

This objective lies at the heart of the HEP. By increasing and/or preserving the quality, quantity, and variety of aquatic habitat in Morro Bay, biological production (biomass) lost through entrainment will be regained, and the overall health of the ecosystem will be enhanced. Each of these factors — quality, quantity, and variety of habitat — are fundamental indicators of a robust ecosystem. The HEP identifies a number of representative projects that will contribute to achievement of this goal, and establishes a project selection process that assigns a high priority to other potential projects that protect, enhance and restore habitat.

3. ***Achieve reductions in sediment transport to Morro Bay and reduce sand migration in the bay.***

It is well recognized that sediment transport and accumulation in the bay represents the most significant ecological stressor to the Estuary. Whether the sediment is carried into the bay from erosion and runoff in upland areas of the watershed, is or caused by aeolian (wind driven) transport off the sandspit, or swept in with the tides, it has the same effect — infilling of the bay and the resultant destruction of habitat. Under contract to the Regional Board, Phillip Williams & Associates, Ltd. (PWA) has identified specific projects designed to control sediment transport to the bay, several of which are included in the HEP.[21]

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[21] The PWA report, entitled *Morro Bay Sedimentation: Historical Changes and Sediment Management Opportunities to Extend the Life of the bay*, is included as Appendix I. The supplement to the PWA report,

4. ***Facilitate implementation of projects identified in the TMDL, NEP, and COE programs affecting the Estuary.***

Duke recognizes that many important efforts are underway to protect and preserve the Morro Bay Estuary. The Regional Board's TMDL process, the NEP's CCMP for Morro Bay, and the COE's habitat assessment and ongoing dredging program are all designed to preserve the long-term health of the bay and estuary. This is a multi-disciplinary and expensive effort. Implementation of the HEP will facilitate the implementation of these programs by providing needed funding, coordination, monitoring, or other necessary support. Duke's HEP will not displace or replace any of these existing programs, but will amplify, accelerate, or expand them. The Administering NGO will work collaboratively with other stakeholders to achieve mutual objectives. This is a major benefit of the HEP—it is synergistic with the goals of these other programs.

3.2 Nexus to Power Plant Entrainment

Regional Board staff and Duke are in agreement that a nexus must exist between the entrainment effects of the MBPP and the benefits from implementing the HEP. As stated in the staff's November 6, 2001 report to the Regional Board,

> "Sedimentation is causing the loss of estuarine habitat and productivity. The Morro Bay Power Plant's cooling water system is also causing a loss of larval productivity. One option for dealing with the Power Plant impacts is to increase productivity in the Estuary by reducing sedimentation. This will prevent the future loss of productivity and allow habitat restoration/enhancement to increase productivity."

In other words, preventing further loss of bay habitat through sediment control is comparable to the restoration and enhancement of habitat which, in turn, will offset the entrainment effects of the MBPP through increased larval production.

The HEP is predicated on the fact that restoration, enhancement, and/or preservation of habitat in Morro Bay will increase biological production in the Estuary and thereby compensate for entrainment losses associated with operation of the modernized MBPP. Putting aside the debate over the level of proportional entrainment mortality that may be occurring, larvae lost through entrainment represent a loss of biomass in the bay. This loss may be mitigated by creating new opportunities, in the form of habitat, for replenishment of those resources. So long as suitable habitat exists, the existing reproductive capacity of the species in question is sufficient to ensure that those habitats will be fully occupied. Thus, restoration or enhancement of degraded habitats will offer new opportunities to these species, and biological production will increase. This linkage provides the necessary nexus between the entrainment mortality caused by the cooling water intake structure and the HEP.

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entitled *Floodplain Restoration Feasibility and Prioritization* (PWA Ref. # 1610), dated August 22, 2002, is included in Appendix J.

The ecological benefits of a comprehensive HEP outweigh the benefits that would be gained merely by minimizing entrainment levels through closed-cycle cooling.[22] The species inhabiting Morro Bay, like most bay species, possess a capacity to produce great numbers of larvae to account for the enormous daily tidal export of their larval out of the bay. These life histories (high fecundity and short generation times) and the adaptive ecology of the bay's resident species equip them with an inherent ability to rapidly expand their populations to take advantage of an increase in the quality or quantity of their habitat. Increases in population abundance are far less likely to result from increases in the sheer number of larvae present in the water column than from increased availability of bay habitat for the settlement and recruitment of the vast numbers of larvae that are already being produced, irrespective of those lost through entrainment. Based on recent trends in the loss of bay habitat due to sedimentation, the outlook for growth of Morro Bay populations will be even more limited in the future, unless this progressive loss of habitat can be slowed or, better still, reversed.

In addressing both the bay's present and future loss of habitat, the Regional Board staff has clearly identified the connection between watershed development, good land management practices, and the infilling of the bay. Overall, the bay has lost 25% of its tidal volume by sedimentation. In the south bay and delta areas, the higher rates of infilling have caused losses of 44% and 66%, respectively. Haltiner (1991) reports that the intertidal mudflats throughout the bay have been raised by about two feet due to sedimentation. Haltiner's most recent studies and analyses (Haltiner 2002) have confirmed that infilling of the bay is continuing on a pace that is consistent with his earlier projections that the bay may fill in and become a meadow in 300 years or less (Haltiner, 1991). A detailed discussion of the technical aspects of sediment control is presented in Attachment B of Duke's May 23, 2002 information package to the Regional Board, entitled *HEP: Sedimentation Control and Restoration of Marsh and Marine Habitats in Morro Bay*.

3.3 Habitat Enhancement Program Elements

As discussed above, the first two building bock of the HEP are focused on reduction in water usage and the entrainment reductions that are achieved through those measures. The third building block, habitat enhancement projects, represents the core of the program and is described in detail below.

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[22] Larvae produced by adult populations in the back bay areas of Morro Bay remain in the back bay for a week or two before growing large enough to begin settling out to their mudflat habitat. By that time, many of these larvae will no longer be vulnerable to entrainment due to their size. In addition, larvae carried by tidal flow into the outer part of Morro Bay are faced with inevitable transport by the same tidal currents out of Morro Bay, with little or no chance of recruiting to their Morro Bay parent populations. Using closed-cycle cooling technologies to prevent or reduce the entrainment of larvae at the intake to the MBPP would have no discernible effect on the supply of larvae for recruitment to Morro Bay's juvenile and adult populations located in the middle and back bay. However, restoring and protecting back bay habitats for these larvae directly increases the number of adults as well as the likelihood of their offspring surviving to recruit into Morro Bay's juvenile and adult populations. Duke's HEP directly addresses this first order need for restored and protected habitat.

3.3.1 HEP Restoration Project Categories

There is broad consensus that the future of the bay is threatened by continued loss of volume and habitat due to sedimentation and that there is an urgent need to address this problem.[23] Both the Regional Board and the NEP have assigned a high priority to sediment control projects. Implementation of sediment controls through, or as adjuncts to, the TMDL program, the COE, and/or the CCMP provides an effective opportunity to restore and preserve bay habitats utilized by many of the species that are entrained by the plant, as well as providing other benefits to the Estuary. The Regional Board's TMDL for sediment and the CCMP for Morro Bay establish the framework and priority of actions that are necessary to protect the health of the Morro Bay Estuary. Many of the physical processes of sedimentation are well understood and have been specifically applied in the CCMP as means to restore and protect Morro Bay. In addition, ongoing research by PWA has been reviewed in order to identify performance-based project designs and their associated sets of expected and measurable outcomes.

Using the TMDL and the CCMP as touchstones, Duke has identified two major categories of projects that are appropriate for inclusion in the HEP projects (building block #3):

1. In-bay habitat restoration and/or enhancement projects that will directly result in improved quality and quantity of habitat in Morro Bay.

2. Watershed projects designed to preserve in-bay habitat by reducing sediment transport to the bay.

Implementation of projects in these categories will result in the replenishment of biomass lost through entrainment, and may well produce numerous other ecological and environmental benefits that surpass this basic requirement. Duke's HEP has been designed to strike a balance between these two types of projects due to their unique contributions to the overall health of the Estuary. Specific representative projects identified by Duke for implementation are discussed in Section 5. The general project types are discussed in more detail below.

3.3.1.1 In-bay Projects

This category of projects includes actions taken directly within the boundaries of the bay to restore bay volume and to restore and/or enhance habitats that serve as spawning grounds for fish and other aquatic species. The area of Morro Bay that could be used for habitat restoration and/or enhancement is limited primarily by existing shoreline development. There are nevertheless numerous possibilities for restoration and/or enhancement of former bay habitat that has been lost primarily due to sedimentation. Examples of projects in this category include restoration of historic bottom level elevations in the bay to promote reestablishment of eelgrass beds and/or low marsh, and control of aeolian transport of sand from the sandspit. Certain types of projects work directly to increase biomass in Morro Bay such as planting new stands of eelgrass.

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[23] CCMP (NEP, July 2002); Regional Board TMDL for Sediment.

The results of restoring and protecting the bay's habitats can be forecasted both qualitatively and quantitatively. Reductions in stream borne silts and clays in the bay reduces the supply of these materials that, when re-suspended in the water column by wind and tidal currents, increase turbidity and reduce the depth of sunlight penetration, frequently a limiting factor in the distribution and growth of eelgrass and macrophytes. Thus, it is equally important to protect and preserve any new or restored areas from sediment impacts as it is to create new eelgrass beds, particularly in areas that present marginal environmental conditions for eelgrass growth and survival.

3.3.1.2 Watershed Projects

This category of projects includes actions taken outside the boundaries of the bay but within the upland watersheds of Los Osos Creek and Chorro Creek, two of the main sources of sediment in the bay. Upland control of both fine and coarse grain sediments limits the rate of infilling and potentially significant adverse changes in Morro Bay's tidal elevations and topography, and improves water quality based on the reduction of suspended sediments in the water column. Elevation changes related to erosion from these watersheds can be observed in the Chorro Creek delta where colonies of hoary cress are rapidly expanding and contributing to the conversion of tidelands to transitional upland habitat as the elevation of the floodplain increases. Left unchecked, there is every reason to expect that the progressive loss of Morro Bay's estuarine habitat as a result of sedimentation will continue in these back bay shallows.

Accordingly, consistent with Regional Board staff's stated preference, the HEP will also focus on projects that control or reduce sediment transport into the bay. These projects may include erosion control projects along upland watercourses, construction of catchment basins, swales and other sediment containment features, land acquisition for purposes of creating conservation easements, minimizing runoff from development activities, restoration of floodplain habitat, and other Best Management Practices. The Chorro Flats sediment trap project stands as an excellent example of a successful watershed management project. In that case, the environmental engineering design and performance led to the prevention of an estimated 250,000 cubic yards of sediment from entering the bay. The implementation of watershed management projects as part of the HEP is based on the clear nexus between loss of bay volume and biologically productive habitat and the infilling of the bay with stream borne sediments eroded from its watershed.

3.3.2 Project Selection Criteria

Section 5 of the HEP identifies representative projects that Duke is recommending be implemented as part of the HEP and discusses the technical aspects of these projects. The project selection criteria for these or other comparable projects that might be implemented include:

- Location
- Nexus to MBPP entrainment effects
- Basic need or justification for project
- Nature and extent of ecological benefits
- Opportunities for leveraging of funds/ Availability of matching funds
- Stakeholder acceptance
- Consistency with ongoing work of Regional Board, NEP and COE
- Implementation costs
- Cost effectiveness
- Ability to measure performance
- Technical feasibility
- Length of time before benefits accrue
- Success of comparable restoration projects
- Likely duration of benefits
- Legal hurdles (e.g., permits, legal access)
- Administrative considerations

To the extent that excess HEP funding is available, or if leveraged funds become available for additional work in Morro Bay, the Administering NGO will develop criteria for ranking potential projects that meet the project selection criteria listed above. Depending on the nature of a particular project that is under consideration, the relative importance and weighting of these criteria may vary. As a general proposition, however, new projects will be selected so as to maximize the ecological benefits to the Estuary. This process will ensure that the most effective projects are assigned the highest priority. Once the Administering NGO has ranked potential projects and consulted with the permitting agencies and advisory committee, the Regional Board, as Chair of the Executive Board of the Administering NGO, will select a list of projects to be undertaken in consultation with the other Executive Board members.

3.3.3 Project Monitoring Program

The monitoring program is an essential component of the HEP. Monitoring provides the information needed to determine if particular projects are developing as anticipated, validate that the anticipated ecological benefits are being conferred, and determine if corrective actions are needed. Each restoration project is unique, and performance criteria and monitoring plans and schedules will be tailored to meet the needs and goals of each project, once project selection and design are complete. Thus, it is not possible, or even desirable, to attempt to delineate the specific performance measures for the projects at this time, as sufficient data are not available.

As a general proportion, however, the performance of specific habitat enhancement projects can be measured directly or indirectly by monitoring environmental variables that respond to project effects. Physical measurements that detect environmental change in Morro Bay before and after implementation of habitat enhancement projects that are expected to provide the most reliable and cost-effective measurement of project success. For example, an expected increase in eelgrass production might be directly indicated by an increase in the total coverage and density of standing stocks or indirectly by positive increases in its habitat characteristics, such as depth of substrate or light penetration.

Similarly, a reduction in the rate of bay infilling might be measured directly by repeated bathymetric surveys of the bay's sea floor elevations, or indirectly reduced levels of bay turbidity and increased light levels. Physical measurement of in-stream sediment concentrations, particularly upstream and downstream and before and after an erosion control project takes effect, would provide direct and accurate information on the success of the erosion control. A number of practical and technical considerations come into play in the design of a monitoring program that are generally resolved through discussions among resource managers, regulatory representatives, and project scientists.

Prior to implementation, the Administering NGO will work with other involved agencies to develop project-specific monitoring plans for each of the projects described in Section 5 using the following general goals and considerations.

1. Determine the habitat features required for project success

- The establishment of vegetation, the use of the habitat by desired species, appropriate water depth or elevation, stability of structures, etc., may all be appropriate features to monitor. Other criteria such as percent survival and percent cover, each measured over specified time periods, may be equally appropriate.

2. Select appropriate performance criteria

- The criteria measured should be representative of desired aspects of the project. For example, percent cover by plants may be used to represent primary productivity. Tidal amplitude in a marsh may be used as representative of appropriate hydrology.

- The criteria should be easily measured. Although biomass or primary productivity may be the parameter of interest, it is easier and less destructive to the vegetation to measure percent cover, which provides a good proxy for biomass.

- There should be a high probability that the criteria selected exhibit a response in the time frame of the monitoring plan. For example, the success of a transplanted eelgrass bed could be determined within a few months, during the first and second year growing season, by repeated measures of aerial coverage, density, and health of plants, or blade and turion biomass.

- Important issues in the selection of performance variables are their sensitivity to expected project changes, independence from influence of other unrelated variables, and reliability over time.

3. Establish a monitoring schedule

- Generally, monitoring is conducted annually for an agreed-upon number of years. However, monitoring may be done more frequently during the first few years of the project.

- Monitoring may be augmented with periodic inspections to assess conditions following a storm or unusual weather, to check for invasive species, or to detect other problems.

4. Determine the appropriate duration of monitoring

- The duration of monitoring is usually dependent on the specific performance criteria being met. Monitoring does not need to extend for the predicted life of the project.

- Monitoring need only last long enough to evaluate with reasonable certainty whether the habitat will confer the benefits that are anticipated and will continue to develop as expected. For example, the establishment of an eelgrass bed by transplant could be determined by repeated measures of perennial growth over a period of time sufficient to demonstrate a pattern of persistent growth. A shorter timeframe might be adequate to demonstrate preservation of an eelgrass bed by a declining rate of loss.

5. Establish criteria that trigger early corrective actions

- Some monitoring programs do not address corrective measures until the completion of the monitoring program, which may be several years after project initiation. Other programs incorporate early corrective measures that can be implemented prior to the completion of the monitoring program to ensure that the benefits of the project are being conferred as anticipated.

- In some cases, specific corrective actions can be specified in advance (e.g., replanting will be done if 50% of seedlings fail to survive for more than 60 days). In other cases, an adaptive management approach may be more appropriate, such that the nature of the corrective action will depend on the reason the performance criterion is not being met. A list of acceptable corrective actions may be developed prior to the start of the project.

- Reasonable limits may be placed on the corrective actions that may be required.

6. Develop force majeure criteria

- Force majeure criteria establish how the project will be completed in the event performance becomes impossible or impracticable as a result of an event or effect that the parties could not have anticipated or controlled. Examples of force majeure events include acts of God, unanticipated or uncontrollable acts of third parties, legal impossibility, and changes in physical or chemical properties of the area.

- Should one or more of the projects discussed in Section 5 become infeasible due to a force majeure event, the Administering NGO would have the discretion to select an alternative project that would yield comparable benefits. Such alternative projects would be funded through the existing HEP funds.

- Once a particular project has been successfully implemented, however, the occurrence of a force majure event may reduce or eliminate the anticipated benefits. Duke would not be obligated to provide additional funding for a replacement project.

3.3.4 Baseline Monitoring Proposal for Morro Bay.

In addition to project specific monitoring, Duke's HEP includes a proposal for baseline monitoring. Duke's proposed Baseline Monitoring Program is presented in Appendix B. The cost of this program is estimated not to exceed $165,000 over five years and is separate from the $12.5 million in HEP funding.

Throughout this proceeding, there have been repeated references to data gaps and the difficulties they pose to decision-making processes related to resource management the bay. The baseline monitoring component of the HEP will contribute to this needed body of information, and will serve to further support and document the biological principles upon which the HEP is based. Beyond the MBPP modernization Project, there is a basic need for baseline information in Morro Bay, and numerous resource agencies, non-governmental organizations, scientists and others will benefit from this improved knowledge base. However, Duke does not believe nor intend that information from the proposed monitoring program can or should be used to determine the specific success or performance of the specific HEP projects. As discussed in Section 3.3.2, selection criteria for project performance measurement would normally exclude the use of biological parameters, except in the case of measurement of restored vegetation growth such as eelgrass beds.

The HEP baseline monitoring program includes hydrological, water quality, and certain biological monitoring components, and will extend both the technical and financial capability of the existing NEP ecosystem-level monitoring program. Although it is well known that monitoring the hydrology and topography of estuarine habitats is essential since these physical factors drive wetland ecology and development (Callaway et al. 2001), this usually requires expensive instrumentation and extensive surveys. Therefore, components of the HEP monitoring program include hydrographic surveys and instrumentation to monitor erosion and sedimentation. Other physical water quality parameters include dissolved oxygen, water clarity and temperature. However, the core of the baseline monitoring program is the proposed ecological tracking components using aerial photography and spectral imaging to map changes in the abundance and distribution of the bay's habitat forming species (pickleweed, mudflat algae and eelgrass) and synoptic field surveys of Morro Bay fishes.

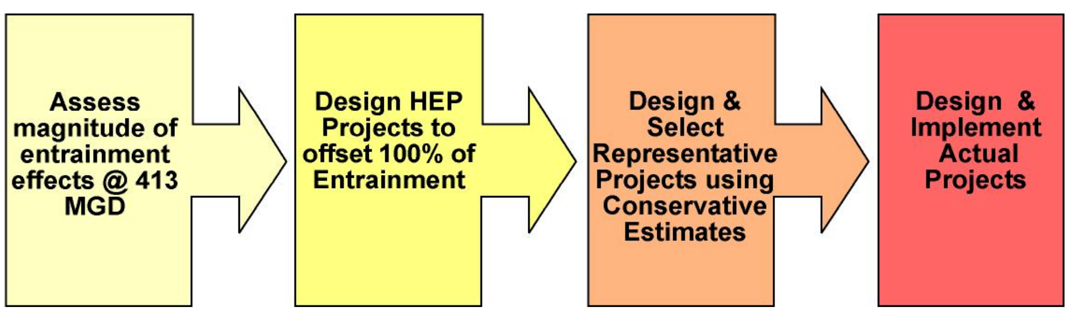
3.4 Safety Factors and Credit Considerations

Duke has developed the HEP around a variety of factors that produce a large, built-in safety margin. These include:

- Using the Regional Board's most conservative assessment of entrainment effects (33%).
- Assuming a higher water usage rate (i.e., 413 MGD) than will actually be used by the modernized plant, thereby overstating entrainment losses.
- Selecting representative restoration projects that offset 100% of entrainment at design flows even though (a) EPA's proposed national performance standard only calls for 60% -90% reduction in entrainment (or comparable offsets) and (b) the plant will not run at maximum loads and flows.
- Using conservative assumptions when designing and preparing cost estimates for the representative projects.
- Contributing an additional $2.8 in HEP funds (~30%) to cover unforeseen contingencies that may arise during project implementation.
- Leveraging HEP funds to raise additional funds that can be used to expand the scope of identified restoration projects or implement additional activities.

Figure 3 summarizes these safety factors, each of which is discussed in more detail below.

Figure 3: Safety Margin Factors



3.4.1 Duke is Entitled to "Credit" for Reductions in Entrainment Based on Reductions in Water Usage

The evidence compiled in this proceeding shows that the progressive loss and degradation of marine habitat in Morro Bay has a greater impact on the health and stability of bay species than does larval entrainment itself. For this reason, one of the major objectives of the HEP is to offset the ***effects*** of entrainment through habitat restoration. However, ***avoidance*** of entrainment through reduced water usage or other means remains a high priority objective, as evidenced by several of the NPDES building blocks:

- Block #1—installation of low capacity pumps and improved efficiency of the modernized plant.
- Block #2—voluntary acceptance of permit limit restricting flow to 370 MGD on an annual average daily basis.
- Block #4— possible deployment of an AFB if determined to be feasible.
- Block #5— anticipated actual water usage significantly below permitted levels.

Each of these physical factors serves to reduce or avoid actual entrainment, consistent with the goals of Clean Water Act section 316(b). While Duke is not seeking any reimbursement or reduction in HEP funding for these avoidance measures, and is not looking to them as direct measures of program success, the fact remains that reductions in entrainment achieved through these physical means create a very large safety margin in the HEP. Were these reductions taken into account, they would substantially reduce the amount of mitigation initially required to meet section 316(b) requirements.

EPA's proposed Phase II regulations for existing facilities provide support for this conclusion. While these regulations are not final (and thus not applicable to the MBPP modernization Project), Duke believes it is reasonable to look to the proposed regulations to establish a benchmark against which reductions in entrainment levels can be measured. In the Phase II regulations, EPA has targeted an overall reduction goal of 60% - 90% for plants located in estuarine environments, based on a variety of site-specific factors.[24] Based on the direct relationship between water usage and entrainment levels, Duke anticipates that approximately 20% of the targeted 60%-90% entrainment reduction range can be achieved simply through reduced water usage by the modernized plant. These reductions come from two different sources:

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24 Whether the final regulations eventually establish a specific percentage reduction, or allow a range, remains to be seen.

1) A ***10% reduction***, representing the difference between the 413 MGD baseline and the proposed NPDES permit limit of 370 MGD, computed as an annual average; ***plus***

2) An ***additional 10%,*** representing the difference between 370 MGD and 328 MGD, the latter figure representing realistic actual water usage over time, given that the plant will not run at full permitted load all of the time.[25]

Using EPA's proposed target reduction level as a point of reference, Duke's "residual" obligation to reduce entrainment is reduced to 40%-70%. Any additional reductions in entrainment gained through deployment of entrainment-reducing technologies such as an AFB would entitle Duke to further "credits" in this calculation. Table 1 in Appendix C demonstrates the relationship between water usage and residual entrainment reduction.

Notwithstanding the existence of these water usage credits, Duke has identified habitat restoration projects that will offset 100% of the entrainment that occurs at 413 MGD, ***without regard to reductions in water usage.*** Reductions in entrainment achieved through reductions in permitted and actual water use, or through deployment of entrainment-reducing technology such as the AFB, serve to increase the safety margin surrounding the HEP anywhere from 10% to 20% depending on the modernized plant's actual water usage.[26]

3.4.2 Calculations of Larval Entrainment Impacts are Based on Conservative Assumptions.

Duke, CEC staff, and Regional Board staff experts have agreed on several conservative assumptions when calculating entrainment impacts on larvae. These assumptions likely result in an overstatement of entrainment impacts and provide a significant safety margin to account for data uncertainties and other factors. As discussed below, the principal conservative assumptions are:

1. There is no survival of entrained larvae despite substantial evidence to the contrary.

2. The plant operates at 100% of its lawful capacity at all times despite the certainty that it will not.

3. There is no compensatory response among populations of entrained species despite widespread agreement that compensatory response occurs.

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[25] Note this number is for illustrative purposes only.

[26] As a matter of principal, Duke believes that entrainment offsets should be based on permitted or actual water usage, which ever is less. In this case, Duke has elected to base offsets on the 413 MGD flow rate because the 316(b) assessment for the MBPP used this number and Duke only recently agreed to accept a permit limitation of 370 MGD.

3.4.2.1 The PM Calculation Assumes 100% Mortality

As explained in Duke's written testimony filed with the CEC on Group IV issues, the scientific literature supports the conclusion that the Regional Board staff's assumption of 100% mortality is very conservative:

> "In the current estimates of P_m, Duke and the TWG have conservatively assumed that 100 percent of the organisms die, despite documentation via intensive through-plant entrainment survival studies at power plants across the U.S. that survival of larval fish and invertebrates can be very high (EPRI 2000). Mean survival rates for most taxonomic groups have exceeded 50 percent (Figure 11, Duke 2002c), the only major exceptions being the relatively fragile herrings (Clupeidae) and anchovies (Engraulidae), which have mean survival rates around 25 percent. Survival rates of 65 percent or higher (up to 100 percent) have been common. For example, total survival rates of 88 percent and 98 percent were reported for naked goby (*Gobiosoma bosc*) in entrainment survival studies at the Calvert Cliffs power plant in southern Maryland. Gobies make up nearly 81 percent of the larval fish entrained at MBPP. Results for blennies and relatives of jacksmelt (silversides, *Menidia menidia*) have been more variable, but average 58 percent (Indian River Power Plant, New York) and 83 percent (Calvert Cliffs Power Plant), respectively. Additionally, most power plants where entrainment survival studies have been conducted do not utilize cooling from a source as consistently cool as that of the MBPP."[27]

Note that the species showing the highest survival rates are gobies (88% to 98% survival), the most predominant species entrained by this facility. Note also that 100% mortality was assumed for all taxa including crustacean, phytoplankton and zooplankton larvae that have much higher entrainment survival than the relatively fragile larval fish studied as described above.[28] While not fully accepting the results of these evaluations, Regional Board staff agreed that "100% mortality maximizes the estimate of proportionate mortality."[29] As a consequence, actual losses attributable to entrainment are likely overstated, thus adding to the safety margin.

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[27] Ex. 266, p. 68. A summary of all of these studies is presented in Ex. 266, Figure 11 following page 68.

[28] *Id.* at p. 43.

[29] 6/6 RT 39:16-17. Dr. Raimondi criticized these studies because the entrained larvae were generally held in controlled conditions rather than studied in the natural environment. Moreover, he suggested that those studies that had followed surviving entrained larvae in a natural environment revealed "massive mortality." 6/6 RT 34:5-8. However, it is essentially impossible to design a study that follows surviving entrained larvae in the natural environment that would produce any meaningful results. (6/6 RT 202:9 through 204:10.) Dr. Mayer further testified that these studies have attempted to mimic natural conditions as much as possible. *Ibid.* Moreover, Dr. Raimondi on cross-examination acknowledged that "massive mortality" was normal for larvae whether entrained or not. (6/6 RT 291:8 through 292:6.) He clarified his statement to say that "some of the studies indicate that there has been an increase above normal in mortality from these surviving larvae." (6/6 RT 293:1-5.)

3.4.2.2 Larval Mortality Calculations Assume 100% Operation of the Plant

The Regional Board's proportional mortality calculation (17%-33%) assumes an average daily cooling water use of 413 MGD based on the very conservative assumption that the power plant would operate at the maximum rate allowed by law at all times. In fact the plant will not operate at this rate all the time. The evidence in the record indicates that the plant will likely operate at 328 MGD even using conservatively high projections. Thus, the assumption of 100% operation further overstates entrainment impacts and adds to the safety margin.

3.4.2.3 Larval Mortality Calculations Assume No Compensatory Response

As a general proposition, there is scientific agreement that mechanisms of compensatory response act to increase the growth rates, survival, and reproduction by those members of a population that survive.[30] However, all of the experts in this case (including Duke's) conservatively assumed that compensatory response mechanisms do not operate in Morro Bay. That is a particularly unlikely assumption in the circumstances of the Morro Bay Estuary. First, as Regional Board staff has acknowledged, there is no evidence in the context that adult populations in this estuary are limited by larval production.[31] In fact, there is considerable evidence that the major constraining factor on adult populations of entrained species is available habitat. Therefore there is ample reason to believe there are far more larvae produced in the Morro Bay Estuary than the habitat can support. This is borne out in the NEP's CCMP. It does little if any good to "save" larvae if there is no habitat to support them. In habitat-constrained environments such as this estuary, compensation for entrainment losses can occur in part due to decreased competition for available habitat.[32]

3.4.3 The representative projects are designed to offset 100% of entrainment at maximum flows

As discussed in Section 2.1.2.1, the proposed Phase II rules for existing facilities require that the level of entrainment be reduced by 60%-90%. While it has yet to be decided whether this proposed range will be included in the final rule, or whether a single target reduction level will be specified, EPA is not proposing that entrainment impacts be eliminated altogether, i.e., reduced by a factor of 100%. Nevertheless, Duke's HEP is designed to accomplish exactly that—a 100% reduction in entrainment, calculated from a baseline of 413 MGD.[33]

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30 Ex. 266, p. 70. See also Exhibit 257 for an extensive discussion of compensatory response.

31 6/6 RT 293.

32 In this regard, the CEC Staff's statements regarding estuarine food web dynamics and "silent partners" are highly misleading. *See* Ex. 266, p. 77-79.

33 This represents the maximum daily flow, on an annual average basis, consistent with the limitations imposed by the modernized facility's air quality permits. And, because Duke is willing to accept an annual average daily flow limit of 370 MGD, this aspect of the HEP will automatically reduce entrainment by an additional ten percent.

3.4.4 The representative projects incorporate conservative design and costing assumptions

As discussed in detail in Section 4, the ecological benefits that will be produced by implementation of the representative projects have been conservatively estimated by using a trophic conversion factor of 10% in one aspect of the HEA analysis. The trophic conversion factor represents the amount of energy that is transferred as one moves up the food chain. Trophic conversion factors of up to 20% are frequently used and are well documented in scientific literature. Use of the 10% factor understates the benefits that are most likely to be derived, meaning that additional acreage is required to provide total benefits needed to offset entrainment.

In addition, Duke's experts have used conservative costing assumptions in determining the cost of implementing each of the representative projects. These costs were then doubled to build in a even larger contingency for unforeseen circumstances or difficulties encountered during project implementation.

3.4.5 An additional $2.8 million in HEP funding will be provided over the estimated $9.7 million for project implementation

In addition to the foregoing, Duke has also committed to provide $2.8 million in additional contingency funding that can be used either to provide additional to expand the scope of the representative projects, or implement additional projects that will supplement or complement those selected by the Administering NGO.

3.4.6 Leveraged funds will further increase the pool of funds available for restoration

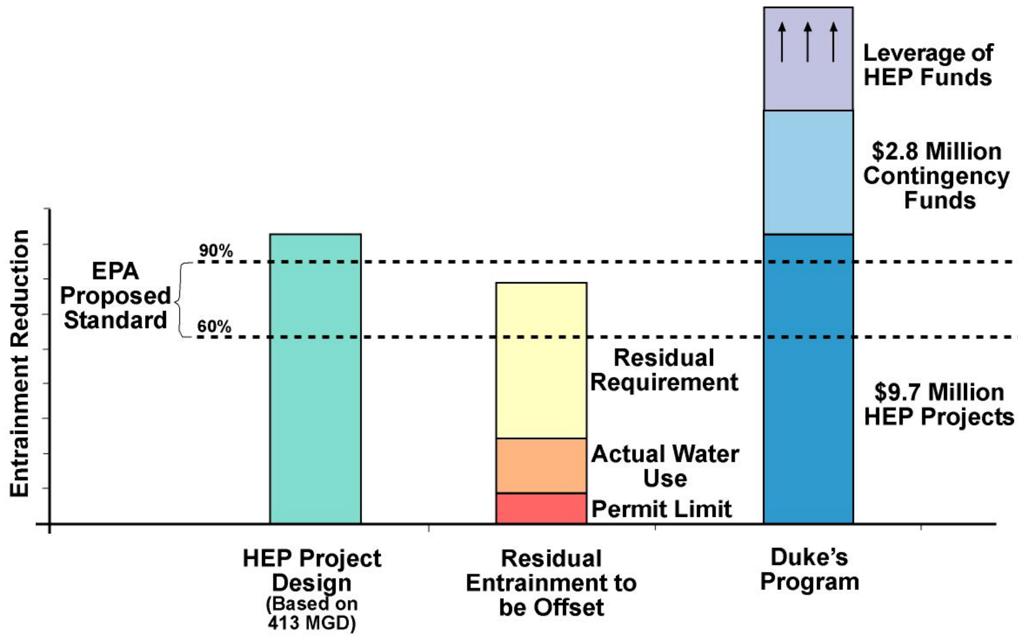
Finally, based on recent precedent, it is expected that Duke's HEP funding can be leveraged by a factor of 3-5 times, resulting in additional revenues of up to $60 million for TMDL implementation, carrying out high priority projects identified by the NEP, and contributing "seed money" for COE dredging projects.

3.4.7 The Cumulative Effect of the Numerous Safety Factors and Credit Considerations Provides a Large Safety Margin Against Uncertainties

The foregoing discussion demonstrates that there is a substantial safety margin built into the HEP. This safety margin is appropriate given data uncertainties and the importance of protecting the Estuary. When all of the safety factors and credit considerations are considered together, their cumulative effect may well be to overstate impacts (and thus overdesign of mitigation) by several fold.

Consider Figure 5 below. The bar on the far left represents entrainment offset that will be provided by the HEP restoration projects, based on 413 MGD. The bar in the middle represents various sources of "credit" that contribute to the achievement of EPA's proposed national standard. The bar on the right represents the sum total of the benefits provided by the HEP and demonstrates that these benefits exceed the proposed EPA standard.

Figure 4: Entrainment Reduction



This simple example shows a significant reduction in entrainment even before the benefits of the restoration projects are taken into account. Furthermore, and as explained elsewhere in this document, many additional biological services will be contributed by the HEP for which Duke is not claiming credit because they lack a direct nexus to MBPP (e.g., improvement in bird and wildlife habitat).

3.5 Measurement of Program Success

As discussed in Section 1.4, Duke's HEP consists of a number of NPDES "building blocks." The overall success of the HEP must be judged in the context of each of these building blocks and against the backdrop of applicable legal requirements. These different program components necessitate a variety of performance metrics or success factors. In understanding how these factors are related to one another, it is important to distinguish between "project level" success factors and "global" measurements of success.

Section 5 of this submittal includes a description of representative habitat enhancement projects, each of which will have a set of reasonable and practicable "project level" performance measures. General parameters for these performance measures are discussed in Section 3.3.3. This section discusses the broader, programmatic success factors or "global" performance measures that are used to evaluate the program in its entirety. These include:

- Successful implementation of specific HEP projects
- Achievement of synergies with other estuary programs overseen by the Regional Board, the NEP, and the COE, that relate to watershed management and habitat preservation and protection.

3.5.1 Specific "project level" success factors

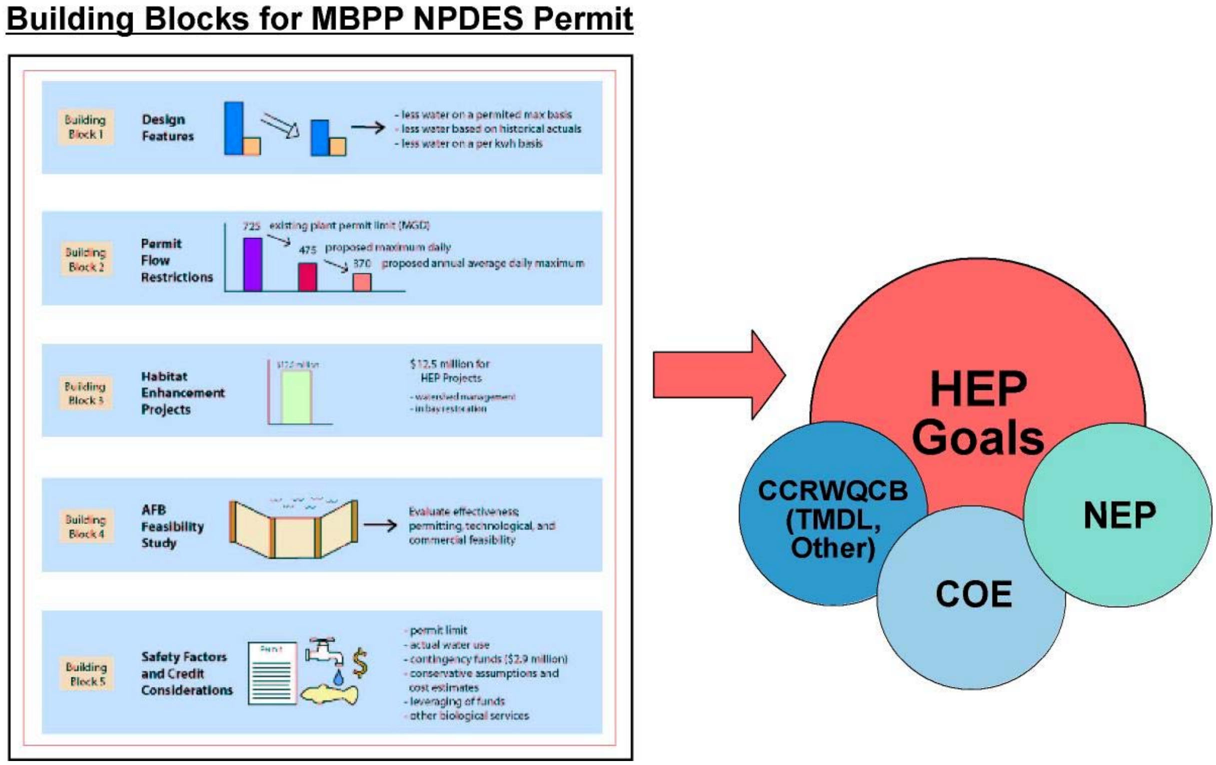
Successful implementation of the specific restoration projects is a cornerstone of the "global" performance goals. As discussed in Section 5, Duke is proposing the implementation of a number of in-bay restoration and watershed management projects. These are representative projects based on good engineering, sound science, and important environmental policy objectives. While Duke anticipates additional discussions with Regional Board staff about these projects prior to issuance of the NPDES permit for the modernized plant, Duke anticipates that the Administering NGO will implement either the projects presented in Section 5 or projects that confer equal or greater benefit to the Estuary.

Based on what is known today, and as demonstrated through the HEA model discussed in Section 4, the implementation of these projects will offset the effects of power plant entrainment. In fact, these projects may well produce ecological benefits that exceed power plant effects. As such, successful implementation of these (or comparable) projects is a key measure of overall program success.

3.5.2 Synergies with ongoing bay protection programs

The principal ongoing bay protection and restoration programs are those being conducted by the Regional Board, the NEP, and the COE. For example, the Regional Board has adopted a watershed sediment control plan through the TMDL program to restore the bay's sediment-impaired water quality. The program's specific sediment control projects are targeted to achieve the Board's goal of 50% reduction in the rate of bay infilling. Such a reduction is projected to extend the habitat service life of the bay by 150,000 acre-years, or 50% of the 300,000 acre-years of service left at the existing rate of sedimentation, as estimated by PWA.

Figure 5: HEP Program Synergies



The HEP has a set of clearly defined goals and objectives, as discussed in Section 3.1. These objectives are synergistic with existing programs of the NEP, the Regional Board, and the COE, as depicted in Figure 5. In order to ensure proper coordination between Duke's HEP and these programs, Duke is proposing that a representative from the Regional Board and the NEP be appointed to the Executive Board of the Administering NGO (a non-governmental organization) that will be established to administer the HEP (see Section 8 for a discussion of HEP governance). In this way, the Administering NGO can be kept apprised of ongoing work of these organizations, identify opportunities for coordination, direct available HEP funds as appropriate to assist these organizations in their respective missions, and ensure consistency of efforts. On a more practical level, it is important for these programs to be synergistic in terms of impact and not work at cross-purposes. Table 2 lists the NEP CCMP priority projects that overlap with the representative projects listed in Section 5.

Table 2: NEP CCMP Projects that Overlap with Representative Projects

NEP CCMP Project	Description
CC-1.	LAND ACQUISITION: Acquire or otherwise protect lands that contain ecologically valuable habitat or habitats that provide beneficial functions to the Estuary, in order to minimize nonpoint sources of pollution entering the Estuary. Such acquisition will occur in cooperation with willing public and private landowners.
SED-2.	Install new and maintain existing sediment traps in order to reduce the delivery of sediment to Morro Bay.
SED-8.	Improve degraded navigational channels and estuary habitat conditions, and increase circulation patterns.
HAB-8.	Implement restoration activities to improve the quality and quantity of eelgrass habitat.
SED-6.	Re-vegetate north sandspit areas without impacting snowy plover or least tern habitat.
HAB-5.	Implement policies and projects to protect, restore, and create habitats, including wetlands, in connection with dredging activities.
CC-3.	TMDLs: Develop and implement Total Maximum Daily Loads for siltation, pathogens, nutrients, metals, and priority pollutants.
SED-1.	Increase use of management measures for road maintenance and construction activities to reduce damage to streams and the Morro Bay Estuary.
SED-7.	Provide incentives for landowners to encourage implementation of Best Management Practices (BMPs) for erosion control and sediment retention.
SED-4.	Supply technical and financial assistance to landowners to implement Best Management Practices (BMPs) on their land.
SED-5.	Supply the technical and financial assistance to landowners to implement creek restoration projects (including re-establishing floodplains and meander patterns) in Los Osos and Chorro Creeks.

These NEP programs, as well as other resource agency programs, are important to the health of the Estuary. For example, the California Coastal Commission Staff Recommendation on Consistency Determination for the NEP's CCMP recognizes that the actions identified in the CCMP are "both a blueprint for and a call to action," and finds that implementation of the CCMP is consistent with the fundamental goals of the Coastal Act, and is consistent with the (cited) applicable policies of the Coastal Act. [34]

Thus, the extent to which Duke's supports or contributes to the achievement of goals established through these other programs is a global performance metric for the HEP. Where synergies in funding, project implementation, or monitoring are achieved, and additional benefits accrue to the Estuary, this should factor into the assessment of how well Duke's HEP is performing.

3.6 Contingency Plan to Address Potential Shortfalls in HEP Performance

In its June 27, 2002 Scheduling Order, the CEC suggested that the HEP should include contingency plans that may be implemented if performance standards are not met. While Duke agrees with this in principle, we believe contingency plans should only be necessary where ***overall*** program performance fails to provide ecological benefits that offset the entrainment effects of the modernized MBPP. Contingency plans are not necessary to address shortfalls in anticipated benefits that are above and beyond those needed to satisfy pertinent legal criteria.

As explained above in Section 3.4, and as documented by the HEA in Section 4, the HEP contains a very significant margin of safety. This margin of safety derives from a number of different considerations, chief of which is the fact that the HEP is conservatively designed to offset 100% of the entrainment effects, assuming entrainment levels associated with annual average water usage of 413 MGD. Actual water usage, however, will be substantially below this level both as a result of the 370 MGD permit flow limitation and because the plant will not run at 100% capacity. In addition, the cost estimate for each representative habitat enhancement project is highly conservative (almost double the expected actual cost), thus assuring the availability of sufficient funds to address problems or other contingencies that arise during project implementation. Finally, based on the experience of the Elkhorn Slough Habitat Enhancement Fund and the local NEP, Duke believes that the HEP funding for the MBPP modernization Project will be able to be leveraged into a much larger reserve that may be used to expand the scope of HEP projects or implement other projects. Duke is entitled to credit for the ecological benefits that will flow from projects that become feasible only through the existence of matching grants or other funds obtained through leveraging Duke funds.

A safety margin fulfills the basic purpose of a contingency plan, i.e., insurance that the required ecological benefits will be realized. In this case, Duke believes that the magnitude of the safety margin built into the HEP obviates the need for a program-level contingency plan altogether. It is also Duke's expectation that the design and planning phase for each habitat

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[34] The Staff Recommendation can be found at http://www.coastal.ca.gov/cd/cd12-00.pdf

enhancement project that is selected for implementation – whether or not one of the representative projects discussed in Section 5 of this proposal – will include a discussion of potential corrective actions or contingency measures and the project-specific circumstances under which such measures should be undertaken. These project-level contingency plans, in conjunction with the overall safety margin, should provide the Regional Board and the Committee with a high level of assurance as to the adequacy of Duke's HEP.

3.7 HEP Case Histories

While there are many cases in which project-related impacts have been offset through habitat enhancement or other in lieu mitigation programs, there are several cases where habitat enhancement and restoration programs have been incorporated into recently-issued NPDES permits for power plants that utilize once-through cooling. These examples provide sound legal and technical precedent for Duke's HEP and are presented in Appendix A.

SECTION 4: HABITAT EQUIVALENCY ANALYSIS

This section of the HEP is devoted to an explanation of the Habitat Equivalency Analysis (HEA) model and how this model quantifies and demonstrates that the proposed habitat restoration measures will adequately compensate for entrainment mortality at MBPP. As a prelude to this discussion, and to facilitate comparison between the Regional Board's approach and the HEA approach, it is useful to first present a description of the Regional Board's methodology. It is also important to emphasize that Duke is not contesting the Regional Board's methodology for purposes of application of this HEA approach. While we believe the HEA offers a more quantitative or analytical approach than that used by the Regional Board, the primary role of the HEA in this process is to demonstrate the conservative nature of the Regional Board's approach and validate scientifically the magnitude of the safety margin that is incorporated into the HEP. Both approaches have the same objective — to increase the quantity and quality of habitat in Morro Bay — and are thus compatible and consistent with each other.

Perhaps more importantly, the conceptual framework outlined by the Regional Board (which evaluates impacts based on acre-years) and the output of the HEA model are aligned in that both focus on improving the health of the bay. By including both in-bay restoration and watershed sediment control projects, the HEP ensures an appropriate emphasis on the long-term watershed improvement goals that are explicitly part of the Regional Board's TMDL framework. It should also be noted that the HEA analysis yields a habitat enhancement funding level that is within the range suggested by Regional Board staff.

4.1 Regional Board Staff Methodology

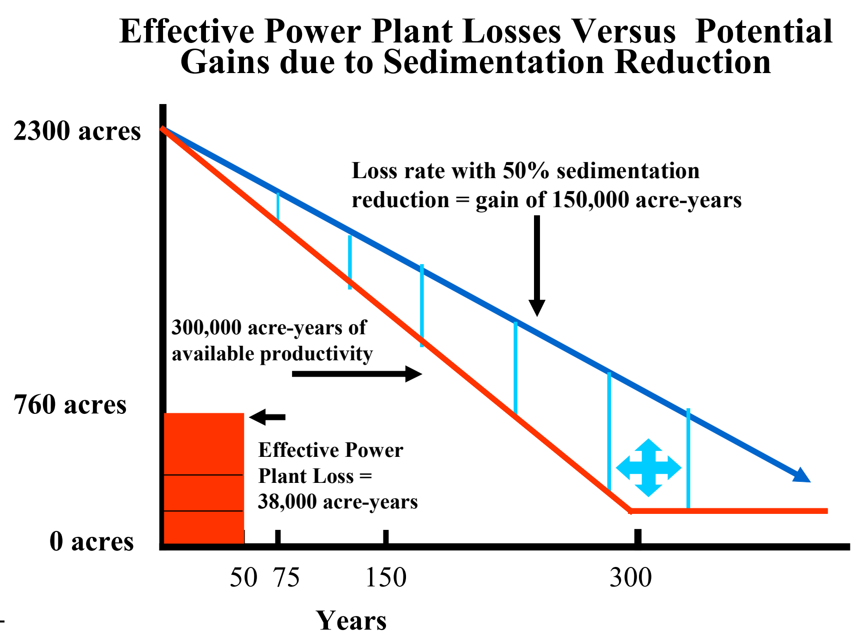
The Regional Board staff and their independent consultants have developed a method of denominating the cooling water intake structure impacts of the MBPP modernization Project in terms of habitat creation and restoration cost. A working assumption of the staff's method is that the whole of Morro Bay's marine habitat is required to produce the entirety of the planktonic organisms that are subject to entrainment, and that the fraction of the bay's total larval production that is removed through entrainment is equivalent to the same fraction of the bay's habitat required to produce them. For example, if the power plant, on average, is entraining 10% of the larval fish and other organisms produced in Morro Bay, then an area equal to 10% of the bay's total habitat would need to be restored or preserved from future loss to replace this loss of production.

The Regional Board staff's report to the Board dated May 23, 2001 and updated July 6, 2001, stated that the proportional larval loss range (for estuarine taxa) caused by the modernized power plant will be about 17% - 33%. Based on the approximate wetted surface area of the bay (~2,300 acres), the staff converted the proportional larval loss to "equivalent" acreage: 17% - 33% of 2,300 acres = 391-759 acres (the acreage it would take to replace the larval loss under this methodology). Staff then converted this acreage to a dollar value range of $11.7 to $22.8 million by assuming that $30,000 per acre on average would be a reasonable cost for acquisition of larger parcels and/or restoration of habitat.

In its report to the Regional Board dated May 9, 2002, the staff revised its original method of translating proportional mortality to bay habitat to include a step that converts preservation of habitat by sediment removal and future control into years of habitat service restored to the bay's future. The staff report quantifies the power plant's entrainment effects over the life of the Project as an effective larval "productivity loss."[35] By expressing the estimated annual power plant loss in acres of habitat, the loss of habitat service is the annual loss multiplied by the years of expected power plant operations. For example, the staff calculates that if the power plant operates for 50 years, then the effective larval productivity loss is estimated as 38,000 acres-years (760 acres per year of habitat services multiplied by up to 50 years of operation of the modernized plant, without entrainment controls). In essence, the Regional Board staff is concerned with the overall longevity of the bay, and has laid out a framework in terms of acre-years of service to advance this concept.

The example used by staff in its report is based on PM of 33% and intake flows of 413 MGD, before Duke agreed to accept a permit condition limiting its flow to 370 MGD. This flow limitation will, in effect, reduce the proportional larval loss estimates of 33% and the corresponding 760 acres (as depicted in Figure 6) by approximately 10%. The "effective power plant loss" of 38,000 acre-years would also be reduced by a similar amount. In order to "true up" the Regional Board's methodology with expected MBPP operations, the actual intake flows of the modernized facility must be used to calculate effective power plant loss. Further, if a proportional larval loss estimate of 17% were used in this example, the "effective power plant loss" would be reduced to 19,000 service acre-years.

Figure 6: Regional Board Methodology[36]



[35] Duke believes that the staff's use of the term "productivity loss" in this context would more accurately be expressed as a loss of production. This issue is discussed in Section 4.6 below.

[36] Slide from Regional Board staff presentation first presented at the June 30, 2002 RWQCB workshop and later, in its present form, at the June 4, 2002 Group 4 CEC Hearings on Marine Biology.

The inherent conservatism of the Regional Board staff's approach lies in several factors. First, the creation, restoration, or preservation of an acre of habitat produces many more ecological benefits or services than the simple replacement of lost larvae. Second, the simple assumption that x% PM equates to x% productivity loss fails to take into consideration the fact that not all of the bay's 2,300 acres are equally productive. Third, the Regional Board staff assumes that x% PM is in fact equal to x% productivity loss. This is not the case, as an acre of the bay's most productive habitat with the greatest number of ecological services (e.g., eelgrass habitat) may well be worth many acres of less productive habitat with fewer services, such as water column-channel habitat. Table 3 below compares the habitats found in Morro Bay and their corresponding productivities; Figure 7 shows the distribution of these habitats in the bay.

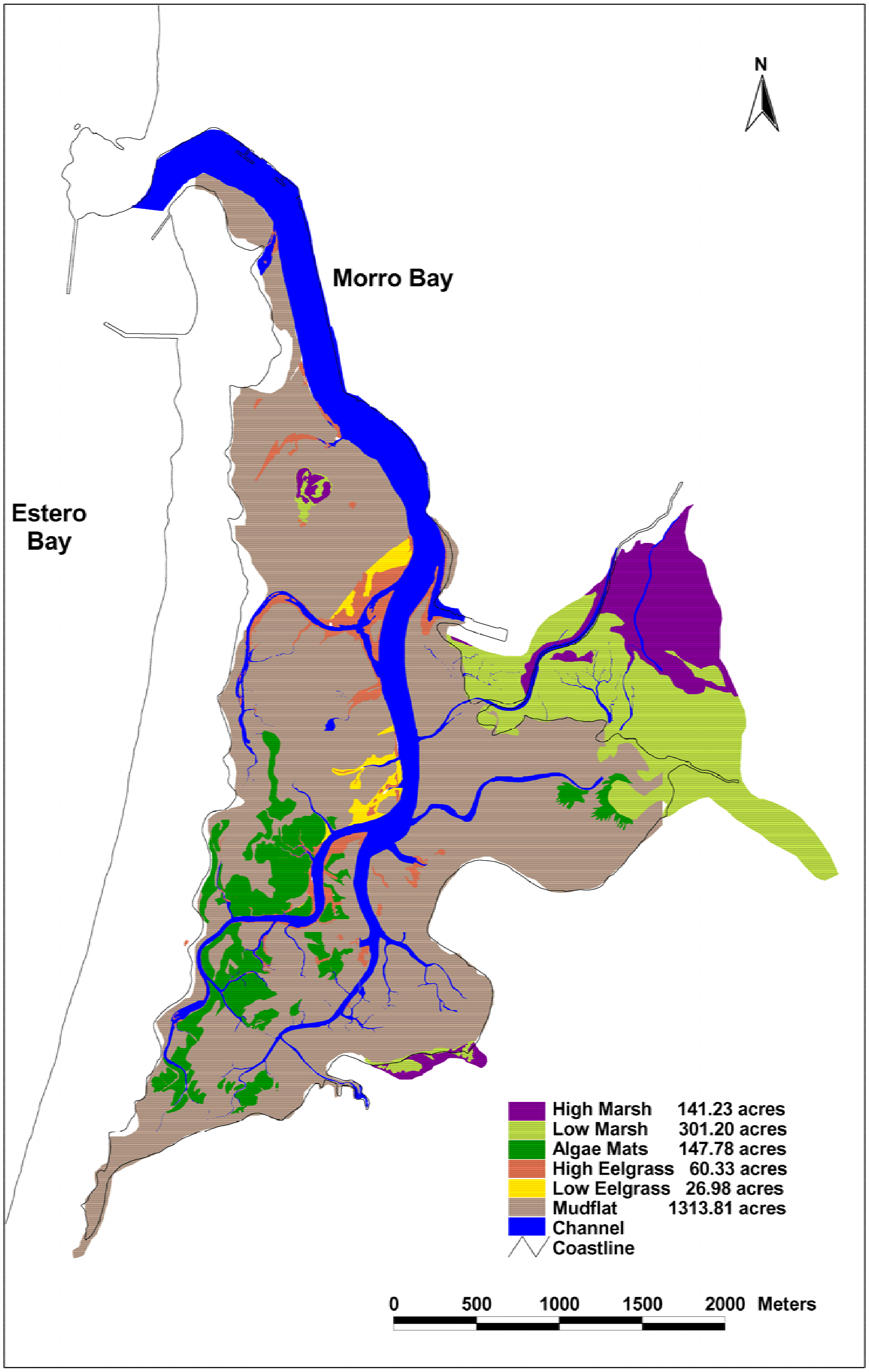
Table 3: Productivity of Morro Bay Habitats[37]

Habitat Type	Acres	Percent	Relative Productivity
Channel	389.60	16%	Low
Mudflat	1,305.05	55%	Moderate
High Eelgrass	60.33	3%	High
Low Eelgrass	26.98	1%	High
Algae Mats	147.78	6%	Moderate
Low Marsh	295.35	12%	High
High Marsh	141.20	6%	Moderate
	2,366.29		

As can been seen from Table 3 above, the most productive of the bay habitats, high and low eelgrass, account for less than 5% of existing bay habitat. Lastly, while the Regional Board's direct conversion of acres to funding provides a straightforward means of assessing mitigation dollars, it does not take into account into many factors that are properly a part of this analysis.

37 Source for percent coverage is from the NEP's CCMP (July, 2000).

Figure 7: Morro Bay Habitat



History and Development of HEA Model

4.1.1 Introduction

In recent decades, there has been a growing acknowledgement that natural resources provide an array of services to society, beyond serving as a source of raw materials.[38] It has only been in the past two decades that resource agencies have begun to use scientific tools to measure injury to ecological resources and to attempt to scale the amount of restoration/ preservation needed to offset those injuries.

Habitat Equivalency Analysis (HEA) is an analytical method (NOAA, 1991) that was initially developed by NOAA to quantify natural resource and service reductions associated with oil spills and services gains associated with restoration actions taken in response to those spills. (Abbott 1996, Strange et. al. 2002). HEA has also been used extensively in the natural resource damage assessment context to establish value of natural resource and service loss and to evaluate the value of restoration projects being considered as compensation to offset natural resource losses. (Bishop 1992, Jones and Pease 1997, Julius 1992, King 1997, Simenstad 1997, and Unsworth and Bishop 1993, Chapman 1998).

The advantage of using HEA over other traditional economic valuation methods is that the losses and gains of natural resources or ecological services are valued using the same ecological measurement of exchange (also know as "currency" or "metric") thereby eliminating the need to assign monetary values to natural resources or services. The use of a metric or standard ecological currency is significant because establishing monetary values of ecological services is often difficult since they are not typically traded in the market place. HEA, with its use of a standard metric to measure ecological losses and gains, can be used to provide a direct link between impacted habitats or services and habitat restoration (Strange 2002).

4.1.2 The Development and Application of Habitat Equivalency Analysis

In 1989, NOAA played a critical role in one of the largest single events that impacted ecological resources, the grounding of the Exxon Valdez. A three-person management group oversaw NOAA's role in the ensuing injury assessment, and made the determinations as to how NOAA would vote in the seven-member trustee council overseeing the entire $170 million Federal/State injury assessment. During the eight years following the Exxon Valdez, NOAA oversaw assessments that resulted in the recovery of hundreds of million of dollars for ecological injuries caused by oil and chemical spills, long-term chronic contamination, and physical impacts.

Liability for damage to natural resources has been established under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), the Clean Water Act, as amended by the Oil Pollution Act (OPA) and the National Marine

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[38] Peck, James. *Measuring Justice for Nature: Issues in evaluating and litigating natural resources damages.* 14 J. Land Use & Envtl. Law 275. Spring 1999. Florida State University.

Sanctuaries Act.[39] The government's most sophisticated application of ecosystem service valuation methods occurs in the determination of natural resource damages.[40] The natural resource damage assessment area was the first area to consider how to measure the cost of ecological injury and how to restore injured ecosystems. Early efforts attempted to simply place a dollar value on the ecological injury. This resulted in distortions, and some methods were found by the courts to be unreliable.[41] When attempting to place a dollar value on resources that were traded in the established market place the process worked relatively well, but when attempting to deal with resources for which no markets existed, the natural resource trustees often stumbled.[42]

In other instances, a controversial approach called Contingent Valuation Methodology (CVM) was applied in an attempt to place monetary values on these non-market resources. In the development of the OPA natural resource damage assessment regulations, the use of the CVM became so controversial that NOAA convened and oversaw the deliberations of a "Blue Ribbon Panel" that included two Nobel Prize-winning economists that ultimately gave a luke-warm endorsement of the methodology. A major consideration for that endorsement was that if CVM was not able to be used, then there were limited alternatives available to trustees for ensuring that the public was adequately compensated for the loss of non-market natural resources. Many felt that CVM created unreasonable distortions when placing values on natural resources. Concerns over these distortions contributed to the desire to come up with a restoration-based method for determining appropriate levels of compensation.

The challenges surrounding CVM and concern over how to properly apply recovery for damages caused NOAA to focus on restoration-based compensation, rather than monetary compensation. In September of 1990, NOAA convened one of the first marine restoration sciences conferences. The conference demonstrated that our capability to restore injured ecosystems was stronger than expected. At the close of the conference it was observed that:

> *The ability to actually restore and reclaim damaged portions of our environment is now a very exciting possibility."*[43]

And then the scientists were presented with the following challenge*:*

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39 20 Stan. Envtl. L.J. 413, May, 2001, Board of Trustees of the Leland Stanford Junior University Stanford Environmental Law Journal.

40 20 Stan. Envtl. L.J. 413, May, 2001, Board of Trustees of the Leland Stanford Junior University Stanford Environmental Law Journal.

41 Commonwealth of Puerto Rico, et al. v. The SS Zoe Colocotroni, *628 F.2d 652,1980.*

42 In the case of the SS Zoe Colocotroni, cited above, a district court damage award for destruction of marine invertebrates was overturned because the appellate court held that the trustees had not reliably valued the resource.

43 Quotation by Thomas A. Campbell, made at the conclusion of the "Symposium on Habitat Restoration" as recorded in the book, *Restoring the Nation's Marine Environment,* (Gordon W. Thayer ed. Maryland Sea Grant 1992) p. 294 and 695.

"The burden rests upon the scientific community to come up with viable, meaningful, useful ways of actually doing damage assessment and restoration work.[44]

Shortly after the conference, a resource economist stepped up to that challenge. Brian Julius (NOAA) approached the General Counsel of NOAA and asked for the opportunity to try a different methodology for the injury assessment for the Exxon Bayway oil spill. The method called for the use of ecological barter. He reasoned that when dealing with ecological resources that were not traded in a market place it was better to use a bartering methodology. He proposed that NOAA use a methodology that they referred to as Habitat Equivalency Analysis. He felt that if a sufficient amount of restoration could be done, then this restoration itself could be sufficient to offset any ecological injury. HEA uses basic principles of economics and biology to ensure that the ecological benefits that come from restoration actions are greater than the harm that comes from an injury to natural resources. The key was to create a common unit of measurement that could measure the injury as well as the compensatory restoration. The unit of measurement arrived at was the "Service Acre Year" (SAY).

In the Exxon Bayway case, the HEA method led to a settlement that in turn led directly to the restoration of wetlands and sea grass.[45] HEA has subsequently been applied to a broad range of circumstances. It has proven to be a flexible and useful tool that numerous state, federal and private parties have applied. HEA has also been found to be reliable by the courts that have been called upon to review it.[46] While HEA first found application in an oil spill context, it has subsequently been broadly used to scale restoration alternatives to offset ecological injuries in a number of different contexts.

Another major application of HEA was a matter in 1992 that involved physical damage to sea grass beds and coral reef habitat of the Florida Keys. In this instance, NOAA constructed an assessment to determine the appropriate scale of alternative projects to compensate for the damage, rather than require restoration in the actual area of the impact because NOAA deemed that restoration of the impact area was impractical.[47] Thus, HEA was first used to scale compensatory restoration. This application was ultimately challenged in federal district court, and the court upheld the methodology finding that the HEA is appropriate to determine the scale of compensatory restoration project.[48] A similar case appeared before this same district court in 2000 with the same result, i.e., the application of HEA was upheld.

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44 *Ibid,* p.695.

45 United States, State of New York, et al v. Exxon Corporation

46 United States v. Mel Fisher, 977 F. Supp. 1193; United States v. Great Lakes Dredge & Dock Co., 259 F. 3d 1300.

47 32 Envtl. L. 57, Winter 2002, Environmental Law Northwestern School of Law of Lewis & Clark College.

48 United States v. Mel Fisher, 977 F. Supp. 1193,

Only the natural resource damage provisions of CERCLA and OPA explicitly require ecosystem valuation as a response to ecosystem service loss.[49] Therefore, the largest body of literature relating to the valuation of natural resources using HEA is found in natural resource damage cases. As a result, the majority of matters that incorporate the use of HEA are spill and superfund related. Other regulatory agencies, such as the US Fish and Wildlife Service have informally explored the use of HEA when evaluating Section 10 Habitat Conservation Plans (HCPs) associated with the Endangered Species Act permitting; however, the actual use of HEA has not been formally incorporated into the permitting process. It is clear from this short history of HEA, that the more familiar the regulatory agencies become with HEA (which is directly related to the Courts' endorsement of settlements based on HEA), the more widely accepted the use of HEA is becoming in other regulatory areas beyond CERCLA and OPA.

A compilation of HEA precedents and case histories is included in Appendix F.

4.1.3 Role of HEA in the MBPP HEP

HEA has been used in this case to ensure that the habitat enhancement projects described in Section 5 provide sufficient compensation to offset potential effects associated with the operation of the MBPP Cooling Water Intake Structure (CWIS). This section describes the HEA model and its application to MBPP entrainment. In addition, an example of a restoration project that would offset the effects of entrainment is summarized and presented in detail as Appendix D.

4.2 Technical Explanation of the Use of HEA in Scaling the HEP

4.2.1 Background

When applying the HEA framework to potential ecological losses, we must begin with the basic premise that habitats are assets from which numerous services flow and that these services can be assigned a value (Daily 1997). Different habitats provide different levels and types of services. High quality habitat typically produces a greater number of different services at a higher level of functionality, whereas low or moderate quality habitat is typically characterized as producing few services and/or having lower functionality. For example, salt marsh areas within Morro Bay that are being converted to transitional uplands are functioning at a lower productivity level than other areas of similar habitat composition that are not subject to infilling. The HEA assigns a higher value to high quality habitat than to low quality habitat.

Services flowing from habitat can be categorized in either ecological or human terms (NOAA 1997). Ecological services are physical, chemical, or biological functions that one natural resource provides to another, (e.g., food, water, protection from predators, habitat, nutrient cycling, etc.). Human uses of natural resource functions provide direct value to the public. Many resources and/or their associated services have well established value to

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49 20 Stan. Envtl. L.J. 413, May, 2001, Board of Trustees of the Leland Stanford Junior University Stanford Environmental Law Journal.

humans because they are traded in the open marketplace, such as commercial fisheries, timber, and crops. However, ecological resources and/or services are rarely traded in the marketplace and are difficult to value.

Ecological resources and services often provide indirect values to humans. These indirect values are the values of the ecological support these resources provide to other resources that do have direct human value. For example, a species that is preyed upon by a commercial species has the indirect value of providing energy to the commercial species. While humans do not directly value the energy that the prey provides, they value it indirectly through the support of the commercial species and the overall ecosystem.

Most aquatic species entrained by the MBPP CWIS have little or no direct human value. For example, there is no commercial fishing of blennies or arrow gobies. Rather, the value of these species is in providing ecological services. Fish and shellfish larvae provide services such as biodiversity and food for other resources. The ultimate human value of these services is ecosystem support, and the quality and quantity of ecosystem support provided by these services are a function of the habitat quality that produces them.

4.2.2 The Effects of Entrainment on Morro Bay Water Column Services

Operation of the CWIS entrains larval lifestages of fish and shellfish in the vicinity of the MBPP intake structure. Using HEA, the habitat affected by entrainment is the water column. Potential effects on the water column are related to either the quantity of water in the habitat and/or the quality of the water column. The quantity of water is measured by volume, and is the amount of water column habitat that is available to provide resources and/or services. As for the quantity of available water column habitat, while a certain volume of the water is removed from the bay, that volume of water column is almost instantaneously replaced by water from the ocean and/or freshwater inflow. Thus, the quantity of water in Morro Bay is not adversely affected as a result of the CWIS.

The quality of the water column is the suitability of the habitat to provide resources and/or services, such as support for aquatic resources. Water quality is generally measured through physical and chemical properties such as dissolved oxygen, pH, total suspended solids, etc. In any event, the MBPP cooling water intake does not likely affect water quality within Morro Bay. The withdrawal of water by CWIS operation induces an increase of ocean water flow into the bay. Since the ocean water is of comparable or better quality than the water within the bay, any negative effects on water quality are unlikely.

While the volume of water withdrawn by the MBPP is returned, a portion of the entrained pelagic organisms that are suspended in the water column at the time of intake are exported from Morro Bay to Estero Bay. This export is not an adverse environmental impact, as most of these organisms would have been exported into Estero Bay by natural processes (Tenera, 2001; Cowan, 2002). However, for the purposes of this report, Duke conservatively defines the “loss” resulting from entrainment as the biomass of fish and crab larvae that are estimated to be withdrawn from Morro Bay and discharged into Estero Bay, without any credit for advective losses. The loss of biomass resulting from entrainment of fish and crab larvae is an “indicator” or proxy service loss for all other organisms that were not measured in the entrainment study. The restoration projects proposed in Section 5 are likewise based on only the production of larval fish and crab biomass equal to that entrained, and do not take credit for all the other organisms that will be produced from the various habitat restoration projects.[50]

The resources contained within the water column withdrawn from Morro Bay include aquatic organisms such as phytoplankton, zooplankton, larval fish, and shellfish. Possible effects on each component of the water column are described below.

The ecological services provided by phytoplankton include primary production and population maintenance. As primary producers, phytoplankton are available as an energy resource for zooplankton and other primary consumers, which are in turn available as energy for other organisms. Because phytoplankton and zooplankton lifespans are short and the growth rates are very rapid, the viability of phytoplankton and zooplankton populations are not affected by entrainment. Nevertheless, the habitat enhancement projects discussed in this document will have a beneficial effect on these types of organisms.

The export of larval fish and shellfish has two potential effects: a reduction in the compensatory reserve of their populations and bay biomass. The plant has been in operation for 50 years without apparent effect on the viability of fish or shellfish populations. There is no reason to assume that operation of the proposed CWIS will cause any measurable population level effects. The other possible effect of entrainment is the loss of biomass from the bay food chain. Whether alive or dead, entrained organisms represent a food supply either as preyed or through detritus. For the purposes of this analysis, we conservatively assume that all of the entrained larval fish and shellfish would have remained in Morro Bay.

The metric selected to measure the service loss (energy value) was measured in terms of biomass. Biomass was considered the best indicator of entrainment effects on the fish and shellfish populations of Morro Bay because it is used to measure aquatic organism production and to estimate the benefits of habitat enhancement projects.

The analysis contains several conservative assumptions:

1. 100% of all entrained organisms suffer mortality as a result of being entrained.

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50 Consistent with EPA guidance and the proposed Phase II regulations, Duke's study and analysis of cooling water entrainment effects focused on the larval fish and cancer crabs because they are potentially important commercial and recreational species in the bay. As importantly, these larvae can be reliably identified and represent an important aspect of the bay's production. Larvae of other aquatic organisms are very difficult to identify, and no data are available on either the numbers or biomass of these organisms that are entrained in the cooling water or living in the bay (e.g., clam larvae entrained by the power plant cannot be reliably sampled and identified due to the large, complicated gamete production). Thus, for both practical and commercial reasons, these species are used as proxies to represent the effects of the power plant on other entrained species.

2. 100% of entrained organisms would have remained in Morro Bay (i.e., they would not have been flushed from the bay by outgoing tides).

3. The plant cooling water withdrawal was is 413 MGD.

4.2.3 Model Inputs and Assumptions

The HEA model has two components, the "debit" and the "credit." The debit is the measure of the resource loss and, in this instance, represents the reduction in the value of the water column habitat due to losses in services resulting from entrainment. The credit is the measure of the benefits generated by restoration and, in this instance, represents the value of the increased resources and flow of services provided by restoration projects outlined in the HEP. The "metric" (or unit of measurement) is often expressed in terms of service acre-years (SAY),[51] which is the level of services provided by the resource during one year at full services. In this case, the assumed service loss is fish and crab larval biomass, and the metric is the assumed annual reduction in fish and crab larval biomass resulting from entrainment. Similarly, benefits provided by example restoration projects are measured in terms of fish and crab biomass produced. The goal of the HEA is to equate the services produced by restoration projects (annual fish and crab biomass produced) to the assumed services lost (annual fish and crab biomass entrained).

Service losses from entrainment and service gains from restoration projects that occur in the future are discounted in the HEA model. Discounting reflects the concept that ecological services today are preferred to ecological services in the future. The exclusion of a discount term would imply that a restoration project which begins many years from now would be as valuable as the same project beginning today. In general, discounting leads to larger restoration projects because the services produced by those projects occur in the future and are less valuable (due to discounting) than the services lost. It should be noted that service losses from entrainment and service gains from restoration occurring at the same time in the future are equally valued. As recommended by the U.S. Department of the Interior and NOAA (DOI, 1996; NOAA, 1996) in similar applications of the HEA model, a 3% discount rate was used in this analysis.

In general, the debit is the measure of the reduction in function experienced by the affected resource from the time of loss to the time of full recovery. This is graphically illustrated in Figure 8 below. In order to calculate the debit, one must understand the baseline conditions. In general, baseline is the level of services that would have been provided in the absence of the incident. Full recovery is achieved when the services provided by the resource return to baseline. Baseline also incorporates anticipated natural fluctuation or variability in the production of services over time.

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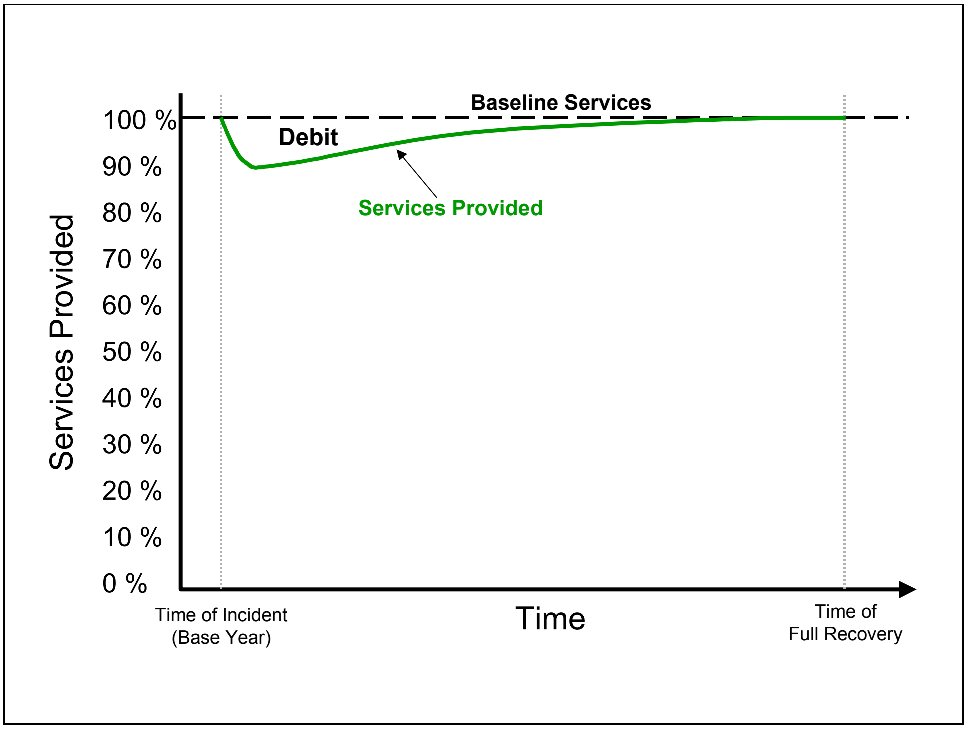
[51] Also known as effective acre-year.

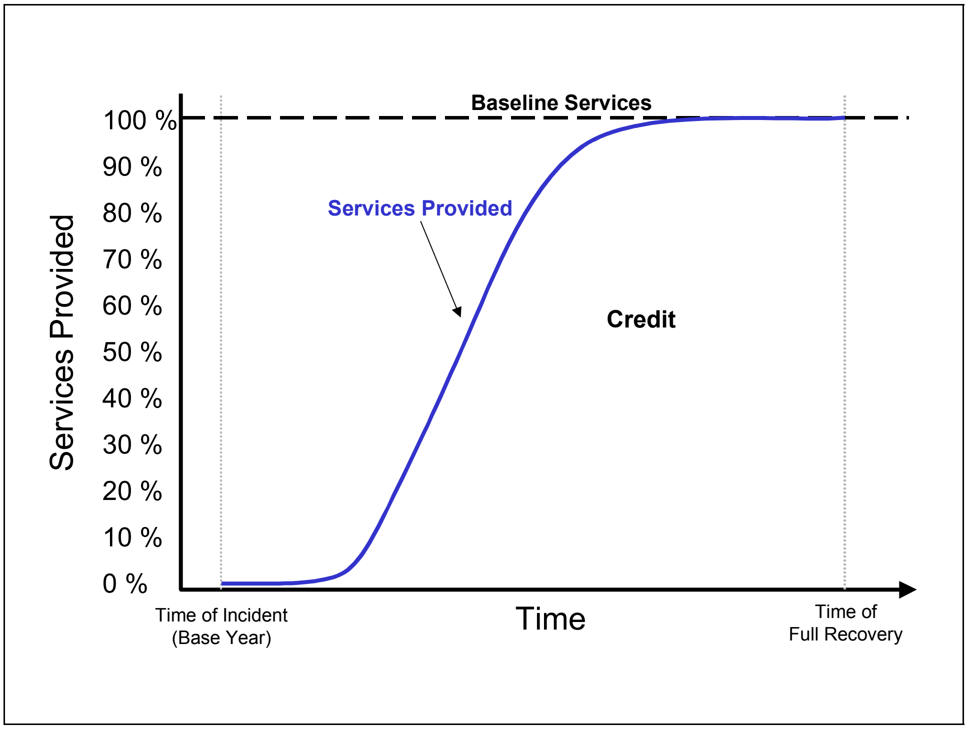
Figure 8: A Typical HEA Debit



In Figure 8, the baseline is defined as 100% services absent the loss. Services actually provided by habitat decrease after the incident, then recover over time through natural recovery and/or primary restoration. The area between the baseline and the services provided curve represents the injury to the habitat or service reduction. This area, when discounted and expressed as present value in the base year, is the debit in the HEA model. The debit is also called the interim service loss.

The credit in this example is the discounted service acre years (DSAYs) provided by a restoration project, expressed per unit area (often acres). Figure 9 depicts a typical credit scenario.

Figure 9: A Typical HEA Credit



Services generated by a restoration project begin some time in the future when the restoration project is complete. The services increase over time as the functionality of the habitat increases (e.g., vegetation grows, benthic invertebrate colonies develop, etc.). Full services are attained when the restoration project provides the baseline level of services to offset the service losses. Note that this means restoration projects need not generate the maximum, or even the historical level of services. Instead, it is the level of services that the habitat would have provided but for the injury. In the scenario depicted above, the services provided by the project continue in perpetuity. The area under the curve, when discounted and expressed as present value in the base year, is the credit per acre generated by the restoration project.

The necessary size of the restoration project is stated as follows:

$$\text{Restoration Project Size (acres)} = \frac{\text{Debit (DSAYs)}}{\text{Credit (DSAYs/acre)}}$$

Formally, the HEA model is given by:

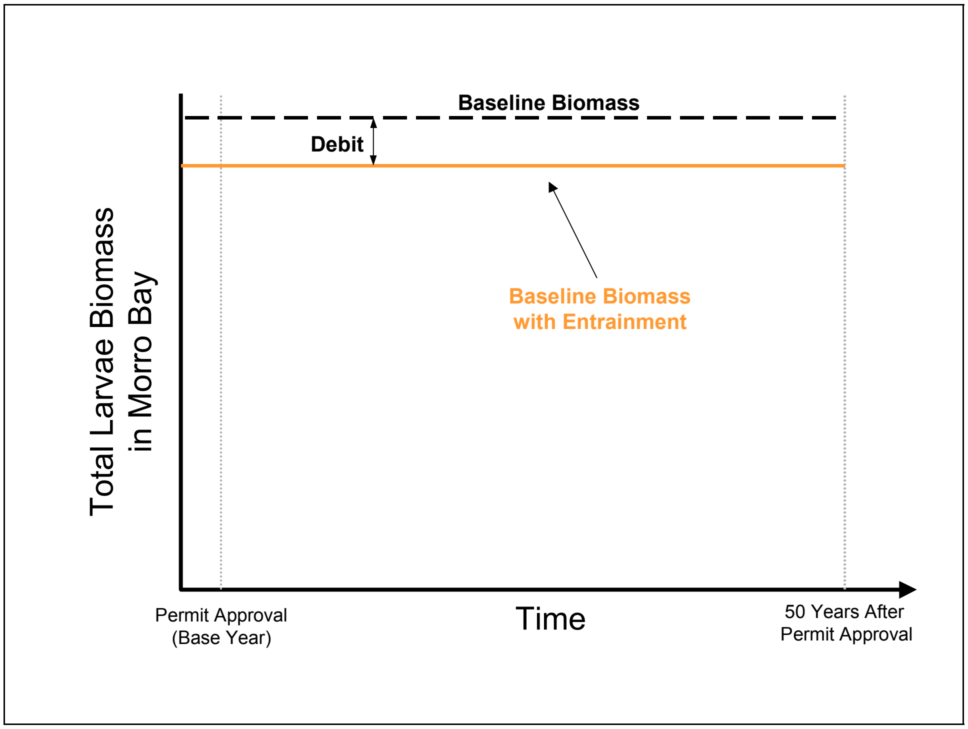
$$\sum_{t=0}^{B}\left[\rho_t \frac{(b_t^j - x_t^j)}{b^j}\right] * J = \sum_{t=I}^{L}\left[\rho_t \frac{(x_t^p - b_t^p)}{b^j}\right] * R$$

where t is time and
t=0 is the base year
t=B is the time of full recovery
t=I is the time that services begin to accrue from the restoration project
t=L is the time at which the restoration project ceases to provide services (can be infinity)
x_t^j is the level of services provided by the injured resource at time t
b_t^j is the baseline level of services at time t
x_t^p is the level of services provided by the restoration project at time t
b_t^p is the level of services provided per acre of the restoration project at time t
ρ_t is the discount factor, where $\rho_t = 1/(1+r)^t$, and r is the discount rate
J is the quantity of units injured (usually area or volume)
R is the size of the restoration project.

4.2.4 HEA Applied to MBPP Entrainment

To quantify the service loss from entrainment, the debit will be presented in terms of reduced biomass due to entrainment. Note that this loss was conservatively assumed to be the annual entrainment presented in the 316(b) assessment, even though many of these organisms would have been transported out of the bay by natural processes. The estimated annual biomass loss was assumed to occur each year for a period of 50 years, the assumed maximum lifespan of the MBPP. The value of this lost biomass over time is the debit. The debit in this scenario is depicted in Figure 10.

Figure 10: The HEA Debit as Applied to Entrainment



Note that it is not necessary to estimate the baseline and biomass in this case because the entrainment sampling conducted in the 316(b) Resource Assessment measured the appropriate reduction in services (biomass in this case) required by the HEA model. The biomass loss was estimated from the annual entrainment estimates presented in the 316(b) Resource Assessment Study (Tenera 2001). Entrainment losses were estimated by extrapolating from weekly larval abundance samples at the CWIS intake an annual estimate based on the proposed maximum annual daily permitted volume that would be withdrawn. A portion of these samples was used as the entrained density of larvae in the Empirical Transport Model (ETM). The entrainment results were based on the proposed maximum annual permitted volume of 413 MGD.

The weight of each larvae entrained was estimated based on length-weight equations from scientific literature. To be conservative, the maximum length collected (Tenera, 2001) for each species was used. The biomass lost for each species is the product of the number entrained and the weight per individual.

The credit for entrainment losses is the value of the services produced by a restoration project (biomass, in this case). Similar to the graph in Figure 10 the biomass produced is initially zero, then increases as the restoration project benefits develop. The durations of the benefits provided are project specific, and are discussed in Appendix D. The following sections describe the methods used to estimate the fish and crab biomass that would be produced by a habitat restoration project.

4.2.5 Habitats Present in Morro Bay and the Ecological Benefits and Services Provided

Possible habitat restoration projects in Morro Bay were identified by considering the habitats that would produce species of entrained larval fish and shellfish biomass. There are three major habitats that directly interact with the water column habitat: eelgrass beds, marsh (upper and lower), and mudflats. Each habitat provides numerous and diverse resources and services to Morro Bay, including the primary production that is converted to larval fish and crab biomass.

The most productive habitats in a coastal ecosystem are water column eelgrass and coastal salt marsh. Eelgrass restoration and preservation has been identified as a priority action in the Morro Bay CCMP. In addition, prevention of sedimentation and removal of existing sediment excess are also listed as priority actions for the bay by the NEP. Removing sediment or preventing sediment accretion will create additional water column habitat within the bay. Because of the clear biological relationship and the desire by local resource managers and stakeholders to conserve or create additional coastal marsh and/or submerged aquatic vegetation (specifically eelgrass), Duke has elected to focus restoration actions and the HEA analysis on these two habitat types.

In addition, as described below, both of these habitats produce many services and benefits above and beyond fish and crab biomass. However, Duke is only measuring the benefits associated with this biomass in the HEA model. This provides additional assurance that the compensation presented in the HEP is more than adequate to offset any losses associated with entrainment.

Summaries of the ecological benefits and services provided by eelgrass and coastal marsh are presented below; full discussions can be found in Appendix G.

Eelgrass Habitat

According to the NEP, a significant decline in the total acreage of eelgrass has occurred in Morro Bay. In recent years, the number of acres of eelgrass beds have been reported to be < 50-90 acres (NEP, 2000, Tenera 2001). The decline appears to be primarily associated with the increase in sedimentation.

Eelgrass (*Zostera marina*) beds residing in Morro Bay are found in the lower intertidal zone in dense stands and are considered critical habitat in this ecosystem. These beds are complex and highly productive systems that serve as a spawning, nursery, and/or forage grounds for a variety of fish and invertebrate species.

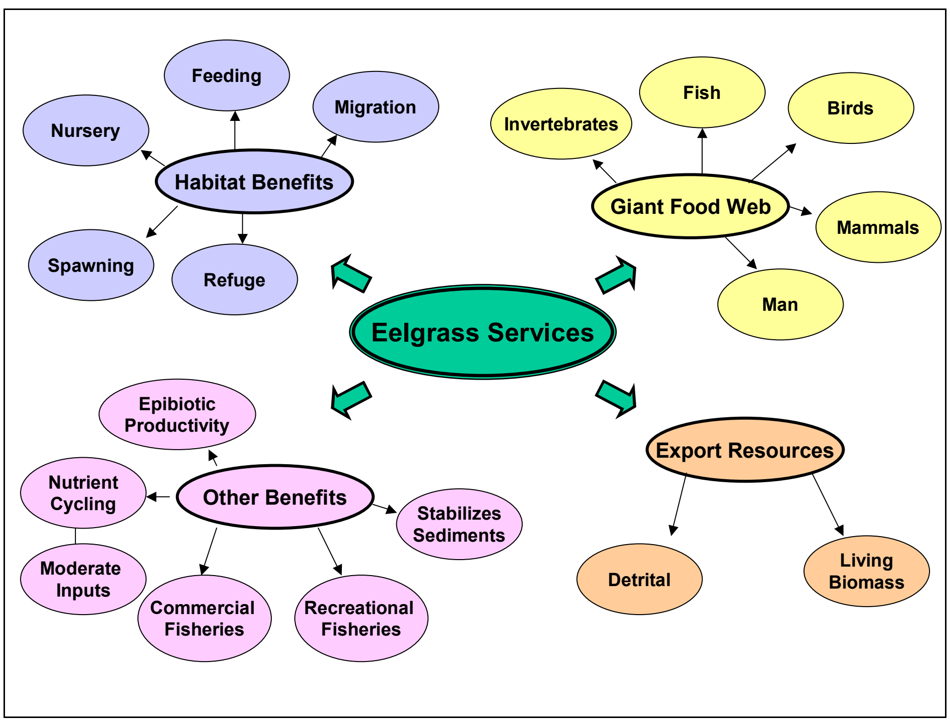
Coastal Marsh Habitats

Coastal marsh habitats provide a transition zone between terrestrial and aquatic environments. Coastal marsh habitats tend to be shallow water estuarine systems that usually exhibit a low diversity of aquatic organisms, but can support a large number of individuals. Salt marshes provide critical spawning and nursery areas for juvenile fish and shellfish. Salt marshes also provide many bird services including nesting, cover, and foraging habitat for a number of bird species. These habitats play an essential role in erosion control and can significantly aid in reducing the effects of sedimentation. In addition, the export of detritus from decaying vegetation provides an important energy source for the surrounding habitats of the estuary. Salt marshes can also act as a trickling filter for the degradation of organic wastes and the cycling of nutrients. The Morro Bay Estuary consists of more than 430 acres of marsh, which is predominantly low salt marsh or high salt marsh in which 17 plant species have been identified.

4.2.6 Services Provided by Eelgrass Beds and Coastal Marsh Habitats

This analysis uses the primary production of eelgrass and coastal marsh habitats to determine the number of acres of habitat required to produce enough fish biomass to offset the effects of entrainment. In addition to offsetting entrainment, the habitat restoration projects exemplified herein would produce many other beneficial services, as discussed below. It is important to consider that all the benefits illustrated in Figure 11 would not result from alternative approaches of compensating for the effects of entrainment, such as aquaculture or operational alternatives that result in no water intake.

Figure 11: Direct and Indirect Benefits Provided by Eelgrass and Coastal Marsh Habitats



Both coastal marshes and eelgrass beds are ecosystems that incorporate a giant food web. In addition to the primary productivity, microflora, and detritivores that have been previously discussed, there are several other groups of organisms that depend upon and utilize coastal marsh and eelgrass habitats. For example, insects in coastal marshes are characterized with high species and trophic diversity. Insects feed on vascular plants and algae as well as decaying plant and animal tissues. Many insects serve as a food source for birds and many other marsh animals. Insects are also important for pollination of various marsh halophytes. A survey of one southern California coastal wetland has reported that the marsh is estimated to support 1,200 species of insects (Zedler 1982). In addition, there are a number of mammals including mice, shrews, fox, gopher and skunk that either reside within the marsh or rely upon the marsh for some other ecological service.

California estuaries provide important habitat for a number of fish and shellfish species with commercial and recreational value including halibut, herring, Dungeness crab, Pacific oyster, and variety of clam species (Zedler 1996). Both coastal marsh and eelgrass habitats support a diverse number of prey and predator fish species that are essential in supporting all or certain life stages including eggs, larvae, juveniles, and adults.

California coastal wetlands support hundreds of thousands of birds and dozens of species that migrate along the Pacific Flyway. The marshes, eelgrass beds, and adjacent tidal flats serve as important habitat for migratory stopovers, breeding, and wintering grounds for numerous waterfowl and shorebirds, including ducks, geese, coots, gulls, herons, along with a variety of other shorebirds (Zedler 1982, Zedler 1996).

Five habitat services –feeding, refuge, spawning, nursery, and migration –are provided by both coastal marsh and eelgrass habitats for a variety of organisms. For example, there are a variety of fish species that will migrate into eelgrass beds at night for protection, while there are other fish species that will migrate into eelgrass beds for feeding. Coastal marshes are important habitat for nesting for a variety of birds, while eelgrass beds provide essential nursery habitat for a variety of fish and invertebrate species.

Wetlands provide a wide range of ecosystem benefits. Their root systems provide a vital function of stabilizing bottom sediments. These habitats also act as a sink for sedimentation and can offer protection from storm and wave action. Water quality improvement through filtering and processing municipal, industrial and agricultural wastes is also another service provided by these habitats along with the recycling of organic and inorganic nutrients (Phillips 1984, Zedler 1982).

A high percentage of threatened and endangered species (T&E) rely on wetland habitats for their survival. For example, 48% of the total T&E fish species, 68% of the total T&E bird species, and 66% of the total T&E mussel species rely upon wetlands habitats throughout the United States. Although wetlands only occupy about 3.5% of the land area in the United States, of the 209 T&E species listed in 1986, about 50% depend on wetlands for survival and viability (Mitsch and Gosselink 2000). In Morro Bay twenty species including birds, mammals, reptiles, amphibians, fish, invertebrates, and plants have been listed as special status species (CCMP 2000).

Another important service or commodity of both coastal marsh and eelgrass beds in Morro Bay is the export of detritus and living biomass. Living biomass is constantly moving in and out of these habitats and offering additional resources to adjacent habitats including the mudflats and open water systems. The shallow estuarine ecosystem of Morro Bay includes approximately 1,300 acres of tidal mud flats (NEP 2000). Tidal flats are ecologically important areas and a vital part of the estuarine food chain. The export of the detritus from adjacent coastal marshes and eelgrass habitats to the tidal flats offers an essential energy input that is utilized by the primary consumers, which in turn are prey for higher levels of the food chain. Tidal flats are the main feeding grounds for coastal shore birds, fish, and many invertebrates (Field, D.W.,et.al. 1991, Phillips 1984, CCMP 2000).

Benefits of coastal marsh and eelgrass habitats to humans encompass various recreational functions including fishing, hunting, and bird watching. They are also valued for education and research purposes, as well as aesthetic, heritage, and non-use values.

The value of all of these functional and ecological services offered by coastal marsh and eelgrass habitats are enormous and would far exceed the value of the ecological services of replacing the fish and crab biomass associated with entrainment presented in this proposal. Essentially, the scaling for fish and crab biomass in providing compensatory acres only accounts for the biomass derived through the detrital food web for crabs and fish. It is important to recognize that the compensatory acres for scaling the entrainment losses in this proposal do not account for the higher food chain organisms that will benefit from the habitat restoration projects, nor do they account for all of the habitat services being provided (i.e. nesting, migration) for a variety of organisms, nor do they account for other resources that rely upon these habitats (i.e. insects, mammals, birds, etc.), nor do they account for the export of detritus and living biomass to the adjacent tidal mudflats and open water ecosystems of Morro Bay, nor do they account for the benefits to T&E species, nor do they account for services and benefits related to stabilizing sediments, water quality improvement, and nutrient cycling, nor do they account for the direct and indirect benefits related to human value.

Because eelgrass and coastal marsh habitats provide the many ecological services discussed above, restoration of these habitats is considered a high priority for both the regulatory agencies and the public in California. Morro Bay is the only significant wetland between Monterey bay and Santa Monica bay.

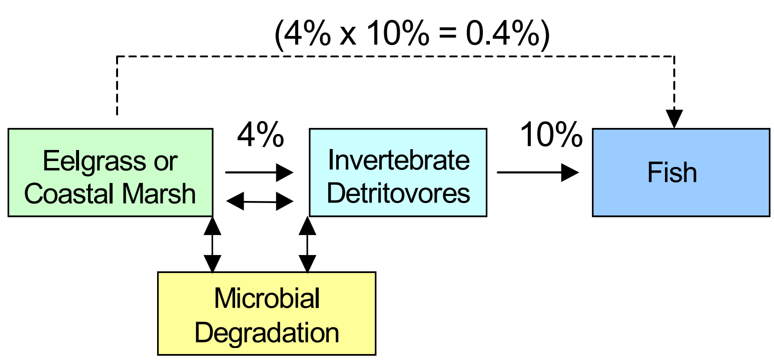
4.2.7 Energy Transfer

As part of the HEA model, an energy transfer (or trophic efficiency) model was used to estimate the amount of aquatic fish and shellfish larval biomass that would be produced by habitat restoration projects. This approach has been used by NOAA (1996) to scale habitat injury to habitat restoration projects. Specific application of this approach can be found at the NOAA website (www.darcnw.noaa.gov/download.htm). For the example of eelgrass or coastal marsh, the trophic efficiencies used 4% for shellfish and 0.4% for fish. These efficiencies were calculated as follows.

Two trophic energy pathways, as depicted in the figure below, are involved in the detrital-based food web systems from eelgrass or coastal marsh vegetation to fish. The first energy pathway is the utilization of detritus by the assemblage of invertebrate detritivores; the epibenthic fauna and benthic fauna. The second energy pathway is the consumption of the invertebrate detritivores by the fish.

The trophic efficiency involving the breakdown and utilization of detritus of coastal marsh or eelgrass vegetation is low as a result of the complexity that is involved with degrading large fractions of detritus into fine particles. It involves three fundamental processes: 1) cycling of soluble organic compounds; 2) colonization of the detrital substrate by bacteria, fungi, and protozoans; and 3) the physical and biological fragmentation of the decaying plant tissue. The invertebrate detritivores, being a mixed group of organisms, obtain some of their energy from the decaying plant material, some from the microbes that are associated with the detritus, and some as carnivores devouring protozoans and other small invertebrates that have fed on the microbes and detritus. Most of the invertebrate detritivores can not digest the cellulose, but they accelerate the process of decomposing the cellulose by breaking-up the detritus into smaller fragments that increases the surface area for microbial activity. The microbes mineralize organic matter, which is absorbed onto the detritus. This sorbed organic matter is assimilated when the particles pass through the guts of the detritivores. The detritivores also produce various proteins and growth substances that stimulate microbial growth. The detrital particles pass through the guts of many species in succession until the substrate is exhausted (Odum 1971, Thayer 1979). This complex process of detritus degradation and successive consumption of detritus by the detritivores assumes a low ecological efficiency of 4% (French, et. al. 1996). NOAA uses the 4% value in evaluating injury and scaling restoration projects for coastal and marine environments.

Figure 12: Energy Transfer Efficiency between Habitats and Fish



The second trophic level to be considered in the model is the secondary consumers or the ecological transfer efficiency of the primary consumers or detritovores to the secondary consumers or fish. This transfer efficiency has been estimated to be 10% to 30% based on literature references for freshwater and marine environments (Slobodkin 1960, 1962, Odum 1971, Peterson and Curtis 1980, Jones 1984, Ryther 1969).

Ecological efficiencies of 5% to 15% were reported for the consumption of killifish (*Fundulus heteroclitus*) by larger predators in coastal marshes (Valiela, et. al. 1977). Killifish, which are a common salt marsh fish, would feed upon an assortment of detritivores and invertebrates. Since energy flow between trophic levels can depend to a considerable extent on the size of the organisms, the smaller the organism, the smaller the biomass that is needed to support a particular trophic level in addition to the energy loss that is created at each trophic transfer (Odum 1973). Subsequently, the ecological efficiencies of the trophic level between killifish and detritivores would be expected to be greater than the 5% to 15% reported for the consumption of killifish by the larger predators.

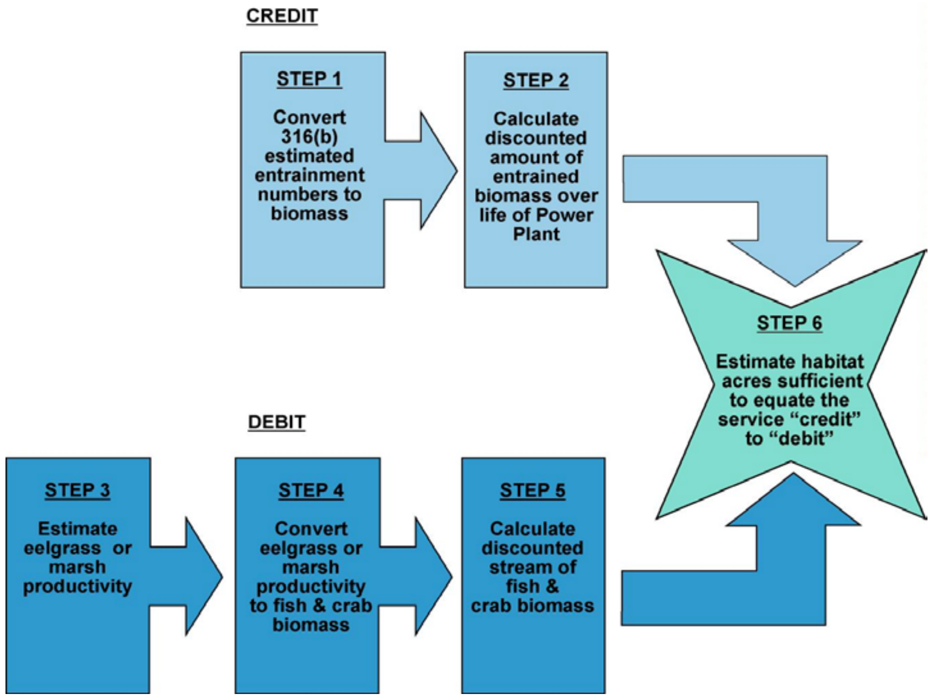
An abundance of available energy has been reported within eelgrass communities, and studies on the transfer efficiency of fish macrofauna communities residing in eelgrass beds have been completed (Thayer et al. 1975). Ecological efficiencies for the macrofauna were calculated to be 12% and a high efficiency factor of 24% for fish communities was determined. The high efficiency of eelgrass systems allows juvenile and small fish to use less energy in searching for food and avoiding predators and more for growth and reproduction (Thayer, et. al. 1975). The higher macrofauna reported most likely includes the epibiota food resource that is also available, indicating the high-energy output that can be expected. For salt marsh restoration in New Jersey the marsh to fish transfer factor was reported to be 10% (PSE&G, 1999). However, this value did not account for unquantifiable detritus export and associated productivity.

For this study, a 10% ecological efficiency for the second trophic level was applied in the HEA analysis. It should be noted that NOAA, in scaling injury and restoration projects to offset the injury, uses a 20% ecological efficiency factor. Several of these studies can be viewed on the NOAA website at www.darcnw.noaa.gov/download.htm.

To obtain the overall efficiency of the conversion of plant biomass (or detritus) to fish biomass, the two trophic transfer efficiencies (for primary and secondary consumers) are multiplied. The result is a 0.4% transfer efficiency rating for either eelgrass or coastal marsh to fish biomass.

The procedure for calculating the amount of biomass lost versus how much biomass will be replaced by the creation of eelgrass or marsh restoration is presented in the following Figure 13:

Figure 13: Procedure for Calculating Biomass Lost and Replaced



4.2.8 Model Output: Restoration Project Acres Required

The debit was calculated for entrainment of fish and crab larval biomass, resulting in two debits as proxy of all entrained organisms. The debit was estimated for total fish and crab larvae biomass loss from entrainment by applying length:weight equations to the measured maximum length for each species. The resulting biomass was multiplied by the total number of larvae reported in the 316(b) Assessment Report to yield the annual biomass loss. This annual loss was assumed to occur for 50 years. In Step 2 the HEA debit is calculated using biomass loss over 50 years loss at a discount rate of 3%. These results for fish and crabs are presented in Table 4 below. A detailed, step-by-step analysis showing how these results were calculated is presented in Appendix D.

As an example for eelgrass or salt marsh restoration, the HEA model credit is determined by estimating the fish and crab biomass produced per acre of habitat restored using the energy transfer model. The total acres required for the restoration project is determined by dividing the debit by the credit as shown in Table 4 below. The steps of the credit calculation (steps 3-6 in Figure 13) are explained in detail in Appendix D.

Table 4: Illustration of HEA Credit and Required Acreage from Eelgrass or Coastal Salt Marsh Creation Projects

	Biomass Entrained (Debit (kg))	Production (Credit (kg/acre))	Acres Required to Produce Entrained Biomass
Fish larvae	120,167	2,232	53.8
Crab larvae	76,759	22,320	3.4
Total			**57.2**

4.3 Comparison of HEA Model Approach with Regional Board Approach

As discussed at the beginning of Section 4, the Regional Board staff's methodology equates proportional entrainment mortality with lost production of the bay, and uses acre-years to measure both the extent of impact and the amount of needed mitigation. Duke agrees in general with the approach based on lost production, but respectfully disagrees with any approach based on lost productivity and remains of the view that sufficient compensatory reserve exists within Morro Bay to ensure that the future production from the populations of entrained species is not jeopardized.[52] Duke does not agree that proportional mortality corresponds with loss of bay productivity (defined in ecological terms as ***the capacity to reproduce***).[53] Further, the approach employed by the Regional Board staff assumes that all acres are equally productive, when that is clearly not the case. For example, restoration of 50 acres of high quality habitat may well provide far more benefits that restoration of 100 acres of lesser quality habitat. The amount of primary and secondary production per acre can vary greatly between types of habitat.

However, Duke agrees that entrainment represents a loss of biomass in Morro Bay that might affect other aspects of the bay's trophic system, even though such an effect would be very difficult to detect. The role of the HEA model is to attempt to quantify the extent of the lost biomass (the "debit" side of the equation) and the amount of biomass (or value of ecological services) that are derived through mitigation (the "credit" side of the equation).

Duke also agrees that the acre-years approach advanced by the Regional Board staff provides an "outer boundary" on the scope of mitigation that could be needed to offset entrainment effects. Duke acknowledges the importance of reconciling the results of the HEA with the staff's methodology, and to "true up" the effectiveness of the HEP and its associated

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52 It is important, however, to recognize that this disagreement does not effect the proposed mitigation, only how that mitigation is best determined.

53 Duke agrees that PM is a measure of the entrainment effects, but that translating this into lost bay productivity on a 1:1 basis is unduly conservative. We believe that the HEA model provides a more effective way of gauging entrainment effect to offset.

NPDES building blocks to meet Regional Board expectations.[54] In this regard, it should be noted that the staff's acreage-based estimate of mitigation funding, when adjusted to account for the differences in the types and value of ecological services provided by different habitats, is similar to Duke's. This convergence provides further confirmation that the HEA approach is reasonable and complementary with the Regional Board's approach.

Whether the Regional Board's or Duke's methodology is a more effective analytical tool is a question that does not need to be answered here. Both methodologies have their rationales and justifications, and both have been used in other cases. What is important is that Regional Board staff and Duke agree that measures which reduce sedimentation, or restore or enhance habitat, ***will*** have the effect of offsetting the effects of entrainment and increasing the function and life of the bay. By any measure, these benefits exceed those that would be achieved by simple replacement of larvae or installation of alternative cooling technologies.

4.4 References

References for the HEA analysis can be found in Appendix H.

[54] This being said, Duke does not believe that acre-years is an appropriate formal performance matrix for the HEP. The scale and scope of natural processes affecting the life of the estuary make measurement inherently imprecise. For example, the recently completed PWA report (Appendix I and J) emphasizes the unknown effects of such macro influences as rising sea levels and major storm and fire events on sediment loading. Also, the PWA report discusses longevity on a near geological time scale of 100s and 1000s of years. While relevant to understanding the influences affecting the bay and identifying programs to address them, the physical nature of these long and macro processes make acre-years inappropriate as a specific performance measure for the HEP.

SECTION 5: SPECIFIC RESTORATION PROJECTS

Duke is proposing to implement a number of in-bay restoration and watershed management projects focused on extending the ecological service life of Morro Bay and increasing the quality and quantity of habitat responsible for aquatic biomass production. The ecological benefits that will result from these projects have been validated by the HEA methodology, which uses worst-case entrainment loss numbers, conservatively estimates benefits associated with the proposed restoration activities, and liberally estimates project costs by using established high-end restoration cost estimates. This analysis demonstrates that the restoration projects proposed by Duke are more than sufficient to offset any loss of biomass that is associated with the MBPP.

To further assure this outcome, Duke has not included in the calculation of ecological credits the value of any of the ecological services or benefits that will be generated by the proposed projects, beyond the production of fish and shellfish larvae. Each of these projects will generate numerous other ecological benefits and services including, but not limited to, improved water quality, increased quality and quantity of habitat for birds (specifically the black brandt) and wildlife, and improved commercial and human recreational use.

PWA has estimated the amount of sediment that has accumulated in Morro Bay since 1884.[55] The PWA report presents the estimates of accretion for the overall bay by presenting it in four distinct zones, 1-4. The backbay is represented by Zones 3 and 4. Sediment accumulations in this area of the bay are the result of watershed fluvial transport and deposition in the delta regions of Chorro and Los Osos creeks. As illustrated in the PWA Report, the loss of bay volume has been greatest in the bay's deltas and shallow backbay.

The most observable symptom of these historical changes has been the drastic decline of eelgrass beds and low marsh as has been recorded in bathymetric charts and a photographic record. Except for areas subject to navigation channel dredging, there has also been a corresponding decrease in the volume of the bay's tidal prism. These changes can be directly tied to the persistent infilling of the bay with stream borne sediments eroded from the bay's watershed and from aeolian (wind driven) transport from the sandspit. Therefore, in order to effectively protect aquatic habitats, the control and reduction of bay sedimentation must begin in the watershed. Without a watershed sediment reduction program, in-bay habitat restoration projects that involve removal of accumulated sediments will have inadequate long-term protection from redeposition of sediment.

The HEP proposes a combination of in-bay restoration activities and watershed projects. This is done in order to balance in-bay restoration with a corresponding effort to reduce future infilling from watershed and aeolian sources. Of the six projects proposed by Duke, three are considered in-bay projects and three are considered watershed/sediment control projects. In-bay approaches extend the life of Morro Bay and increase biomass production through the restoration or preservation of eelgrass or low marsh, and may include

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[55] See PWA Report, Table 3-1 (Appendix I).

dredging of accumulated sediment from the bay or delta, or both. Removing sediment accumulation also benefits Morro Bay water quality by restoring important bay hydrodynamics and flushing rates. The bay's tidal volume directly determines the bay's hydrodynamic processes, particularly in these backbay reaches, which appear to have reduced circulation. Reducing and preventing sediment infilling of these backbay reaches can restore hydrodynamic processes that increase the rate at which potentially harmful contaminants are flushed from the system.

Watershed approaches include sediment trapping through restoration of native vegetation and possible structural traps, the implementation of Best Management Practices (BMPs), and the acquisition of property rights to strategically located properties. Discontinuing sediment infilling will directly preserve and potentially improve every ecological service presently provided to Morro Bay. Sediment infilling not only smothers the bay's populations of clams and other filter-feeding organisms, but also directly eliminates the production of water column food supplies. Nearly all of the sediment-dwelling organisms (infauna) provide the only link between the bay's primary producers and its primary and secondary consumers. The ecological benefit of preventing further losses of bay volume is equivalent to preserving the bay's food web and all of its numerous services to the bay's fish, shellfish, and wildlife.

The following subsections describe each of Duke's proposed restoration projects, including a discussion of project goals and objectives and a cost/benefit analysis. A full HEA model result for each project can be found in Appendix E. Duke anticipates that it will have additional discussions with Regional Board and CEC staff and their independent experts concerning these projects prior to issuance of the NPDES permit for the modernization Project. However, Duke does not anticipate that the level of funding or intended outcomes of the projects will change in any material way. As such, implementation of these representative projects is a key objective of the HEP.

5.1 Summary of Selected Projects

The projects summarized in Table 5 were selected using the project selection criteria discussed in Section 3.3.2.

Table 5: Summary of Representative Projects

Project	Category	Acres of Credit (estimate)	Cost	Benefit (% of debit)
1. Removal of Hoary Cress	In-bay	18	$1,500,000	31.43%
2. Restoration of Mudflat and Eelgrass	In-bay	16	$2,080,000	28.80%
3. Sand Spit Stabilization	In-bay	3	$500,000	3.42%
4. Chorro Flats—Phase II	Watershed	52	$3,200,000	27.03%
5. Hollister Ranch Sediment Control	Watershed	27	$2,000,000	16.05%
6. CalPoly-Walter's Ranch Sediment Control	Watershed	1-2	$400,000	0.27%
Total		**117-118**	**$9,680,000**	**107.00%**

Each project is discussed below. The Administering NGO, in conjunction with interested stakeholders, will work to develop specific implementation and monitoring strategies, as well as performance metrics for each project.

5.2 Removal of Hoary Cress from Chorro Delta

5.2.1 Description of Project

The Hoary Cress Removal Project is located on the Chorro delta near the Twin Bridges, in an area owned by the State Department of Parks and Recreation. Both the NEP and PWA have identified restoration of this 13-acre area as a high priority action item. Figure 14 provides a photo of the area.

As described in the PWA report, Hoary Cress is an invasive herbaceous plant that occurs throughout California and exists in most areas where disturbance is prevalent. It occupies the transition zone between marsh and upland habitats. The presence of Hoary Cress on the Chorro Delta is attributed to and indicative of increased deposition of eroded watershed sediments and the resultant increase of surface elevation. Hoary Cress exists in areas which range in elevation from +4 to +7 NGVD, and it overlaps considerably with the native salt marsh vegetation, predominantly *Salicornia virginica* (also known as pickleweed). It is believed that saltwater inundation limits the lower extent of this species. The most efficient way to eradicate Hoary Cress is to excavate it.

Figure 14: Ground Level View of Hoary Cress

The Hoary Cress project has been discussed in some detail in Section 3.2.1 of the PWA report, although details of project design and engineering have not been developed. As presently envisioned, the project involves significant earthmoving activities to convert the area from a transitional upland habitat to low coastal marsh habitat. Subject to feasibility analysis and engineering input, the restoration activities that will be carried out as part of the Hoary Cress project include:

1. Excavation of sediment over the 11-13 acre tract discussed in the PWA report to reduce the surface elevation to approximately +3 to +4 NGVD. This will result in the removal of approximately 2 feet across the project area, allowing the reestablishment of low marsh. The estimated volume of material to be removed is approximately 50,000 cubic yards.

2. Excavation of the adjacent channel to remove accumulated sediments and to increase surface water circulation into the back portion of the delta.

The amount of sediment to be removed is included in the amount of material estimated above. The purpose of this action would be to ensure that the channel is at the proper elevation to allow adequate circulation into the back portions of the project area and adequate hydraulic connectivity between the constructed low marsh and the bay.

3. Excavation of an additional 5-acre area (approximate) identified in the PWA report that is adjacent to the primary Hoary Cress area and extends underneath the Twin Bridges, near the Chorro Flats project.

   Since the new bridge was constructed to replace the Twin Bridges, the area underneath and immediately north of the bridge has become silted in and the elevations have increased to such a level that Hoary Cress and other transitional upland vegetative species have invaded this area.

   The amount of material that will have to be excavated to restore this area to low marsh habitat is approximately 6,500 cubic yards.

Thus, the total amount of material that will have to be excavated in order to restore this 18-acre area to low marsh will be approximately 60,000-70,000 cubic yards.

5.2.2 Project Objectives and Goals

The primary goal of the project will be to create low marsh habitat for the purpose of increasing the production of biomass in the delta. This will require the excavation and removal of accumulated sediment and invasive vegetative species. In addition, the project contemplates minor modifications to the associated channels in the delta, which would improve circulation, sediment flushing from the Chorro delta and hydraulic connectivity with the bay to ensure that Hoary Cress does not reestablish itself in this area.

5.2.3 Cost/Benefit Analysis

Because the land for this project is under public ownership, this project is ranked high under a cost/benefit analysis because all restoration dollars spent will go directly to restoration activities. Thus, more ecological benefits can be generated per dollar spent. The project also has a high feasibility and likelihood of success for generating the type of benefits that Duke is seeking to generate to offset entrainment losses from the MBPP.

While the project as been identified by both the NEP and in the PWA report, a source of funding for its implementation has not been identified. Accordingly, HEP funding supplied by Duke will enable this important project to be completed in a timely manner.

The PWA report estimates construction costs to range from $5-10 per cyd of sediment removed. For the entire project, Duke estimates that approximately 60,000 to 70,000 cubic yards of sediment will have to be removed in order to create low marsh. Based on the PWA cost range, removal costs are estimated to range between $350,000 - $700,000. This cost estimate does not include any costs associated with replanting of low marsh vegetation since it is anticipated that the area will naturally recolonize with appropriate vegetative species once the elevation is corrected.

To insure the availability of sufficient funding to implement the project, Duke has doubled this construction cost estimate to include funding for management, planning, permitting, engineering, monitoring, and disposal, if required. Therefore, for this analysis, the total estimated cost range for the project is approximately $700,000 to $1.5 million.

The volume of material being excavated may vary based on exact topographic elevations and engineering input, which have not been developed for this area. The wide range in the cost estimate is also related to the fact that the restoration tasks are in the preliminary stages and have not yet been scoped, designed and/or engineered in more detail. The project cost estimates include funding for planning, design, engineering, sediment disposal, monitoring, and project management.

Based on the preliminary cost estimates, Duke is allocating $1.5 million of the total HEP funding for the Hoary Cress removal-low marsh restoration project. The creation of approximately 18 acres of in-bay low marsh habitat in the Chorro Creek delta will serve to directly offset a proportion of the loss of biomass attributed to entrainment associated with the MBPP.

5.3 Restoration of Mudflat and Eelgrass Habitats

5.3.1 Project Description

Morro Bay's mudflat and eelgrass habitats are vitally important to the health and biological production of the bay ecosystem. The loss of volume in the bay's tidal prism as a result of infilling of the bay also represents a direct reduction in the amount of water column habitat. These losses can be directly tied to the persistent infilling of the bay with stream, borne sediments eroded from the bay's watershed and from aeolian (wind driven) transport from the sandspit.

The proposed Mudflat Recovery and Eelgrass Restoration Project focuses on efforts to recover historical mudflat and eelgrass habitat lost due to infilling by watershed (fluvial) and beach (aeolian) sediments.

This project consists primarily of the dredging of existing mudflats to restore at least 16 acres of historical eelgrass beds. The selection for the location of these 16 acres has not yet been made. The COE is currently in the process of assessing these and other in-bay restoration projects and has conducted a number of public workshops and stakeholder meetings, in addition to convening a technical advisory committee to assist in assessing the feasibility and effectiveness of a wide range of in-bay projects. The Coastal Engineering Division of the COE's Los Angeles District is currently evaluating various alternatives for restoration of the mudflats and the costs and benefits of these alternatives.

Duke has assessed the mudflat removal project and considers it to be a viable candidate for inclusion in the HEP. It appears from bathymetric maps included in the PWA report that as many as 600 acres of mudflats currently exist in Morro Bay. Based on a review of these maps, Duke estimates that approximately 1.5 to 2.0 feet of sediment per acre would have to be removed in order to re-establish eelgrass habitat in select locations. As part of this project, approximately 52,000 cubic yards of material will require removal and disposal.

Duke proposes that this project would be conducted in conjunction with the COE's larger in-bay restoration project. As such, this project should be eligible for federal matching grant money available through the COE. Under the current grant program, the local sponsoring agency is only to provide 35 cents of every project dollar, with the balance paid by the COE.

5.3.2 Project Objectives and Goals

The primary objective of the proposed mudflat-dredging project is to reestablish historical patterns of mudflat drainage channels and tributaries and the restoration of elevation in Zones 3 and 4, as identified in the PWA report. Duke proposes that this project be carried out in conjunction with the COE' "in-bay" restoration activities. Reduction of accumulated sediments from select areas in Zones 3 and 4 will encourage eelgrass restoration and preservation. Reducing bay bottom elevations in Zones 3 and 4 by removing accumulations of sediment, as well as the restoration of historic intertidal and subtidal hydrodynamics on the mudflats themselves, will directly benefit biomass production in the bay, increase the amount of depth-limited eelgrass meadows, and reduce the rate at which further eelgrass and low marsh are being lost or exchanged for mudflats and high marsh.

5.3.3 Cost/Benefit Analysis

While PWA did not include this project in its report, they have significant experience with such projects. During personal communications with PWA staff, Duke established an estimated cost range for dredging operations in the Morro Bay area ranging from $10-$25 cyd, noting that cost may be driven to the higher end of this range due to potential disposal costs. Also, based on some of the bathymetric maps generated by PWA in its report, Duke determined that approximately 2 feet per acre would have to be dredged or otherwise removed from much of the mudflat area to reduce the elevation such that it would be appropriate for eelgrass colonization. That estimate translates into approximately 3250 cubic yards per acre for removal. Based on this estimate, approximately 52,000 cubic yards would have to be removed to restore 16 acres of eelgrass. Using the higher end of the cost range ($20 cyd) results in an estimated cost for removal of $1.04 million This amount is expected to be sufficient to address costs associated with removal/construction, planting, and disposal.

To insure the availability of sufficient funding to implement the project, Duke has doubled this construction cost estimate to include funding for management, planning, design, and permitting, if required. Therefore, the total estimated cost is approximately $2.08 million. It is important to note that this project has been scoped and costed out based on its implementation in conjunction with the COE's larger in-bay work.

Because federal funding for this project is not certain, Duke proposes to fund 100% of this project, in the amount of $2.08 million, In the event that COE funding becomes available and is able to pay $0.65 of every dollar, HEP funding required to implement this project could be reduced to $728,000. The balance of the HEP funds allocated to this project could be used either to expand the project area or to implement other projects that would benefit the Estuary. In the former case, $2.08 million would provide enough local funding to restore 45.7 acres of eelgrass, assuming the availability of federal funds at the ratio described above.

The restoration of eelgrass habitat will serve to directly offset a proportion of the loss of biomass attributed to entrainment associated with the MBPP. Obviously, the greater the amount of acreage restored, the greater the offset effect. It should also be noted that this project is closely integrated with the watershed projects included in the HEP, which are designed to control erosion and sediment transport to the bay. Implementation of these upland projects will help preserve and maintain the areas restored through the in-bay efforts described in this section.

5.4 Sandspit Stabilization

5.4.1 Description of Project

The Sandspit Stabilization Project has been identified by the City of Morro Bay and will most likely be included in the COE's report on in-bay restoration actions. Based on historical records, it appears that the northernmost tip of the sandspit experienced a "blowout" in the 1940's which jeopardized the integrity of the entrance to Morro Bay. In an effort to stabilize the tip, the COE filled the "blowout" area with sand. Approximately 2 million cubic yards were placed in Area B during the period of 1942 to 1946. An additional 900,000 cubic yards were placed in Area B in 1956, followed by 81,200 cubic yards in 1968 and 190,000 cubic yards in 1971. Cumulatively, approximately 3.2 million cubic yards of sand were deposited in this area between the years of 1942 and 1971. It is unclear whether additional deposits were made after 1971.[56] Figure 15 shows these areas.

As a result of this deposition and aeolian transport mechanisms occurring naturally in this system, much of the sand material had migrated to the bay side of the spit. As a result, portions of the bay have been and are currently undergoing sedimentation and infilling. After reviewing historical aerial photos, Duke estimated that as much as 1 acre per year is being lost in this area due to migration of the sandspit. Figures 16 and 17 show historical (1960s) and curent conditions.

[56] COE map entitled: "COE Draft Environmental Statement, March, 1973."

Figure 15: Dredging Areas

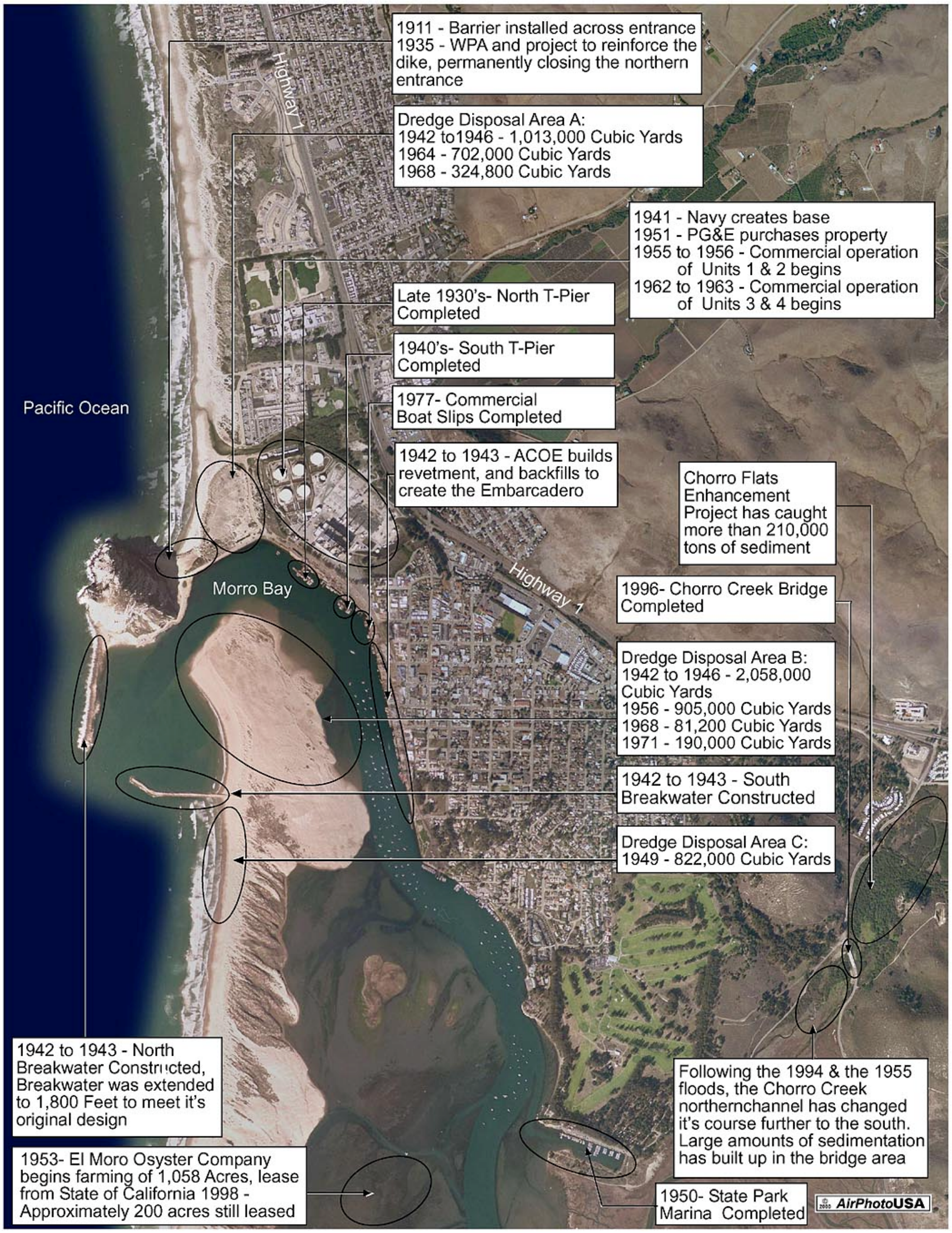

Figure 16: Morro Bay in the 1960's

Figure 17: Current Conditions of Morro Bay

Subject to feasibility analysis and engineering input, the restoration and enhancement activities associated with this project are anticipated to include:

1. Stabilization of the existing sand by strategic placement of stabilization structures.

   Because the sandspit is a coastal barrier, it is an extremely dynamic system, and the specific actions taken to stabilize future movement of the dunes will require detailed engineering to determine where, what kind, and how many stabilization structures will be required. The near-term goal is to reduce the rate of migration of the dune sand enough to allow for the establishment of vegetative cover. Once established, this vegetative cover will function as the long-term stabilization mechanism.

2. Implementation of a vegetation enhancement and management program to further assist in stabilization of the sand system.

   The establishment of vegetation on the dunes is a critical component of the dune stabilization program. Currently the dunes are sparsely vegetated, particularly at the northern end. Based on previous unsuccessful efforts to vegetate the dunes, it appears that additional plantings, without the assistance of stabilization structures, may not be successful or may not produce any measurable benefit. Duke is therefore proposing to implement both of these measures in order to achieve stabilization (or at least a significant reduction in migration rates) of the dunes.

5.4.2 Project Objectives and Goals

The primary goal of this project is to preserve eelgrass and in-bay volume that is being lost due to infilling from migration of the sandspit dunes. Stabilization will be accomplished by implementing both natural and artificial stabilization techniques, which include vegetation planting and management and construction of stabilization structures, respectively. It is expected that approximately three acres of eelgrass habitat will be reclaimed through this project.

5.4.3 Cost/Benefit Analysis

The land for this project appears to be under public ownership, therefore this project is ranked high under a cost/benefit analysis because all restoration dollars spent will go directly to stabilization activities. Thus, more ecological benefits can be generated per dollar spent.

Based on cost estimates for similar work conducted on the sand spit by the City of Morro Bay, Duke has established an estimated cost range of $100,000 to $250,000 for stabilization structures (such as fencing) to stabilize/reduce the migration of the dunes and allow the establishment of vegetative cover. These costs have been doubled to provide for funding and oversight and plant material associated with a planting program, resulting in an total project cost range of $200,000 to $500,000.[57] The cost estimate includes project planning, design, engineering, monitoring, and management. As in the case of the other projects, Duke is allocating the high end estimate ($500,000) for this project. At the present time, it does not appear that federal funds have been allocated for this work. Thus, Duke's HEP funds will enable this project to be implemented in a timely manner.

It is difficult to quantify with any degree of precision all of the benefits that will accrue to the City of Morro Bay and the bay itself from this project. However, based on historical aerial photographs illustrating siltation rates in this part of the bay, it appears that by implementing the stabilization actions described above, it can reasonably be anticipated that approximately three acres of adjacent eelgrass habitat will be protected from infilling over the next 10 years even though the rate of siltation may actually be higher. An additional benefit is the improvement of the dune habitat for snowy plovers through the implementation of a dune vegetation management program.

5.5 Chorro Flats-- Phase II

5.5.1 Description of Project

In 1996 the Regional Conservation District purchased 100 acres, of which 60 acres were used for the creation of the very successful Chorro Flats Sediment-Trapping Project. That project cost an estimated $1.0 million to construct and to date has trapped approximately 250,000 cubic yards of sediment, and preventing its deposition in Morro Bay. Figure 18 shows the Chorro Flas area.

A remaining, adjacent 40 acres (Chorro Flats II) have not yet been scheduled for restoration. However, this acreage provides comparable sediment-trapping opportunities, either active or passive depending on the approach considered most beneficial to the watershed. The restoration activities envisioned at Chorro Flats II would be very similar to the original Chorro Flats project and include, at a minimum: 1) removal of existing vegetation, 2) dirt moving and grading of the existing elevations to create the sediment trap, and 3) other associated activities needed to assist in directing watershed flow over the sediment trap.

The PWA Final and Supplemental Reports (Appendix I and J) will address this watershed project, resulting in possible changes to the scope of this specific watershed project to ensure that the most ecological benefit is generated for the effort and resources expended. Subject to feasibility analysis and engineering input, these activities would include all those described above and additional activities as needed to implement and complete the construction and operation of the 40-acre sediment trap.

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[57] Note that the actual implementation costs will be driven by the number of acres included in the program and the type, size, and number of stabilization structures that would be needed to provide sufficient protection for the vegetation-planting program.

Figure 18: Chorro Flats Area

5.5.2 Project Objectives and Goals

The primary goal of the project will be the capture and removal of stream borne sediments from the Chorro Creek watershed. The degree to which the project is ultimately able to prevent these sediments from entering Morro Bay will determine its value to preserving the bay and delaying the loss of estuarine habitat. Each acre-foot of sediment removed from Chorro Creek by the project prevents a corresponding loss of an acre-foot of bay volume, thus preserving bay volume for plankton and fish populations. Even more importantly, each acre-foot of sediment that is kept out of the bay slows the rise of the bay's seafloor elevation and the continuing loss of its productive eelgrass meadows and mudflat habitats. The documented sediment infilling and rise in elevation of the seafloor are strongly correlated to the diminished acreage of these bay habitats, over both past and recent flood events. Chorro Flats II would operate in conjunction with the already successfully operating original Chorro Flats sediment control project, and would be effective in retarding long-term bay infilling by controlling deposition of stream borne sediments.

Secondarily, by removing stream borne sediments from Chorro Creek, the project is expected to improve the water quality of the creek before it enters Morro Bay, thereby lowering turbidity levels in Morro Bay. The reduction of turbidity levels in the bay addresses one of the primary goals for the Regional Board's TMDL program and promotes growth of eelgrass meadows in the bay by increasing the depth of penetration of the bay's photosynthetically active light. The project's ability to both slow the further rise of the bay's seafloor and to increase the amount of sunlight reaching the seafloor will doubly benefit the bay's eelgrass meadows. Not only can the bay's production of eelgrass be directly linked to the production of larvae entrained by the MBPP, but a number of recent studies have documented the importance of eelgrass in the rearing of other fish species not affected by the MBPP, such as rockfish.

5.5.3 Cost/Benefit Analysis

Once again when developing cost estimates, Duke relied on PWA for input. PWA determined that the original Chorro Flats project was constructed for approximately $1 million which resulted in an approximate cost of $10,000 per acre. PWA noted, however, that it would be unlikely that the costs of a similar project would be that low, and further indicated that PWA had implemented a similar project recently in a nearby watershed for approximately $40,000 per acre. Therefore, the estimated construction costs range from $400,000 - $1.6 million. This wide range is also reflective of the fact that this project remains in the preliminary stages and has not yet been scoped, engineered, or designed in detail.

To ensure the availability of sufficient funding to implement the project, Duke has doubled this construction cost estimate to include funding for management, planning, permitting, engineering, monitoring, and disposal, if required. Therefore, the total estimated cost range for the project is approximately $800,000 to $3.2 million. The project cost estimates include funding for planning, design, engineering, potential disposal of sediment, monitoring, and management of the project.

The anticipated benefits for this project have been based on the sediment trapping rates demonstrated by the original Chorro Flats project, normalized over 30 years. It is well understood that the amount of sediment captured by the original project was most likely dramatically accelerated as a result of the 1994 fire and other atypical weather events. Therefore, it is not likely that the second phase of the project would capture sediment at this same accelerated rate. PWA has estimated a normal typical sediment capture rate, which has been used by Duke to estimate the benefits to be gained from this phase of the project.

Based on that normalized sedimentation rate, Chorro Flats II is anticipated to capture approximately 168,000 cubic yards of sediment and prevent its deposition in Morro Bay. At this rate, this project will protect and preserve approximately 52 acres of low marsh habitat from almost certain loss due to sedimentation. The credit generated by Chorro Flats II is determined by the number of low marsh acres preserved, based on the relationship between the anticipated amount of sediment removed by the project and years of low marsh habitat service extension.

The benefits that have been developed for this project using the HEA model used conservative assumption that the project would be designed as a "passive" sediment trap with one-time use. Once the trap has been filled to capacity, it will be managed as habitat.

However, based on the performance of the original Chorro Flats project, it may be more beneficial, and more ecological credit could be generated, by managing this project as an "active" sediment trap. In this case, the trap could be periodically mined upon reaching capacity and the fill material properly disposed of, thus extending the benefits of the project indefinitely.

5.6 Hollister Ranch Watershed Sediment Control Project

5.6.1 Description of Project

The NEP has expended significant resources in its endeavor to determine what restorative actions should be taken in and around Morro Bay to protect and preserve its natural resources. Consistent with this charge, the NEP has developed an extensive list of projects that could and should be implemented in the bay and the adjacent watershed(s). Also as part of its TMDL program, the Regional Board hired PWA to develop a list of possible watershed management projects. Based on the PWA final findings, the scope and scale or selection of the watershed projects may be changed in order to ensure that the most benefit is generated for the effort and resources expended.

As part of Duke's effort to achieve an appropriate balance between in-bay and watershed projects in the HEP, the Hollister Ranch project focuses on watershed management and improvement approaches outlined by the NEP. It is sufficiently advanced in planning and design, and has a sufficient nexus to MBPP entrainment effects to warrant its inclusion in the HEP. It involves primarily floodplain restoration and is located in the Chorro Creek watershed, which has been identified by the PWA report as the primary contributors of sediment to Morro Bay.

The San Luis Obispo Trust for Public Lands (TPL) purchased the 580-acre Hollister Ranch on Chorro Creek for the purposes of enhancing sediment capture, habitat restoration and preservation of water rights. This year, Hollister Ranch will be acquired by the State from TPL through funding from the Wildlife Conservation Board, Coastal Conservancy, CalTrans, US Fish and Wildlife Service, and the NEP. The California Department of Fish and Game (CDF&G) will be holders and managers of the property, which will be dedicated as a natural preserve. The NEP has offered to assist CDF&G with the preparation of the land management plan. The Regional Conservation District (RCD) has also indicated a willingness to help with the planning and management as well.

The Hollister Ranch site includes approximately 50 acres of floodplain. The restoration activities envisioned in the floodplain area include: 1) sediment control/trapping, 2) vegetation management, 3) relocation of electric transmission lines and poles located in the floodplain, and 4) reduction of shallow aquifer withdrawal (by plugging surface water wells) which should increase available surface water flows in the nearby creek. Other portions of the site may be suitable for restoration activities that result in: 1) protection of freshwater springs, 2) possible addition of raptor platforms, and 3) possible creek enhancements targeted at benefiting steelhead trout habitat.

The restoration activities envisioned for the Hollister Ranch have not been fully scoped, designed, or engineered in any particular detail. The project as it is presently conceived involves significant earthmoving activities to convert the property's orchard and cropland into sediment catchment basins. Various diversion channels and revetments may need to be constructed to direct high stream flows into the project's engineered catchments or constructed wetlands. Secondarily, the removal of orchard crops and long-term vegetation management will restore the shallow supply of groundwater that is presently consumed at the site and assist in sediment control. Restored groundwater supplies might yield increased stream flows and seasonal reliability. However, in order to implement the floodplain restoration activities, the electric power transmission lines and poles will have to be relocated to an area that will not be inundated by floodwaters.

Subject to feasibility analysis and engineering input, specific restoration activities might include:

- Opening/removal of existing levees located along Chorro Creek which will allow the flooding and reestablishment of the surface hydrology in the former orchard area. Once the surface hydrology is reestablished, this area would be managed to encourage reforestation and revegetation with native floodplain vegetative species, such as willows and cottonwoods. The result is expected to be much like the Chorro Flats area. The reestablishment of natural vegetative cover will also provide a mechanism for terrestrial deposition of sediment loads being transported by the creek floodwaters, thus preventing their transport and deposition in Morro Bay.

- The construction of a series of overflow ponds, wetlands, and sediment traps (active or passive) to naturally capture sediment that would otherwise be deposited further downstream in Morro Bay.

5.6.2 Project Objectives and Goals

The primary goals and objectives of this project are to maximize the capture and removal of stream borne sediments from the Chorro Creek watershed. The degree to which this project is ultimately able to prevent the sediments from entering Morro Bay will determine its value in preserving the bay and delaying the loss of estuarine habitat. Each acre-foot of sediment removed from Chorro Creek by the project prevents the loss of a corresponding loss of an acre-foot of bay volume, thus preserving the bay's volume for its plankton and fish populations. In addition, each acre-foot of sediment removed slows the rise of the bay's seafloor elevation and the continuing loss of its productive eelgrass meadows and mudflat habitats. The documented sediment infilling and rise in seafloor elevation are strongly correlated to the diminished acreage of these bay habitats both over past and recent flood events.

The Hollister Ranch Sediment Control Projects would be effective in controlling sedimentation driven by short-term flood events and, in conjunction with the successfully operating downstream Chorro Flats sediment control project, retarding long-term bay infilling.

5.6.3 Cost/Benefit Analysis

Using the PWA cost estimates referenced in the Chorro Flats II project, Duke has estimated the construction costs of the Hollister Ranch project to range between $10,000 to $40,000 per acre, which translates in to an estimated overall budget of approximately $500,000 to $2 million. Since the Hollister Ranch project may not require the amount of dirt moving work that would be associated with the Chorro Flats projects, Duke estimated the most likely cost per acre to be in the middle of this range, or approximately $1 million for the floodplain restoration activities over the entire 50 acres.

To ensure the availability of sufficient funding to implement the project, Duke has doubled this construction cost estimate to include funding for management, planning, permitting, engineering, monitoring, and disposal, if required. Therefore, the total estimated cost for the project is approximately $2 million.

The sediment abatement and removal performance anticipated as a result of the implementation of floodplain restoration actions at the Hollister Ranch is expected to be only 25% as effective as the normalized sediment trapping rate of Chorro Flats. This is primarily due to its location in the watershed and the fact that it will only be effective during high water events. Based on this, it is anticipated that Hollister Ranch could trap up to 86,250 cubic yards of sediment over the 50-year life of the project. The credit generated by the Hollister Ranch project is determined by the number of low salt marsh acres that would be preserved based on the relationship between the anticipated amount of sediment removed and years of low salt marsh habitat service extension. This project is anticipated to extend the life of the Chorro Flats 2 Project and preserve up to 27 acres of low march in Zones 3 and 4.

Secondarily, as in the case of the Chorro Flats II Project, the project's control and removal of stream borne sediments is expected to improve the water quality of Chorro Creek before it enters Morro Bay, thereby lowering the turbidity levels in Morro Bay. This will promote growth in the bay's eelgrass meadows by increasing the depth of penetration of sunlight, allowing eelgrass to grow to deeper depths.

Finally, although difficult to quantify at this time, the removal of the cropland at Hollister Ranch and the implementation of floodplain restoration activities can lead to significant improvements in shallow groundwater supplies on-site, and groundwater flows reaching the streambed. These increased flows would be expected to affect both water temperature and dissolved oxygen levels favorable to migrating and rearing steelhead, and reduce hypersaline conditions in the back bay in late summer.

5.7 CalPoly-Walter's Ranch Watershed Sediment Control Project

5.7.1 Description of Project

The NEP has also identified the CalPoly – Walter's Ranch as another watershed management project that could significantly aid in the reduction of stream borne sediments in

Morro Bay. Like the Hollister Ranch project, the CalPoly-Walter's Ranch project is located in the Chorro Creek watershed, which has been identified by the PWA report as the primary contributors of sediment to Morro Bay.

Based on the PWA final findings and Supplemental Report, the scope and scale or selection of the watershed projects may be changed in order to ensure that the most benefit is generated for the effort and resources expended.

The NEP and PWA have both identified the CalPoly-Walter's Ranch project located on publicly owned land within the Chorro Creek watershed where the implementation of "best management practices" could result in a significant reduction in the sediment load being transported from the watershed and deposited into Chorro delta and Morro Bay. The Ranch is approximately 800 acres in size, out of the overall 3,000 acres owned and managed by CalPoly.

The Ranch has historically been used primarily as rangeland for cattle grazing. As a result, much of the native vegetation across the property either been removed by man or degraded by cattle use, and is no longer present. The Ranch and CalPoly have expressed great interest in implementing BMP controls at this site.

Some of the BMP/restoration activities envisioned included: 1) implementation of a rotational grazing program (may require additional fencing), 2) exclusion of cattle from streams and riparian areas, and 3) reestablishment of vegetative riparian buffer zones and other native vegetation.

5.7.2 Project Objectives and Goals

The primary goals and objectives of this project are to maximize the capture and removal of stream borne sediments from the Chorro Creek watershed. The degree to which this project is ultimately able to prevent the sediments from entering Morro Bay will determine its value in preserving the bay and delaying the loss of its estuarine habitat. Each acre-foot of sediment removed from Chorro Creek by the project prevents the loss of a corresponding loss of an acre-foot of bay volume, thus preserving the bay's volume for its plankton and fish populations. In addition, each acre-foot of sediment removed slows the rise of the bay's seafloor elevation and the continuing loss of its productive eelgrass meadows and mudflat habitats. The documented sediment infilling and rise in seafloor elevation are strongly correlated to the diminished acreage of these bay habitats both over the past and recent flood events.

Unlike the Hollister Ranch Sediment Control Project which will be effective in controlling sedimentation driven by short-term flood events, the implementation of BMPs at the CalPoly/Walter's Ranch is expected to have comparable but more day-to-day benefit in sediment reduction.

5.7.3 Cost/Benefit Analysis

When determining the approximate costs of implementation of the BMPs at the Walter's Ranch, Duke referred to the NEP and its cost estimates. Previous cost estimates used for grant requests indicated that the project in its entirety could be implemented for approximately $250,000.

To ensure the availability of sufficient funding to implement the project, Duke has almost doubled this estimate to include funding for management, permitting, engineering, and monitoring, if required. Duke did not double the cost estimate since much of the planning has already been conducted as part of previous grant proposals that were ultimately not obtained. Thus, the total amount of funding that Duke has allocated for this project is $400,000.

Based on the findings of the PWA report, implementation of BMPs on rangeland will result in sediment abatement. The removal performance anticipated as a result of the implementation of the BMPs at the Walter's Ranch is approximately 1,400 tons of sediment from the Chorro Creek sediment load over the project lifetime of 50 years. Therefore, it is anticipated that these activities could preserve approximately 1 to 2 acres of low marsh in Zones 3 and 4.

SECTION 6: POTENTIAL ROLE OF THE AQUATIC FILTER BARRIER

6.1 Introduction

As explained in Duke's July 1, 2002 HEP submittal to the CEC, Duke is proposing only to ***study the feasibility of installing a pilot-scale AFB*** near the MBPP intake structure. This feasibility study will ***not*** involve any physical construction activities in the water body, nor does the study require any regulatory or other local government approvals. Specifically, Duke is not seeking any conditions of certification permitting relating to the physical installation of the pilot-scale or a full-scale AFB. Consequently, no CEQA review of the AFB is required or appropriate at this time. Indeed, any attempt at CEQA review would be premature given that Duke does not know what the physical parameters of the pilot AFB would be, what permits are required and how long it might take to obtain them, and whether the AFB is even commercially viable given the evolving costs and commitments of this project. However, this proposal set aside $125,000 (these funds are not included in the $12.5 million for implementation of HEP projects) for a feasibility study to evaluate environmental, regulatory, and engineering issues that would need to be addressed to determine the potential for a pilot AFB.

6.2 Current Status of AFB Technology

Duke believes that Aquatic Filter Barrier (AFB) technology may have considerable potential at Morro Bay to minimize or "avoid" power plant entrainment effects, and thus constitute BTA. A successful AFB must integrate the biological profiles of the organisms sought to be protected from entrainment, the engineering parameters of the barrier material, the hydraulic properties of the source water body, the physical constraints of the site, and the operating characteristics of the power plant. As discussed below, there are several emerging developments with respect to the role of the AFB in Clean Water Act section 316(b) compliance determinations.

6.2.1 Description of Aquatic Filter Barrier

An AFB is a form of physical barrier technology designed to reduce biological losses associated with marine lifeform entrainment. The semi-porous barrier material is manufactured with appropriate diameter perforations to meet particle size filter specifications and in lengths and widths of sufficient surface area for plant intake flows. A newer version of a very fine mesh barrier net – the MLES™, currently manufactured by Gunderboom — consists of non-woven polyester fiber strands that are pressed into a water-permeable fabric mat. The mat or net which extends the entire depth of the water column is deployed ahead of a cooling water intake structure with a large screening surface area such that velocities through it are extremely low. The net is maintained in position, or in a specific footprint, by an anchoring and mooring system. The net requires some sweeping flow along its surface, and may require an air burst system to keep it clean. The net serves as a physical barrier that substantially prevents larval forms of marine life from being drawn into the cooling water intake structure, thus preventing entrainment, and prevents juvenile and adult fish, and invertebrate species from being impinged. Bottom depths in the installation area generally determine the AFB's dimensions.

6.2.2 Clean Water Act Section 316(b) Regulatory Developments

EPA considers the AFB as a BTA alternative in the Technical Development Document for the final Phase I section 316(b) regulations for new power plants, concluding that "[a]lthough this technology [i.e., the Gunderboom MLES ™ technology] has been implemented at only one cooling water intake structure, it appears to be a promising technology to reduce entrainment impacts."[58] EPA goes on to cite numerous advantages of this technology, including:

- The AFB can be used in all types of water bodies.
- Biofouling is not significant.
- Most organisms (and all larger organisms) are able to swim away from the barrier because of low velocities; impinged organisms are released back into the waterbody.
- Little damage is caused to fish eggs and larvae if the are drawn up against the fabric.
- Installation can occur with no or minimal plant shutdown.
- The filter is easily deployed for seasonal use.
- Modulized panels may easily be replaced.

Further consideration is given to the AFB as a BTA alternative in the proposed Phase II regulations, which are currently expected to become final in August 2003. All told, the benefits of AFB technology relative to cost appear to be promising, and in Duke's estimation, clearly warrant the performance of a feasibility study for a pilot-scale AFB in Morro Bay.

6.2.3 Case Histories

Gunderboom AFB technology is being used at the once-through cooling intake structures at the Lovett Power Plant on the Hudson River Estuary,[59] resulting in a near 100% reduction in impingement and an 80% reduction in entrainment. While declining to find the

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[58] Technical Development Document for the Final Regulations Addressing Cooling Water Intake Structures for New Facilities, November 9, 2001, p. A-39. In the May 2002 Tetra Tech report to the Regional Board entitled "Evaluation of Cooling System Alternatives – Proposed Morro Bay Power Plant," Tetra Tech states that it supports the concept of allowing Duke the opportunity to demonstrate the waterbody-specific performance of the AFB as a potential component of BTA. It noted that this idea is consistent with some of the options that EPA is considering at the national level to allow further development of "innovative" technologies. Tetra Tech Report, at p. 3.

[59] See FSA, Appendix A – Cooling Options, p. 14; Duke Energy's Testimony on Alternative Cooling Technologies (Appendix D of Aquatic Biological Resources Testimony) filed May 13, 2002 (See Exhibit 228), Attachment 2 – Discussion of the Aquatic Filter Barrier; Duke Energy's Aquatic Biological Resources Testimony filed May 13, 2002, p.81; Gunderboom, Inc. submittal of February 15, 2002 (Docket # 24.627

AFB represents BTA due to the "premature" nature of that application, the SNYDC Commissioner nevertheless found AFB deployment at Lovett to be a "success."[60] Various system improvements have been made to the Lovett AFB as needs have arisen, including the installation of a manual AirBurst Cleaning System to help prevent the filter fabric from being clogged by sedimentation. A formal BTA decision is anticipated this year in the late summer or early fall.

In August 2000, Mirant Bowline, LLC, applied to the New York Department of Environmental Conservation (NYDEC) for permission to construct and operate a 750 MW combined-cycle generating facility on Haverstraw bay (designated by the state as a Significant Fish and Wildlife Habitat under the Coastal Zone Management Program) of the Hudson River. Mirant proposed a hybrid cooling system and use of a 2-millimeter wire screen and a Gunderboom MLES™ to minimize entrainment of aquatic biota. On March 19, 2002, the NYDEC formally determined that the AFB should be implemented at Bowline and that it should be considered BTA.[61] The Bowline decision relied on the EPA 316(b) regulations for new facilities, and most significantly, determined that the Gunderboom AFB technology is not experimental, but is available technology for BTA determinations. The Bowline decision notes other studies supporting the availability of the Gunderboom AFB and states that BTA decisions are case-by-case determinations based on evidence in the record.[62]

6.3 Feasibility Study of Pilot AFB

As stated in our July 1, 2002 letter and information package to the CEC, the role of the AFB has evolved and been modified during the course of this proceeding. While Duke's original proposal was centered around the AFB with habitat enhancement funding as back-up, Duke has tried to be responsive to CEC staff and Regional Board staff concerns with respect to the perceived experimental nature and possible permitting difficulties for a pilot or full-scale AFB. In addition, in view of technical, administrative, and financial refinements and improvements to the program and the AFB emerging technology, it has become apparent to Duke that more time to study the feasibility of the AFB is needed before a pilot or full-scale proposal can be effectively prepared and submitted. As a result, the role of the AFB in this project has been modified.

At this point, Duke's reason for including an AFB component in its HEP proposal is to determine whether the CEC and the Regional Board support AFB technology in concept. Most importantly, however, Duke wishes to explore whether the HEP may be designed to allow for and encourage the possibility of success in reducing entrainment through a proven AFB and thus eligible for HEP performance credits.

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[60] In the Matter of Athens Generating Company, LP (June 2, 2001), at p.10.

[61] The FSA acknowledges this decision. See FSA Appendix A – Cooling Options, p.14.

[62] The Bowline decision also references the Bethlehem Energy Center facility, to be constructed and operated by PSE&G Power New York, Inc. pursuant to a Certification granted by the New York State Board on Electric Generation Siting and the Environment on February 28, 2002, which will utilize a Gunderboom AFB, in addition to hybrid cooling, to reduce adverse impacts on aquatic life pursuant to a SPDES permit issued on February 13, 2002.

Based on preliminary discussions with Gunderboom, the initial application most likely to be suitable for Morro Bay is a small-scale filter barrier that accurately reflects the probable performance of a full size deployment. This could be accomplished by housing submersible pumps on a support barge in front of the intake in an area of minimal environmental concern for a few months to create a flow rate of about 15,000 gpm around which is placed an elliptical shaped Gunderboom MLES™. The barge system would have a spud type mooring and should require little in the way of attendance, other than the biological monitoring and testing. The boom system would provide a full depth curtain of material.

The feasibility study would include a detailed evaluation of the governmental permits that would be required to deploy a pilot-scale AFB in Morro Bay. Meetings and discussions with agencies would include the City of Morro Bay Harbor Department, the COE, the Regional Board, the U.S. Coast Guard, and others.

Design considerations for a feasibility study for a pilot-scale AFB program might include the following:

- Determination of fabric type, size of perforations, density and configuration of perforations, and total area of fabric required.
- Relationship to possible full-scale AFB design.
- Determination of alternative configurations.
- Design for compatibility with existing uses of the harbor.
- Avoidance of negative impacts (i.e., eelgrass beds, shoreline area, channel for boat traffic).
- Potential methods of monitoring entrainment reduction effectiveness.
- Appearance and viewscape considerations.
- Considerations of factors affecting operation, maintenance, repair, and/or replacement, including the effects of tidal currents and biofouling.
- Design, deployment, and monitoring/testing of the pilot system.

Commercial feasibility of the pilot-scale AFB involves an analysis of the capital and long-term operation and maintenance costs associated with installation of an pilot-scale AFB, as well as Duke's ability to negotiate reasonable and appropriate conditions on any local land use approvals required for the work. The study would also evaluate the potential for interference with commercial and recreational use of Morro Bay, interference with local marine traffic, and visual effects.

6.4 Potential Future Activities

If Duke determines that a pilot-scale AFB is feasible from a technical, commercial, and permitting perspective, then Duke will decide whether it wants to proceed with actual installation of the pilot-scale AFB. If a decision is made to proceed, Duke will seek an amendment to its CEC license at that time for the sole and limited purpose of including conditions of certification relating to installation of the pilot-scale AFB. Any required CEQA review would be conducted at that time. Assuming appropriate amended conditions of certification were issued and all required permits and other approvals could be obtained, Duke would proceed with installation of the pilot AFB. If the amended conditions of certification were deemed unreasonable, or if required approvals could not be obtained, Duke would not proceed with the pilot project. Similarly, if the process becomes too protracted or costly, Duke reserves the right in its sole discretion to withdraw this element of the program altogether.

Assuming the pilot AFB were successfully permitted, installed and demonstrated to be effective in reducing entrainment, Duke would then have the further option of seeking appropriate regulatory approval for proceeding with installation of a full-scale AFB. Should Duke decide to proceed with full-scale implementation, the licensing proceeding would need to be reopened a second time. The design and details of a full-scale AFB are beyond the scope of this submittal.

SECTION 7: HABITAT ENHANCEMENT PROGRAM FUNDING

7.1 Evolution of HEP Funding Proposal

In previous correspondence to the Regional Board and the CEC staff, Duke proposed initial HEP funding at a level of $6 million, followed by supplemental funding of $6 to $12 million (for a total of $12 to $18 million) based on assumptions about the deployment of the AFB. The basis for the initial funding amount of $6 million was earlier estimates that restoration projects might be pursued to restore or protect as many as 200 acres, at a cost of $20,000 to $30,000 per acre. This was a good estimate at the time and consistent with information and assumptions brought forward by the Regional Board staff (although predicated on a smaller number of acres than suggested by the staff[63]).

Duke had an opportunity to present its funding proposal to the Regional Board at the May 30, 2002 workshop. Many insightful questions were raised, many of which related to the installation of an AFB. In the intervening time, Duke has had an opportunity to develop a specific set of representative habitat restoration and watershed management projects as presented in Section 5. We have also had opportunities to talk with the Regional Board staff and the Director of the NEP, and have the benefit of the PWA report (Appendix I and J). Further consideration of the funding issue, based on all of these sources of information and feedback, have enabled Duke to define a set of specific representative in-bay restoration and watershed management projects. Duke has also been able to cost these projects out at a conceptual level and discuss details about implementation and performance.

7.2 Principles for a Refined HEP Funding Proposal

In developing a refined HEP funding proposal, Duke established the following principles:

- The set of representative projects has been selected to achieve a balance between watershed management and in-bay restoration projects, and has been subject to rigorous cost estimating. Funding is proposed at an approximate 50/50 level to diversify the efforts and underwrite projects that address root causes of sedimentation (i.e., watershed management) as well as those with the most direct linkage to entrainment (i.e., habitat restoration and preservation).

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63 See Page 19, of the July 12, 2001 "Status Report for Workshop Regarding Duke Energy's Proposal to Modernize the Morro Bay Power Plant and Renew their NPDES Permit". Quoting from the report: "Staff considers the reasonable cost for simple habitat restoration to be about $20,000 per acre. A reasonable range for acquisitions appears to be $10,000 to $55,000 per acre. Using a middle value of $30,000… The range is then $11.7 million to $22.8 million." By using an early planning estimate of 200 acres, Duke's funding estimate of $6 million was lower than the staff's.

- While the specific projects that will be implemented may change in scope, priority or location, the cumulative effect of the HEP as a whole can be effectively approximated by applying the HEA methodology to this set of representative projects.

- The basic objective of these representative projects is to offset 100% of the entrainment effects of the power plant, assuming entrainment levels at the baseline established by the Regional Board staff, namely 413 MGD.

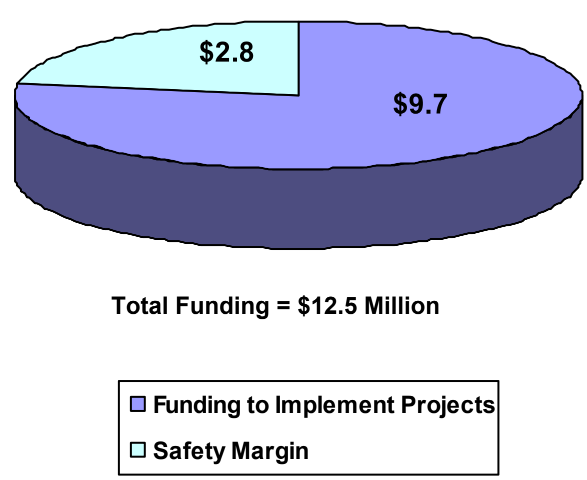
- To establish certainty in the project planning process, the total funding amount should be a fixed amount and not be subject to credits or deductions.[64]

- To address potential stakeholder concerns and differences with the Regional Board staff's methodology (see Section 4.1), the total funding amount should reflect a safety margin over and above what is derived through the HEA model.

7.3 Refined HEP Funding Proposal

Based on the information gathered since May 30, 2002 and the principles stated above, Duke has formulated a slightly modified funding proposal. This is presented in Figure 19 and Table 6 below.

Figure 19: Breakdown of HEP Funding (in millions)



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64 This is a good example of where input from the Region Board has shaped the proposal since May 30, 2002. At that time, Duke proposed a credit mechanism for reduced water use associated with the actual capacity factor of the plant. However, we had yet to flesh out the mechanics of how this credit might work. One choice could be to reduce funding, but in attempting to explain this approach it appeared confusing. Accordingly, Duke has retained the credit concept, but moved it into a more appropriate part of the proposal, namely performance. Thus, under this proposal, reductions in water use in actual operation would not reduce funding for the HEP programs but would be relevant in evaluating their performance under the HEA model evaluation.

Table 6: Revised HEP Funding Proposal

Element	Amount	Description
Total funding amount	$12.5 million	The program is guaranteed. Funding will ***not*** be reduced by credit mechanisms for performance, AFB technology, or water use.
Initial funding amount	$9.7 million	Based on the cost to implement the representative projects discussed in Section 5. Highly conservative cost assumptions have been used.
Residual funding (safety margin)	$2.8 million	Additional funding will be released over time. This funding is not required to offset entrainment effects, assuming successful implementation of projects. Consequently, this additional funding is a safety margin for uncertainty, partial performance, or changes to underlying cost assumptions.
Leverage	$37-63 million	While not provided by Duke, and expressed as a wide range, Duke's HEP funding of $12.5 million can very likely be leveraged through grant making. Estimates of a leverage factor of 3 to 5 times are not unreasonable. See discussion in Section 7.7.

7.4 Timing of Funding

Duke is proposing that the initial HEP funding of $9.7 million be released on the following schedule:

- 25% at the time the foundations for the modernized plant are poured
- 50% upon commencement of commercial operation
- 25% two years after commencement of commercial operations

The remaining funds ($2.8 million) would be contributed, on an as-needed basis as determined by the Regional Board, beginning five years after the first disbursement of initial funding.[65]

Duke is proposing this funding mechanism for the following practical reasons:

- This program is intended to offset the entrainment impacts of the modernized facility over its 50 year lifespan and therefore it is not appropriate to commit these

[65] Duke's payment of HEP funds would be deferred pending the resolution of any challenges to the NPDES or CEC certification permit.

funds until the modernization occurs. By initiating funding at the time the power block foundation is poured, funding will be available approximately two years prior to commercial operation.

- The initial funding of $9.7 million is based on the cost to implement the listed representative projects.

- Funding of this magnitude should not be spent quickly. Rather, it should be used carefully and prudently. The money should be put to its highest use, which means careful planning, understanding what is working, and fine-tuning project implementation over time.

- Duke is submitting this HEP on a voluntary basis. Assuming the Regional Board approves the HEP, Duke understands that it will be incorporated into the operative provisions of the NPDES permit for the modernized plant, and that Duke will be legally obligated to provide the HEP funding described herein. Accordingly, placement of the funds in an escrow account at the time of permit issuance or CEC certification is not necessary.

7.5 Safety Margin

Based on the HEA, Duke is confident that the ***initial HEP funding alone*** exceeds what is needed to offset entrainment effects of MBPP, especially when considered against the list of projects (and their costs) that have already been identified by the NEP and other organizations to address sedimentation and restoration in the Estuary. This funding, coupled with these other mechanisms enumerated in Section 3.4, creates a large, built-in margin of safety which will provide Duke, the Regional Board, and other interested agencies with a high level of confidence that power plant entrainment effects will be offset, and that the HEP will yield long-term, self-sustaining ecological benefits to the Morro Bay Estuary that far surpass what would be derived from any other alternative, including the installation of closed cycle cooling.

As noted in Section 3.4, there are multiple factors that ensure a significant safety margin.

7.6 Basis for Total Funding Cap of $12.5 Million

Duke is proposing revised funding of $12.5 million for the HEP. This does not include additional funds that Duke may expend to conduct the feasibility study of the pilot-scale AFB or the costs for the baseline monitoring program. As discussed above, the bulk of this funding ($9.7 million) is based on the cost of implementing the representative projects discussed in Section 5. This amount was determined using a "bottoms up" approach, meaning that the specific effect or "debit" (i.e., the entrainment) was considered using the HEA model, and then projects were selected to meet this "debit" by providing sufficient ecological services to create an offsetting "credit." Next, the cost of implementing each of the projects was conservatively estimated. Although emphasis was placed on finding project opportunities that would provide the most "ecological bang for the buck" or that have a high likelihood of success relative to cost, Duke did not establish a total funding amount and then "back into" specific projects.

To address uncertainties, Duke has applied a 30% contingency factor to its base funding level, as follows:

$9.68 million (rounded to $9.7 in the funding proposal) x 1.3 = $12.5

This additional safety margin, which is twice the standard 15% contingency factor typically added to engineering projects, will enable the projects to be expanded in scope and will provide additional opportunities for leveraging of HEP funds.

It is useful to compare Duke's proposed HEP funding to funding levels previously suggested by Regional Board staff. In its July 12, 2001 report, Regional Board staff states:

> Staff considers the reasonable cost for simple habitat restoration to be about $20,000 per acre. A reasonable range for acquisitions appears to be $10,000 to $55,000 per acre. Using a middle value of $30,000 per acre, the dollar value range from the habitat valuation approach is calculated as: 391 acres x $30,000/acre = $11.7 million, and 759 acres x $30,000/acre = $22.9 million. The range is $11.7 million to $22.8 million.[66, 67]

More recently, the May 9, 2002 staff report indicates that:

> "Staff is currently working to define costs on a "per acre-year" basis so that we can evaluate an appropriate dollar amount for the habitat enhancement fund. The report does go on to discuss likely program costs, including $9.7 million for "short term" sediment reduction actions and $13.5 million for best management practices on watershed properties. The report identifies additional long-term acquisition and restoration costs of $20 million associated with implementation of projects in the CCMP.[68]

Duke's initial HEP funding ($9.7 million) is virtually identical to the Regional Board's funding requirements for "short term" actions to reduce sedimentation. When the residual HEP funds are taken into account, the total HEP funds ($12.5 million) are within the range discussed by Regional Board staff using the "per acre-year" approach. When potential leveraged funds are added to the mix, total funding provided by or made available through

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66 July 12, 2001 Staff Report, p. 19.

67 Also, the Regional Board derives its range by evaluating the acquisition and restoration costs by blending together the costs of acquisitions and the costs of restoration (e.g. $30,000) but these can be significantly different and each can have wide ranges associated with them. Duke also disagrees with the general nature of this estimation process because more detailed information is available. Also, Duke does not agree that the power plant is responsible for offsetting the productivity of 1/3rd of the estuary, an assumption embedded in the Regional Board staff's approach.

68 May 2, 2002 Staff Report, p. 16.

Duke adds up to more than the total funding requirements discussed by Regional Board staff in its May 2002 report.

The Regional Board staff report from May 2002 sets out several guiding principles surrounding habitat restoration funding, each of which is met by Duke's HEP funding proposal:

- First, funds should be available "to help pay" for the short-term action items.
- Second, "a substantial fund is necessary to ensure success and to account for uncertainties involved in the approach."
- Third, it is important "to establish appropriate projects and their scope . . . then determine costs, rather than just establishing a dollar amount."

In summary, Duke's funding proposal achieves the following:

- Provides for substantial funding in the guaranteed amount of $12.5 million.
- Bases this funding on a "bottoms up" approach rather than establishing a fund and then "backing into" projects.
- Provides for a funding safety margin or contingency of 30%.
- Provides a significant opportunity to obtain more funding through leveraging.
- Is consistent with the Regional Board staff's recommendation that the HEP ***help*** fund a portion of the short term action items associated with the Morro Bay National Estuary Program, estimated to cost $9.7 million.
- Falls within the funding range ($11.7 - $22.8 million) previously suggested by Regional Board staff.

7.7 Leveraging of Funds

As discussed above, Duke anticipates that its HEP funds will be able to be leveraged through matching grants from private and/or public sources, thus further increasing the safety margin. For example, Duke's $7 million contribution to the Elkhorn Slough Environmental Enhancement and Mitigation Plan for the Moss Landing Power Plant has yielded matching grants at a ratio of 1:3, effectively tripling Duke's HEP funds for the Moss Landing facility. Also, the use of Consent Decree funds provided through the bay Foundation to the NEP in the Diablo Canyon settlement has resulted in significant leveraging. The settlement funds committed to NEP restoration and enhancement projects to date have achieved a ratio of 1:7. The HEP is constructed so as to provide mutual incentives to Duke and other interested stakeholders to pursue additional HEP funding through matching grant programs and donations.

Based on the experience of the Elkhorn Slough Habitat Enhancement Fund and the NEP, it is not unreasonable to expect that the MBPP HEP funds can be increased by a factor of 3 to 5 through a variety of financial mechanisms used to leverage private funds. Table 7 illustrates this potential.

Table 7: Potential Additional Funding Through Leverage

	Low – factor of 3 times	**High – factor of 5 times**
Duke-provided HEP funding amount	$12.5 million	$12.5 million
Incremental funding through grant making	$37.5 million	$62.5 million
Total funding amount	**$50.0 million**	**$75.0 million**

By assuming a leverage factor of 3 to 5, the HEP funds are multiplied to provide a total funding package of between $50 and $75 million. To demonstrate the real nature of this possibility, it is useful to provide some background about recent NEP experience.

The NEP is funded in several different ways. Appendix K provides a table of recent programs funded by the bay Foundation, NEP, and partner organizations, as part of the PG&E Diablo Canyon Consent Decree settlement. This appendix shows that the NEP provided $1.9 million in funds for estuary programs, and in doing so received additional contributions of $13.6 million, for a leverage factor of 7 to 1.

Land acquisition funding, project management support, in-kind services, and other forms of support have been extended to the NEP from a variety of organizations. Some of these organizations have been funding partners. This list is provided to point out the large number of organizations participating with the NEP in estuary programs of some kind. They include:

- California State Coastal Conservancy
- Trust for Public Lands
- Morro Estuary Greenbelt Alliance
- Army Corps of Engineers
- Los Osos Community Services District
- Coastal Conservancy
- California Fish & Game
- California Department of Parks and Recreation
- Central Coast Regional Water Quality Control Board
- California Conservation COE
- City of Morro Bay
- Private Sources
- Coastal Commission
- Friends of the Estuary
- Wildlife Conservation Board
- Small Wilderness Area Preservation
- Land Conservancy of SLOCo. (potential land manager)
- Cal Trans
- US Fish & Wildlife Service
- Coastal San Luis Resource Conservation District
- The bay Foundation of Morro Bay (bursar for the NEP)
- State Water Resources Control Board
- County of San Luis Obispo
- Packard Foundation
- Other Non-Profits (Audubon Society, Small Area Wilderness Preservation and Morro Bay Beautiful)

In the future, the NEP may not be as successful in leveraging its consent decree and other funding due to the economy, the state budget problems, and other reasons. However, there remain many potential sources of funding for estuary programs that require matching funds which could be met through HEP funds. Additionally, the Consent Degree funds will sunset in 2009 making the timing of the HEP fund that much more important to ensure the continuation of NEP and other restoration and enhancement projects for the bay and estuary. Given the synergies between the HEP and many of these other programs, particularly those of the Regional Board, the NEP, and the COE, Duke expects that its HEP funds will spawn additional financial contributions to those programs. While the HEP is focused on entrainment offsets, the same restoration measures will provide valuable water quality and habitat restoration and protection benefits consistent with the goals of these other organizations.

SECTION 8: HABITAT ENHANCEMENT PROGRAM GOVERNANCE

Duke is proposing the following governance structure for implementing the HEP restoration projects. This proposed structure is a starting point and can be modified to efficiently accomplish the HEP goals as the permitting process moves forward.

8.1 Establishment of an Independent Organization

8.1.1 Nature of Organization

The HEP would be administered by a qualified independent, private non-profit organization subject to primary oversight by the Regional Board. Duke suggests that a new 501(c)(3) non-profit corporation be established for this purpose. The name of this group is to be determined, but for purposes of this document it will be referred to as the "Administering NGO." Duke recognizes that there may be other existing organizations with a similar structure that might be suited to play the same role, but believes the Regional Board and other stakeholders should evaluate the best way to provide the necessary functions.

Whether a new NGO is to be created or an existing organization with similar structure utilized, its activities should be conducted through an Executive Board with a diverse membership as discussed in Section 8.1.3 below. The Executive Board would be charged with implementing the representative habitat restoration projects discussed in Section 5 and in soliciting, reviewing, and recommending additional habitat restoration and preservation projects to the extent funds are available.

The Administering NGO would build on the work of the NEP, as outlined in the CCMP, and would work in close coordination with the Executive Committee of the NEP. Building on the work of the NEP has several advantages including:

- The scientific basis of its "high priority actions" has already been considered by a diverse stakeholder group.
- There will be a "bigger bang" for mitigation funds when they can be used to support larger, rather than smaller, projects.
- Supporting NEP projects may result in leveraging of the HEP funding into considerably more mitigation dollars.
- The experience of the NEP in successfully implementing programs will help ensure that the requisite technical and analytical expertise is available to judge project performance, effectiveness, and to recommend adjustments as necessary.

The Executive Board would also consider the in-bay restoration planning process being conducted by the COE and, for watershed project planning, would consider the Regional Board's TMDL process for sediment control including Chorro Creek, Los Osos

Creek, and the Morro Bay Estuary, as reflected in the Board's Basin Plan amendments adopted on May 31, 2002.

The Administering NGO would prepare a charter setting forth basic tenets of its governance, project consideration, selection, implementation, monitoring process, and expenditures of funds. The CCMP and charter of this Administering NGO will guide HEP implementation actions.

8.1.2 Purpose of Administering NGO

The purpose of the Administering NGO is as follows:

- To solicit, recommend, fund, and ensure implementation of restoration/preservation projects described in this submission, or other projects with equal benefit to the Estuary that offset MBPP entrainment effects.
- To work within the conceptual framework for estuary restoration/preservation created by the Regional Board and NEP.
- To fund projects that will cost effectively create the maximum possible ecological benefit to the Estuary.
- To fund projects that meet the project selection criteria set forth in Section 3.3.2 above.
- To seek public and private matching funds in order to maximize leverage of HEP funds.
- To responsibly manage the restoration funds.

8.1.3 Composition of Executive Board

The Executive Board will be chaired on a permanent basis by the Regional Board, and will include representatives of the CEC, NEP, City of Morro Bay, Los Osos Community Services District (LOCSD) and County of San Luis Obispo as permanent members of the Board. The Regional Board would appoint three ad hoc members from other interested groups. These ad hoc members shall serve at the pleasure of the Regional Board, but in no case shall their term exceed two years. Executive Board members should not include individuals or organizations that are involved in any litigation related to the MBPP as this would create potential conflicts of interest and be counter to successful implementation of the HEP. Duke would act as a non-voting advisory member of the Executive Board.

8.2 Powers and Responsibilities of the Administering NGO

The Administering NGO would be charged with implementing the habitat enhancement projects identified in Section 5 or alternative projects that have a sufficient nexus to the MBPP entrainment effects and that are determined through the HEA methodology to provide comparable ecological benefits. More generally, the Administering NGO would support the existing infrastructure of other conservation/restoration organizations working for the restoration/preservation of the Morro Bay Estuary. Where possible, the Administering NGO would seek to fund projects with broad support that are being conducted by or through other conservation/restoration groups. Whenever possible the Administering NGO would secure matching funds to expand the nature and extent of restoration/preservation efforts in the Estuary. Duke will serve in an advisory role to ensure consistency and continuity.

8.2.1 Investment of HEP Funds

The Regional Board, as Chair of the Executive Board, and in consultation with other members of the Executive Board, would determine how Duke's HEP funds should be invested and administered until they are used in restoration projects. The Administering NGO shall prepare periodic reports on the status, use, and availability of HEP fund.

8.2.2 Review and Approval of Projects

The Executive Board would publish and circulate a request for proposals describing the project objectives and types of projects the Administering NGO would be willing to fund using available residual HEP funds or other funds obtained through leveraging of HEP funds. The Executive Board would review proposals for restoration/preservation projects submitted by various governmental and non-governmental groups wishing to conduct work in the Morro Bay estuarine system. The Executive Board would select and fund projects that best meet the objectives stated in Section 3.3.2. The selection criteria will consider factors that will include but not be limited to:

- Likelihood of success
- Capability and experience of implementation team
- Opportunities for leveraged funding
- Extent to which the project meets the mission objectives of the fund
- Project selection criteria set forth in section 3.3.2 above

8.2.3 Authorization of Expenditures for Approved Projects

The Executive Board would vote on projects and create an annual slate of recommended projects. The Regional Board would approve the projects submitted and could veto any project or the entire slate of projects if, in its reasonable discretion, the project(s) were determined to be inconsistent with the objectives of the HEP. If necessary, the Regional Board could, in its reasonable discretion, refine the charter of the Administering NGO to provide better instruction to the Executive Board, so long as any revisions were fully consistent with the underlying requirements imposed by Clean Water Act section 316(b) as it relates to the MBPP modernization Project. Once projects are approved by the Regional Board, the Administering NGO is authorized to make appropriate expenditures.

8.2.4 Oversight of Project Implementation

Actual project oversight would be done by the NEP, subject to review by the Regional Board and such other agencies as the Regional Board may see fit. The NEP would issue any contracts for project implementation, oversee project implementation, and issue progress reports to interested parties as called for in the NEP.

8.2.5 Review of Project Performance and Success

The NEP would conduct regular project review and monitor the long-term success of restoration/preservation, subject to oversight by the Regional Board. The Executive Board would define specific success criteria for each project selected. The NEP, working with the Administering NGO, would establish a monitoring program within the objectives of the HEP for determination of project success.

8.3 Stakeholder Identification and Roles

As noted above, the Regional Board would select three ad hoc members to sit on the Executive Board. The Executive Board would work with local stakeholders to obtain information and community input which is to be weighed as a factor in deciding which projects would be selected for funding and implementation. The Regional Board would appoint a technical advisory board or committee of up to ten people to assist the Administering NGO in the project selection and implementation process.

SECTION 9: APPENDICES