COAST LAW GROUP LLP

169 Saxony Road
Suite 204
Encinitas, CA 92024

Tel 760-942-8505
Fax 760-942-8515
www.coastlawgroup.com

April 6, 2009

Mr. John Robertus
Executive Officer
California Regional Water Quality Control Board
San Diego Region
9174 Sky Park Court, Suite 100
San Diego, CA 92123-4340

Via Electronic Mail
RB9agenda@waterboards.ca.gov

RE: Carlsbad Desalination Project
April 8, 2009, Agenda Item 13
Environmental Groups' Supplemental Comments

Dear Mr. Robertus:

Please accept the following supplemental comments on behalf of the Surfrider Foundation and San Diego Coastkeeper (Environmental Groups) pertaining to Poseidon Resources LLC's (Poseidon) proposed Carlsbad Desalination Project (CDP).

Numerous comment letters, briefs, and other documents have been submitted regarding the inability of the CDP to comply with Porter-Cologne section (PC) 13142.5 as a stand-alone facility utilizing the once-through-cooling (OTC) infrastructure of the Encina Power Station (EPS). While we will endeavor not to repeat our arguments previously made, we must reiterate certain themes in response to the expanded (though still faulty) PC 13142.5 analysis provided in Poseidon's March 27, 2009 Flow Entrainment and Impingement Minimization Plan (Flow Plan) and related documents.

These comments reflect review of documents provided to the public by Regional Board staff (staff) as of April 3, 2009 at 5:35 pm, and the California Coastal Commission's letter of April 6, 2009. In light of expected last minute submissions by various parties, the Environmental Groups reserve the right to provide additional comments orally and in writing until the matter is finally resolved at a public hearing by the Regional Board.

Procedural Objections

The procedural irregularities of the CDP approval process must be raised at every instance, especially as the disjointed review by agency staff and the public continues. While we certainly appreciate the direness of drought conditions in California and the San Diego region, the immediate need for a new source of water does not justify the reckless manner in which CDP consideration has progressed. The fact that significant new information continues to unfold – including evidence of applicant misrepresentation and scientifically unsound data and statistical analyses – at such a late date indicates that prior agency approvals were likely premature, and importantly, that a sound foundation of data for impacts assessment was never actually generated. Without question, Poseidon chartered a course very early on with respect to EPS co-location, and now seeks to rationalize post-hoc virtually every piece of the regulatory puzzle. Many, if not all, of these considerations should have been resolved as a component of project design at its outset.

In this regard, the City of Carlsbad's EIR, well beyond the time for challenge, reflects an entirely different approach to impacts assessment than now before the Board. That entrainment impacts are to be significant is no longer reasonably in debate, yet Poseidon continues to assert based on the EIR that any mitigation it provides is more charitable than scientifically required to offset impacts. Based upon third-party independent review, the EIR conclusions regarding *di minimus* impingement impacts are also no longer valid. The EIR should hardly be referenced, let alone relied upon for PC compliance. Should the Environmental Groups succeed in requiring preparation of a Supplemental EIR by the State Lands Commission, reliance upon the faulty EIR here by the Board could render its approvals null and void.

At the Coastal Commission, Poseidon repeatedly took the position that it was the Regional Board that had primary jurisdiction over entrainment and impingement mitigation (and PC 13142.5 compliance in general). Poseidon's implication, if not directly expressed, was that the Commission need not worry if it missed a piece of the mitigation or environmental review puzzle because the Regional Board would certainly ensure all potential impacts were mitigated as legally required by the Water Code. And yet, the Board will certainly hear Poseidon repeat its mantra that because every agency that has looked at the project thus far has approved it, the Board should not add mitigation obligations or other project conditions beyond those already required. This is particularly true with respect to impingement impacts, discussed further below. Poseidon's attempts to "have its cake and eat it too" should be rebuffed by the Board, with focus on strict PC compliance maintained.[1]

Because we are nearing the end of the regulatory process, these procedural problems and their implications must be understood and appreciated by the Board. The public, unquestionably more limited in resources than the applicant, has been told to respond to mitigation plans within specific comment periods, only to have the plans change and significant new "expert" reports and materials arrive at the last minute. To expect that the public, including the Environmental Groups, have the resources to provide multiple in-depth meaningful reviews of the reams of documents submitted by Poseidon at every twist and turn of the regulatory process is unrealistic and contrary to the Water Code's consideration of the public's important role in water resource issues. (See e.g. Ca. Water Code §13292) That these submissions take place within days and even hours of final decisions should be seen as a reflection of the project's inherent flaws, and yet further evidence of Poseidon's attempts to "game the system."

Poseidon faced significant and well reasoned staff opposition at the Coastal Commission, yet politics prevailed and much expert analysis (including independent third-party review) was ignored or given short shrift. Poseidon faced staff opposition at the State Lands Commission, and again prevailed on political lobbying coupled with drought policy arguments over science. In light of comments by Regional Board members at the February 11, 2009 hearing, we have

[1] The Board should pay particular attention to the Coastal Commission's April 6, 2009 letter, as it reflects the difficulties encountered by agency staff and the public in assessing the CDP and coming up with appropriate mitigation conditions. The project is and has been, for lack of a better term, a moving target. As the largest of its kind in the western hemisphere, and a precedent for other desalination plants throughout the California, the CDP review and approval process should have been much cleaner. Instead, it has been a civic embarrassment.

every reason to believe a majority of the Board has already made up its mind to approve the CDP regardless of the impacts and mitigation obligations warranted by evidence in the record. We nonetheless implore Board members to approach this (potentially) final hearing with an open mind, confidence in staff, and particular deference to third-party independent review of complex scientific material beyond individual Board members' expertise. While the Board may still be inclined to approve the project, it should do so only with appropriate conditions and mitigation measures required.

If at the end of the day legal and scientifically sound conditions of approval render the project economically infeasible, so be it. There will likely come a time when technology and science, the need for and cost of water, conservation and reclamation efforts, legal frameworks, and societal values all evolve to support appropriately designed desalination as a major source of potable water for the San Diego Region. The CDP as proposed does not reflect such a condition.

Co-Located Approval v. Stand-Alone Analysis

The March 9, 2009 staff report indicates the CDP is being considered for approval solely as a co-located facility, but that assessment and mitigation of impacts at intake volumes reflecting stand-alone operations is necessary. The rationale for this approach is founded on expectation that there will likely be intermittent periods of CDP operation where the full 304mgd of CDP intake requirement will be pumped solely for the benefit of CDP.

As a preliminary policy-based matter, we believe **the CDP should be conditioned to allow production of potable water only at quantities supported by EPS flow requirements**. The benefits of co-location and use of OTC infrastructure are all but lost once the CDP's needs drive the total flows and resulting impacts. If the Board is unwilling to so constrain approval of the co-located EPS only to those flows required for EPS operation, the Board should establish an objective point at which the CDP would be reconsidered as a stand-alone facility. The Tentative Order recommends additional PC 13142.5 review only when the "EPS permanently ceases operations and the Discharger proposes to independently operate the existing EPS seawater intake and outfall for the benefit of the CDP..." This all-or-nothing standard has many problems.

Foremost, it incentivizes continued operation of the EPS and the environmentally undesirable OTC infrastructure. The owners of the EPS are seeking to construct a new, more efficient power plant adjacent to the EPS. In fact, the EPS would be entirely retired in relatively short order but for the fact that the California Independent System Operator has determined a portion of the EPS is necessary for electricity grid reliability (pending construction of additional energy generating or transmitting facilities). As such, the EPS is expected to run at very low operational capacities, with attendant reductions in intake flows. If CDP approval requires PC 13142.5 compliance reconsideration only once the EPS goes away entirely, it is certain Poseidon will apply every bit of political leverage possible to ensure the EPS remains in place regardless of environmental benefits associated with its demise. Hence, a different "trigger" is warranted.

Second, the all-or-nothing standard for reopening the CDP permit would prolong such consideration in circumstances where only a relatively small portion of the CDP intake is

required for EPS maintenance.[2] The Environmental Groups therefore recommend that **if for any given quarter (3 month period), the EPS intake flows are less than 50% of the CDP's needs (152mgd), then the CDP permit should be reopened and PC 13142.5 reassessment required.** Such a condition would accurately reflect the CDP's position in driving total intake flows, and appropriately justify reconsideration of the project at this location. At the same time, the benefits of co-location would be recognized only where legally and rationally justifiable.[3]

Notwithstanding the arguments contained herein regarding the failure to comply with various aspects of PC 13142.5, the Environmental Groups agree that at best, the CDP can now only be approved as a co-located facility with the EPS. While we expressly do not support such approval, we believe that limited approval of the CDP conditioned upon continuing EPS function most accurately reflects the factual conditions surrounding the eventual cessation of OTC infrastructure use by the EPS. Any resolution of approval should accurately reflect the impermanent status of CDP operations pending future PC 13142.5 site analysis once such review is triggered.

Specifically, **Poseidon should be put on notice that the site analysis conducted thus far is predicated upon the benefits of co-location with the EPS, and that evidence in the record regarding site-specific infeasibility of alternative intakes may serve to preclude continued operation of the facility at currently proposed levels once the stand-alone review is triggered.** Poseidon is clearly betting that capital investment in the construction of the co-located facility coupled with numerous water districts' reliance[4] on desalinated water to meet demand, there will be overwhelming pressure to maintain such service regardless of EPS OTC infrastructure availability. There should be no question that site analysis will be part of the stand-alone reassessment under PC 13142.5. Should the Board refuse to make this point clear, then the existing site analysis is clearly insufficient and the Project cannot be approved based upon the current record. (See further discussion of site alternatives analysis, below)

Were the EPS recently constructed and its OTC infrastructure truly expected to persist for a substantial period of time, or the legal framework of OTC not so heavily weighted toward elimination of the technology, the Environmental Groups would likely agree construction of a co-located CDP makes environmental sense. But, given (a) the overwhelming evidence indicating relatively near term cessation of OTC throughout the country due to legal constraints and ongoing advances in power generation technology, and (b) the site-specific circumstance of EPS replacement and OTC phase-out, allowing the CDP to be built in a location without

[2] For instance, if and when the inefficient EPS electricity generation units are not being utilized, service water pumps remain in operation, but convey only 62.1 MGD to keep the EPS functional. (Flow Plan at 2-3).

[3] The Coastal Commission's letter reflects a related, though not identical, concern with appropriate triggers for CDP mitigation requirements. (April 6, 2009 CCC letter at 7-8)

[4] It is even more important that the water districts be put on notice that long term reliance upon the quantities of desalinated water currently proposed may not constitute sound public policy. While Poseidon may well choose to risk private investors' funds to build a plant that may be considered inappropriately sited in the future, the same gamble by any of the water districts would be a significant breach of public trust and fiduciary duty to ratepayers.

alternative intake capabilities is much like allowing construction of a house directly within the path of a planned future highway. Poseidon must be made aware that investment in such a scheme carries significant inherent risk that the facility may have to be abandoned or drastically modified once the EPS is gone.[5]

PC Section 13142.5 Analysis - Site

While the Environmental Groups appreciate that staff and Poseidon are finally reciting the appropriate legal standard of review under PC Section 13142.5, we continue to disagree that the statute is being properly applied.[6] PC 13142.5 mandates that the project use the best available site feasible to minimize marine life mortality. The first step to appropriate site analysis for PC 13142.5 compliance is establishment of a legally viable and factually accurate project scope, also described as the project purpose or project objective.

In the context of litigation with the CCC, Poseidon argues that alternatives need not be considered that do not meet the project's purpose. See *Surfrider Foundation et al. v. California Coastal Commission*, San Diego Superior Court Case No. 37-2008- 00075727-CU-WM-CTL, Combined Memorandum of Points and Authorities of Real Parties in Interest in Opposition to Petitioners' Motion for Writ of Mandamus, p. 18. (Poseidon's CCC Opposition Brief) The Environmental Groups do not disagree. But, it does not follow that agency consideration of alternatives can be limited by an artificially constrained description of project purpose.

In the Poseidon CCC Opposition Brief, Poseidon contends the CDP's primary purposes are "delivering water to Carlsbad and the San Diego region to enhance local reliability and reduce local dependence on imported water." (Poseidon CCC Opposition Brief at 18) Poseidon then criticizes the Environmental Groups for failing to identify an alternative location within the City of Carlsbad, implying that in order to meet the so-called primary purposes, the project would have to be sited within the City. The March 27, 2009 Flow Plan is consistent with this flawed perspective, and reflects that the only alternative sites considered were within the City's boundaries. (Flow Plan, Chapter 2)

Poseidon's framework for restricting site alternative analysis does not take into account the means by which water is currently conveyed to and within the San Diego region:

- **The CDP is intended to service water districts beyond the boundary of the City of Carlsbad.** In addition to the Carlsbad Municipal Water District, Poseidon

[5] Because there exist certain scenarios under which the CDP may become taxpayer owned (e.g. failure to perform results in plant ownership by City of Carlsbad or eventual sale to, or condemnation by, the County Water Authority) the Board should give extra consideration to both the prudence of facility siting and legal notice regarding possible future requirements. If the plant's limited life is accurately reflected in the record, it's value can more appropriately be assessed (i.e. not inflated) should Poseidon seek to sell or otherwise have to relinquish the facility to taxpayers at a later date. At the very least, the scope of future 13142.5 site analysis requirements should be explicitly established now.

[6] Numerous prior submissions by Poseidon indicated that the CDP was designed to minimize the *impacts* of marine life mortality. The correct standard requires minimization of marine life mortality in the first instance, regardless of whether, and before, the impacts of such mortality occur.

has service contracts with Vallecitos Water District, Sweetwater Authority, Valley Center Municipal Water District, Santa Fe Irrigation District, Olivenhein Municipal Water District, Rincon Del Diablo Municipal Water District; Rainbow Municipal Water District, and possibly others. While the City of Carlsbad may be able to connect directly to the CDP, the others certainly will not. Hence, siting the project in Carlsbad is not critical to service of the other water agencies.

- **The non-Carlsbad Agencies will receive water through the County Water Authority's network of conveyance and storage.** Of the 50mgd expected to be produced by the CDP, approximately half is allocated to water agencies outside of Carlsbad. All of these agencies are members of the County Water Authority, and purchase varying amounts of imported water via the Authority's conveyance and storage system. Exhibit 1, attached hereto, taken from the County Water Authority's Draft Regional Facilities Master Plan (2002) (CWA Master Plan) reflects the interconnectedness of the agencies and County Water Authority infrastructure.

- **Desalinated water produced virtually anywhere within the areas serviced by the Metropolitan Water District can be allocated to end users and achieve Poseidon's stated project objective.** The focus on "local" reliability simply means an alternative to reliance on Colorado River and State Water Project imported water. The Metropolitan Water District (MWD) sells water to the County Water Authority, which in turn sells to local water agencies, including those contracted to receive desalinated water. Contractual arrangements at all levels, from regional to sub-regional to local, dictate both the quantity of an agency's allocation, as well as its certainty. A desalination plant constructed outside of the County Water Authority's boundary could be financed by the Authority or its member agencies, and result in a paper-transfer of water rights between the jurisdiction that would receive the actual desalinated water and the financing entity, with implementation through MWD. Just as Poseidon is proposing to build the CDP in Carlsbad and service water districts in South San Diego County, so could it build the plant anywhere along the San Diego County coastline and sell water back to Carlsbad and the full suite of agencies with which it has contracted. Exhibit 2, attached hereto, also from the CWA Master Plan shows the regional conveyance infrastructure, including MWD input connections.

  A good example of the feasibility of such water transfers is evident in the Imperial Irrigation District (IID) agreement with the County Water Authority. The so-called IID Water Transfer Agreement is a contract whereby the County Water Authority will purchase up to 20,000 acre feet per year of Colorado River Water previously allocated to agricultural uses in the Imperial Valley. Because these flows are truly "owned" by the IID (due to historical usage), and not likely to be significantly reduced as Colorado River use restrictions are implemented, the agreement to transfer the water to the County Water Authority is considered 100% reliable. (See p. 2-6 of the CWA Master Plan, "Throughout the 30-year study period, IID transfer water is considered to be 100 percent reliable.")

In light of the physical connectivity between the MWD, the County Water Authority, and all of the contracting water agencies, constraining the PC 13142.5 "best site" analysis to the City of Carlsbad is inappropriate. Because the Flow Plan indicates alternative source water intake options that would minimize marine life mortality are not feasible to achieve the stated production goal of the CDP at the EPS site, the Regional Board must at the very least consider sites outside of the City of Carlsbad where minimization of marine life mortality might be achieved.[7]

Poseidon's justifications for PC 13142.5 compliance with regard to site alternatives analysis are predicated entirely upon the benefits of co-location with the EPS. (Flow Plan, Chapter 2). As noted above, were circumstances such that it could be credibly argued that the EPS would remain in place and be the dominant use of OTC flows for the expected life of the desalination facility, alternative site analysis might not be as critical. But, given the clear legal and regulatory signals that OTC-based power plants are on their way out, compliance with PC 13142.5 requires a broader site alternatives analysis at this time.

PC Section 13142.5 Analysis - Design and Technology

PC section 13142.5 analysis of project design to minimize marine life mortality suffers from similar failings as the site alternatives assessment.

In the Flow Plan, Poseidon presupposes that any design of the project that does not achieve the stated 50 mgd goal of desalinated water production renders such technology infeasible. The structure and wording of PC 13142.5 clearly demonstrate the legislature's intent that coastal dependent industrial facilities be planned with a holistic consideration for minimization of marine life mortality. Hence, where technologies are available to minimize marine life mortality, industrial facilities should be designed around such opportunities. Here, the cart is leading the proverbial horse.

First, it is a legal fallacy and mere regulatory construct that the CDP design options must be limited to those that will produce 50 mgd of potable water. No one disagrees the needs of the San Diego region are well beyond the 50 mgd benchmark. Nor is there disagreement that a reliable source of water controlled by local entities would be beneficial. But, the history of the CDP, including the involvement of the County Water Authority as a potential owner/permittee, sheds light on how the 56,000 acre foot (approx. 50 mgd) was manufactured as a target production floor. Such information is already in the record, and will not be repeated here. The number could just as easily been 25 mgd, or 100 mgd. No rational basis exists in the record to support the 50 mgd volume as the only reasonable size for the CDP, yet other sized design options have been summarily discarded. Indeed, PC 13142.5 contemplates that the size of the

[7] The Environmental Groups have previously submitted arguments and evidence supporting the viability of desalinated water production utilizing alternative intake structures as nearby as Dana Point. While Poseidon has argued in litigation briefs that the Environmental Groups have proposed that the Dana Point plant be pursued in lieu of the CDP, the true purpose for citing to the Dana Point project is to show that there are alternative locations with the region where alternative intakes would be viable, and as such feasibility is more than merely speculative. Poseidon has not provided substantial evidence to prove appropriate conditions for sub-surface intakes cannot be found within, or within a reasonable distance of, San Diego County.

plant (i.e. the design) will be driven by minimization of marine life mortality, not a strict adherence to an artificially identified volume goal.[8]

The CDP has not been designed with technologies to minimize marine life mortality as a stand-alone facility. This much is clear. Virtually every technological option described, from alternative intakes to impingement reduction screens are discarded because they are not feasible in conjunction with a co-located CDP and EPS. The difficult question for the Board is when, and to what extent, design and technological alternatives can be required for the stand-alone condition. The Environmental Groups believe that PC 13142.5 requires assessment of these factors for the stand-alone condition now, as relinquishment of OTC infrastructure by the EPS is reasonably foreseeable.[9] Nonetheless, as technologies evolve and alternative intake options become available, the PC 13142.5 requires that the CDP evolve to incorporate such opportunities to minimize marine life mortality.[10]

Impingement[11]

The March 27, 2009 Staff Report reflects significant disagreement between Poseidon and staff regarding the recently spotlighted marine life impacts from impingement. The Environmental Groups' staff members with scientific expertise have reviewed Poseidon's March 27th Flow Plan, the April 1, 2009 Staff Report, and expert reviews conducted by Chris Nordby, Dr. Jenkins, Dr. Chang, and Dr. Raimondi, and offer the following comments on the proposed compensatory mitigation for CDP impingement impacts when CDP intake requirement exceed EPS flows, or during periods of temporary EPS shutdown.[12]

General Comments

The April 1, 2009 Staff Report identifies a data discrepancy with regard to flows reported from the EPS during the relevant sampling period. (April 1, 2009 Staff Report at 15 fn. 31). EPS

[8] In this regard, the design of the CDP such that 304mgd of source water (and attendant marine life mortality) be required to produce only 50mgd of potable water is problematic. If alternative concentrate disposal opportunities were further explored (such as co-mingled discharge with an improved reclamation facility outfall), the source water needs of the CDP might be drastically reduced. Reduced source water requirements would in turn render alternative intakes more viable for a reasonable quantity of water produced.

[9] That the Coastal Commission was compelled to make findings sufficient to permit the CDP as a stand-alone facility is compelling. The Regional Board cannot blindly accept Poseidon's assertion that the EPS will remain indefinitely, and restrict project assessment to only a co-located facility. Unless the entirety of the facility's approvals is restricted to the co-located condition.

[10] See related discussion in Coastal Commission's April 6, 2009 letter, at 10.

[11] A draft version of this section was provided to Regional Board staff on April 3, 2009. Various changes have been made and this final version supercedes the previous submission.

[12] Though just transmitted to the Environmental Groups and not part of our most recent impingement impacts review, the Coastal Commission's letter is largely in accord with our perspective, and we support the recommendations contained therein.

monitoring reports also show flows consistently lower for the data set compared to that contained in CDP/EPS consultant Tenera's flow data. (Personal communication with staff). Both data sets should be made publicly available, and re-evaluated. If impingement rates are calculated as mass/volume, the data set will be skewed in Poseidon's favor when flow rates are over-estimated.

Poseidon's assertion that .5 feet/second (fps) velocity at inlet screens will reduce impingement to insignificant levels is unsupported. We concur with Staff's determination that most impingement intake and mortality occurs at the rotating screens rather than on the bar racks. (April 1, 2009 Staff Report at 8). Further, installation of VFDs on CDP intake pumps to reduce total intake flow for the desalination facility will only reduce intake flow for up to 104 MGD, as 200 MGD (dilution seawater) never flows to the desalination plant. Any reduction of impingement through use of VFDs (which is unvalidated and unquantified) is therefore only attributable to that portion of flows going directly to the CDP. (April 1, 2009 Staff Report at 10). As Poseidon does not currently "take credit" for VFDs, or propose to use any design or technology measures to reduce impingement, we offer this position to rebut any future attempts to "take credit" for such measures. Further, because Poseidon fails to quantify the reduction in impingement resulting from any such technological "improvements," characterization as such is unwarranted and does not serve to meet PC section 13142.5 requirements.

Calculation Impingement Attributable to CDP Operations

Poseidon's individual sampling impingement rates are calculated as follows: average impingement weight, divided by the associated flow volume for the sampling day, multiplied by 304 MGD. These resulting "weights" are then averaged. Two sampling events had higher associated impingement rates. Poseidon argues for their exclusion, while Dr. Raimondi and staff believe they should remain in the data set. We concur with Dr. Raimondi and staff: the two data points with high associated impingement rates should not be considered outliers.

As staff correctly points out, Poseidon's proposed rainfall "flushing" theory is based on several flawed assumptions.

- High impingement rate is not always associated with heavy rainfall. (April 1, 2009 Staff Report at 14).
- High impingement rate does not correlate with any rainfall. (April 1, 2009 Staff Report at 15).
- The mechanism by which heavy rainfall might cause high impingement is unclear. (April 1, 2009 Staff Report at 15).
- Poseidon's proposed theory is unsubstantiated. Moreover, the data itself belies the proposed "flushing" theory, as the percentage of freshwater fish impinged is small. (April 1, 2009 Staff Report at 15).

Staff points out that several lines of evidence are missing and Poseidon has provided no actual data to shed light on the origin of high impingement rates. Moreover, staff's proposed theories as to the origin of the higher impingement rates on the two contested days are more persuasive

than Poseidon's theory, and favor keeping the two days within the data set. (April 1, 2009 Staff Report at 15).Without conclusive proof that the two high impingement days are truly "outliers," the data set must remain undisturbed.

Dr. Raimondi also argues that Poseidon's theory is flawed and based on logical error. (Raimondi, 7). The lack of historical impingement data weighs in favor of being inclusive, rather than considering certain data sets outliers. (Raimondi, 7).

Further, Poseidon's proposed theory, as supported by Jenkins and Chang, is flawed and unsupported by the existing data. Indeed, Dr. Chang's analysis is flawed in and of itself. As Dr. Chang admits, the sampling period (2004-2005) was an abnormally wet period, as total rainfall was 26 inches as opposed to a typical average of 13 inches. However, Dr. Chang's overly narrow focus on the two data points undermines the credibility of his entire analysis. Without providing the rainfall data or statistical analysis of the probability of occurrence for the entire data set, Poseidon cannot credibly argue that the two "suspect" data points are outliers. Moreover, as Dr. Raimondi correctly points out, even if the storm events themselves are outliers (which we cannot know without the entire data set), this does not mean the impingement associated with those rain events is atypical. (Raimondi, 7).

Dr. Jenkins' data is equally unpersuasive. He first concludes that the rainfall data does not alter the validity of the sampling data, because lagoon salinity was not depressed on a persistent basis. (Jenkins, 2). He then concludes the above-average rainfall during the sampling period was "fortuitous" because it spanned the full range of "natural hydrologic variability" and "captured a range of conditions, including some that are not likely to re-occur in most years."

It does not follow then, that the two "statistically anomalous" extreme storm event days should be excluded from the data set. (Jenkins, 4). If the entire data set includes a range of "natural hydrologic variability" the entire data set must be used. The fortuitous event of capturing these two high storm events, using Jenkins' logic, favors being inclusive rather than exclusive. Similar to Dr. Chang's analysis, Dr. Jenkins' assertions as to the two contested data points is flawed as well due to his overly narrow focus on those two data points. In failing to compare those two days to the entire sampling period, he also fails to prove why they should be excluded. Thus, Poseidon has not met its burden of conclusively proving the two days should be considered anomalies.

Heat Treatments

The impingement impact calculation also seems to reflect only "normal operations" and not heat treatments. Poseidon's Flow Plan calculations (and Dr. Raimondi's calculations based on approach 3-B) result in a weighted average impingement rate of 4.7 kg/day. This results in an annual impingement of 1715kg (to a 50 percent confidence level). However, as pointed out in the April 1, 2009 Staff Report, heat treatments will continue during co-located operations. The organisms already in the intake channel are killed when the intake channel is closed off, and the heated discharge water is circulated for hours. (April 1, 2009 Staff Report at 12 fn. 23). These organisms end up impinged when the pumps return to normal operation. Poseidon and Raimondi's calculations do not take into account the proportion of organisms killed during heat treatments attributable to Poseidon's flows. If EPS intake pumps are operating for the benefit of CDP, a larger number of organisms will be present in the intake channel than would occur if

CDP were not operating. Thus, a larger number of organisms will be impinged at the time of heat treatments. The proportion of impingement due to CDP operations as opposed to EPS operations can be calculated real-time by determining the percentage of flow attributable to CDP operations, and multiplied by the total impingement due to heat treatments.

Poseidon's Proposed Impingement Mitigation Measures

Based on Dr. Raimondi's review of Chris Nordby's analysis, Poseidon's proposed mitigation for impingement is wholly inadequate. We agree with Dr. Raimondi's assessment that the approach used by Poseidon (and Nordby) is flawed for the following reasons:

- Entrainment compensation cannot also be used for impingement compensation. (Raimondi, 1-2)
- Nordby's approach relies on a 27-year old study by Larrry Allen that is inapplicable here.
- Nordby's estimation of fish production is based on mudflat wetlands, which only comprise 40 percent of Poseidon's proposed entrainment mitigation (as adopted by the CCC).
- The estimation of fish production also assumes no current production - which is only true if wetlands are created, not restored. The MLMP contemplates significant restoration, but because the site or sites have not been identified, quantification of restoration and creation acreages is not possible.
- Nordby's calculations are based on a 50 percent confidence level. The accepted scientific standard is 95%, and the Coastal Commission precedent is 80% for the MLMP mitigation calculations. (Raimondi, 3).
- Nordby's calculations rely on fish production calculations (productivity of newly created wetlands) based on species that are entrained, which results in "double-counting".
- The calculations incorrectly assume entrainment calculations equate to actual impact of entrainment.
- Entrained species are also impinged - thus the impacts are additive, and cannot be mitigated through creation or restoration of wetlands that mitigate for entrainment

Environmental Groups' Proposed Impingement Compensatory Mitigation[13]

[13] The Environmental Groups maintain that compensatory mitigation is illegal pursuant to the rationale described in the prior comment letters, based upon the *Riverkeeper* case. This proposed impingement mitigation requirement should not in any way be considered an endorsement of the entrainment compensatory mitigation scheme approved by the CCC and contemplated in the MLMP

In light of recent studies reflecting the poor performance of compensatory wetlands creation, a very conservative approach should be taken in assigning productivity to wetland mitigation. (See, An Evaluation of Compensatory Mitigation Projects Permitted Under Clean Water Act Section 401 by the California State Water Resources Control Board, 1991-2002, (2007) Ambrose, et al)(Mitigation Success Study). Two findings of the Mitigation Success Study are particularly relevant here:

- Given the low ecological condition of most mitigation wetlands, it seems likely that many mitigation projects did not replace the functions lost when wetlands were impacted.

- A lack of explicit consideration of the full suite of functions, values, and services that will be lost through proposed impacts and might be gained through proposed mitigation sites and activities is at least partly due to regulatory agencies approving mitigation projects with conditions or criteria that are too heavily focused on the vegetation component of wetland function, with inadequate emphasis on hydrological and biogeochemical conditions and their associated functions and services.

The basic premise for compensatory mitigation is that the newly created or restored wetlands actually compensate for the loss associated with the project. Thus, the mitigation required for CDP impingement must take into account the validity of the impact calculations and the validity of mitigation calculations. Put another way, we cannot be certain that the impingement calculations truly reflect actual impingement impacts. They serve as a proxy for actual impingement assessment. Thus, the highest level of statistical certainty must be applied to impingement impact calculations. This equates to a 95 percent confidence interval in Raimondi's study. (Raimondi, 4)

Second, the mitigation wetland productivity calculations should be conservative, as underscored by the lack of success in actual wetland mitigation. Thus, because wetland productivity assumptions are based on completely newly created wetlands, Poseidon must be required to actually create wetlands, as opposed to restoring them. Another assumption associated with wetland productivity relates to the type of wetland created. Poseidon's MLMP presents a mix of wetlands, comprised of 40 percent intertidal mudflats or subtidal. Dr. Raimondi's calculations associated with this mix should be used to provide a wetland mitigation acreage. (Raimondi, 6)

The Mitigation Success Study also found "[t]he success of compensatory mitigation depends fundamentally on the mitigation requirements specified by the regulatory agencies." (Mitigation Success Study at v.)[14] Thus, additional requirements regarding the success of compensatory mitigation must be imposed. Staff correctly points out that the success of MLMP entrainment

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before the Regional Baord.

[14] Additional documents are submitted herewith that describing factors required for consideration prior to establishing a compensatory wetlands mitigation scheme. See Environmental Group Appendix of Wetlands Documents.

mitigation is assessed through a 95 percent confidence interval of correlation in physical and biological criteria compared to (yet-unspecified) reference stations, for a period of three consecutive years. (Staff Report, 19). This iterative assessment may result in a period of time where the restored wetlands are not meeting these criteria. For those years when the criteria are not met, the goal of compensatory mitigation-namely offsetting CDP impacts through productivity at the restored wetlands-is not being met. Thus, the whole basis for calculating the wetland mitigation is undermined. In order to account for this, a penalty for not meeting the performance criteria within a specified timeframe must be included in the permit. For example, if within 5 years of wetland restoration the 3-year benchmark is not attained, an additional 5 years of unmitigated impingement impacts must be taken into account. This would result in a total increased wetland restoration acreage. As the benchmark performance standards continue to be unmet, the penalty increases.

To summarize, at a minimum, the impingement compensatory mitigation should meet the following criteria:

1) Impingement impacts should be calculated to a 95 percent confidence interval, as extrapolated by Dr. Raimondi from a 4.7kg/day (50 percent confidence interval) impact assessment.

2) Impingement impacts should be calculated at a rate of 304 MGD attributable to CDP impacts, or calculated real-time.

3) Impingement compensatory wetland productivity calculations must take into account the type of wetland created. If Poseidon's proposed mixture in the MLMP is applied to impingement mitigation, Dr. Raimondi's calculations should be used at a 95 percent confidence interval.

4) Wetlands must be created, not restored.

5) Penalties should be assessed when performance criteria are not met for a given period of time.

Using the above criteria, the required compensatory mitigation for impingement only, assuming 100 percent of CDP intake is attributable to CDP operations, a minimum of 54 additional acres of newly created wetlands (40 percent intertidal or subtidal) should be required.

Additional Miscellaneous Comments

So that we may provide these comments as soon as possible to staff, the following are general comments based upon various documents recently submitted:

- The Board at its February 11, 2009 indicated a desire for Poseidon to narrow its consideration of mitigation sites to 5 within the San Diego Region. Implicit in this request was that Poseidon provide added specificity regarding the feasibility of achieving the desired wetlands functionality criteria at these sites, not simply that they be prioritized over those outside of the region. Given that the feasibility of the mitigation required cannot be assured (see discussion, infra.) even at the

best of sites, it is imperative that appropriate pre-selection assessment occur. Approval of the MLMP as currently proposed violates the PC 13142.5 requirement that best available mitigation be implemented, as the Board cannot make such assessment without baseline information about the site or sites where wetlands will be created or restored.

- Regardless of whether the impingement study design was approved by the Regional Board staff at some time in the past, if the results are not sufficient to provide an accurate assessment of likely impingement impacts, additional data should be acquired before project approval. Given the disagreements among experts regarding the so-called outlier impingement events, additional data collection and analysis is warranted. The fact that the Regional Board staff must rely upon a 1979 document does not necessarily speak to the unreliability of that document, but rather, the appropriateness of confirming its findings with additional data now.

- Poseidon's claims that the "late-arrival" of concerns regarding impingement impacts render them in any way less valid is nonsense. The entire CDP regulatory approval process has been a fight to acquire accurate information from Poseidon within timeframes that allow for appropriate consideration. That Board staff, an independent third-party reviewer, and the Coastal Commission staff all agree (with Environmental Groups) that impingement impacts will be greater than previously disclosed by Poseidon, that they will be significant, and that they require mitigation in addition to that provided for entrainment impacts, provides more than enough reason to discount Poseidon's veiled attempts to argue such concerns were somehow waived by past actions.

- Poseidon's concerns regarding expert disagreement can most appropriately be rectified by postponing approval of the CDP and holding a public workshop so that the matters can be aired entirely.

- Poseidon, in its rebuttal of Dr. Raimondi's impingement impacts assessment repeatedly sets up straw man arguments that are incorrect reflections of Dr. Raimondi's position. The Board should further consider this evidence of Poseidon's misrepresentation of facts throughout the regulatory process. (See, for instance, Poseidon's Comments, April 2, 2009, at p.3, claiming that Dr. Raimondi "has opined that juvenile and adult fish that will be present in the proposed wetlands cannot be used to compensate for fish lost at the CDP," and claiming that such assertion is "nonsensical." What is nonsensical is Poseidon's attorneys reading Dr. Raimondi's report in this way. Dr. Raimondi's position, consistent with that of Board staff, CCC staff, and Environmental Groups, is that without data regarding the quality of wetlands to be restored or created, it would be impossible to prescribe some quantity of the marine life enhancements as accounting for anything but the entrainment impacts upon which the MLMP is based.)

- Poseidon's attempts to compare impacts of a stand-alone CDP to those of the EPS are irrelevant. See straw man argument discussion, immediately above.

- Arguments that the Agua Hedionda Lagoon will revert to mudflats if the desalination plant is not approved are laughable at this point. There is no evidence to suggest decommission of the EPS will result in abandonment of management measures to support marine life viability in the lagoon.

- Poseidon and its experts persist in their attempts to characterize impingement and entrainment impacts solely in terms of biomass lost. This may have succeeded for the limited CEQA review by the City of Carlsbad, but the regulatory agencies have made absolutely clear that the proposed compensatory mitigation scheme seeks to account for lost ecosystem function associated with the individuals lost to impingement and entrainment. Because the loss of individuals will have a different impact on the ecosystem depending on their unique characteristics, mitigation obligations must be based upon extremely conservative impacts assumptions.

- Poseidon seeks to minimize the impacts from impingement based upon conservative assumptions built into the data collection and characterization. Such arguments are accounted for in assessment methodology, and there is no overarching argument regarding conservativism that is relevant to final impingement mitigation requirements.

- The repeated references to the consumption volumes of the Brown Pelican are meaningless. Just because a Pelican consumes a certain biomass of fish does not mean the Pelican feeds from a single location within its home range. By way of analogy, comparing the volume of food a human consumes to the amount of food in a supermarket is much different than comparing it to the amount in his or her refrigerator. Simply indicating that humans eat a certain amount does not reflect upon the impacts of consumption without specificity regarding the source of the food.

- Poseidon's claims of best design based upon assertions to the Coastal Commission that have now been removed from consideration should be disregarded. See CCC letter, and compare to Poseidon's assertions on page 4 of its April 2, 2009 Comment.

- The 80% confidence limit applied by the Coastal Commission is not protective enough. The Board should require mitigation acreages calculated at the 95% confidence level. While the Board's utilization of APF calculation may be appropriate to assess impacts, it does not follow that the same is an appropriate for restoration scaling. (See memorandum from Dr. Liz Strange, attached hereto as Exhibit 3)

- The recently decided US Supreme Court *Riverkeeper* decision regarding the application of cost-benefit analysis under Clean Water Act 316(b) does not invalidate the lower court's ruling regarding lack of availability of compensatory mitigation in lieu of implementation of best available technology.

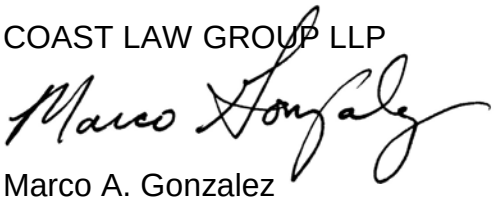
Conclusion

The CDP was originally designed and proposed to be a co-located facility. Any rationale offered as to the benefits of it standing alone are post-hoc rationalizations that should carry little or no weight. For stand-alone conditions, the Board must assume it has carte blanche ability to require the best site, design, technology, and mitigation measures feasible to minimize marine life mortality. Given that the EPS OTC infrastructure will not persist for the expected 30-year life of the CDP, it is legally inappropriate to consider the current analysis in any way sufficient to support a stand-alone facility. Approval of the co-located facility is bad policy, and likely illegal. Approval of a stand-alone facility would certainly be illegal.

Thank you for your careful consideration of these comments.

Sincerely,

COAST LAW GROUP LLP



Marco A. Gonzalez
Attorney for San Diego Coastkeeper
and the Surfrider Foundation

EXHIBIT 1

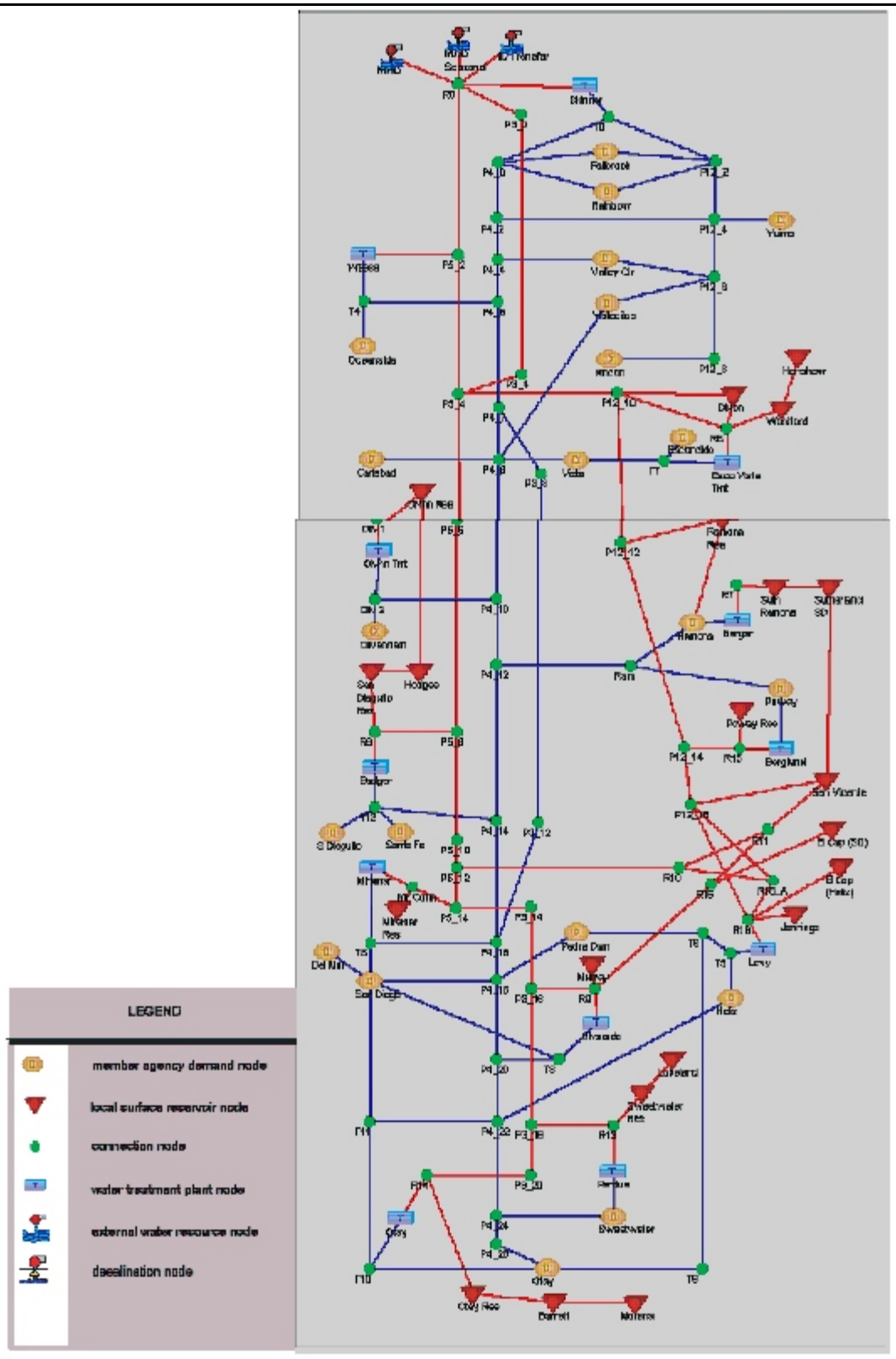


Figure 2-1. Schematic Representation of Regional Treatment and Delivery System, including ESP Projects, as Modeled by Confluence™

EXHIBIT 1

EXHIBIT 2

Figure 1-1. Authority Service Area

EXHIBIT 2

EXHIBIT 3

Memorandum

To: Surfrider Foundation and Coast Law Group LLP

From: Elizabeth M. Strange, PhD, Stratus Consulting Inc.

Date: 8/4/2008

Subject: Review of Poseidon Resources Marine Life Mitigation Plan for the Proposed Carlsbad Desalination Plant

This memorandum provides a technical review of Poseidon Resources' Proposed Marine Life Mitigation Plan (MLMP) for the Carlsbad Desalination Project. The review does not address all details of the MLMP, but focuses on the key issues associated with the Area Production Foregone (APF)[1] method and principles of restoration scaling.

1. Use of APF As a Measure of Entrainment Impact

Conceptually, the APF is a way to express entrainment losses in terms of habitat area using data obtained from larval sampling for the Empirical Transport Model (ETM; MacCall, 1983; Steinbeck et al., 2007).[2] The ETM is an entrainment assessment method that estimates the proportional mortality (PM) of larvae based on the ratio of entrained larvae to the population of larvae in the source water area (SWA) that are at risk of entrainment.

The APF is estimated by multiplying the PM by the SWA as follows:

$$APF = PM \times SWA$$

For the Carlsbad MLMP, an average APF was calculated from the average PM for the species accounting for 98% of entrainment losses at the Encina Power Station (CIQ^3 gobies, blennies, and garibaldi) and the estimated SWA of those species in the Agua Hedionda Lagoon (Poseidon Resources, 2008a):

$$AFP_{AVG} = 0.122 \times 302 \text{ acres} = 37 \text{ acres}$$

1. Also known as Habitat Production Foregone (HPF).

2. The ETM used in California is a modification of the original model developed to evaluate entrainment by Hudson River power plants (Boreman et al., 1978).

3. Gobies of the genera *Clevelandia*, *Llypnus*, and *Quietula*.

Another 5.5 acres was added to this estimate by Dr. Peter Raimondi of the University of California at Santa Cruz to account for impacts to ocean species, resulting in a total of 42.5 acres. Subsequently, Dr. Raimondi estimated a total of 55.4 acres based on an additional uncertainty analysis (Poseidon Resources, 2008b).[4]

2. Use of the APF to Scale Restoration

The APF provides a convenient way to express entrainment impacts estimated with the ETM in terms of habitat, and the extension of the APF for restoration scaling is a logical way to make use of the data generated by the ETM. However, ETM data and the APF method are not necessarily the best way to scale restoration. The restoration scaling literature provides information on data and methods that can provide a more accurate and reliable estimate of the amount of restoration needed to offset a given loss (see especially the 2003 "Special Theme Section on Restoration Scaling" in the Marine Environment, Marine Ecology Progress Series 264:17173-307). Under some circumstances, the APF may provide a valid first approximation of the scale of restoration if (Strange et al., In review):

- The SWA comprises relatively uniform habitat
- The habitat in the SWA and the habitat to be restored are the same type and quality
- The SWA is located where organisms are at risk of entrainment is the source of larval production
- Larval production is habitat-limited.

As discussed in the following sections, these conditions have not been demonstrated for MLMP restoration scaling.

2.1 Assumptions About Habitat Characteristics of Agua Hedionda Lagoon and the Proposed Restoration Site

The Agua Hedionda Lagoon includes a diversity of habitats (Tenera, 2008), making it inappropriate to assume a single, average SWA for the purposes of scaling using the APF. In addition, the MLMP states that offsite restoration is required because there are no suitable restoration options in the Agua Hedionda Lagoon (Poseidon Resources, 2008a). If this is the

4. Note that the ETM does not consider impingement losses, and therefore these estimates apply to entrained species only. However, a conceptually similar model was developed for impingement by Barnthouse et al. (1979).

case, then it is inappropriate to estimate potential gains from restoration using fish sampling data from the Agua Hedionda Lagoon. If the Agua Hedionda Lagoon and the restoration site, San Dieguito Lagoon, or any other potential restoration site, do not provide habitats of similar type and quality, then rates of production at the two sites are unlikely to be comparable.

In fact, it has been reported that the density of adult and juvenile arrow goby, a member of the CIQ goby complex that dominates entrainment losses at the Encina Power Station, averages 20 per square meter (m^2) in the Agua Hedionda Lagoon, whereas the density of *all* gobies estimated from restoration monitoring in Batiquitos Lagoon, 7 kilometers south of Agua Hedionda Lagoon, is only 0.3 to 1.6 m^2 (Tenera, 2008).[5] Such potentially significant differences in habitat quality at impacted and restored sites must be accounted for to produce a valid scaling estimate.

A complicating factor is that even if the habitat targeted for restoration is of low quality, it may currently support some "baseline" amount of fish production. In this case, potential restoration gains must be assessed as the incremental change in quality, not simply the quality after restoration (NOAA, 2006).

The implementation of APF for MLMP scaling implicitly assumes that all acres of habitat are equal at the original and restoration sites and that there is a simple one-to-one relationship, on an areal basis, between fish losses and gains. If this assumption is violated, the APF estimate will inaccurately estimate the amount of restoration needed to offset entrainment losses. Assumptions About Source of Larval Production

The MLMP does not demonstrate that the Agua Hedionda Lagoon is the source of larval production for all entrained species. In fact, the five most abundantly entrained species at the Encina Power Station include species associated with rocky reef habitat (garibaldi and kelpfishes) and coastal pelagic habitats (anchovies), as well as species of bay and harbor habitats (gobies and blennies; Tenera, 2008). It is unreasonable to assume that restoration of lagoon habitats will lead to increased production of reef and coastal pelagic species.

2.2 Assumptions About Habitat-Limitation

The MLMP implicitly assumes that the populations of all species entrained from the Agua Hedionda Lagoon are habitat-limited, but this is not demonstrated in the MLMP. There are numerous factors that can limit fish populations. For example, local populations of fishery species may be limited by fishing mortality on adults, or larvae may be limited by food

5. Both estimates are from sampling with enclosure traps, considered the most accurate sampling devices for gobies (Steele et al., 2006).

availability. If such factors are limiting populations of entrained species, then restoration of habitat may do little to increase recruitment and offset entrainment losses, even though restoration may be beneficial to the environment in general.

3. Scaling Based on Averages

The APF scales restoration for the MLMP based on the average PM for the target species. An argument that has been presented in favor of averaging is that each taxon can be considered an independent sample from the collection of all taxa that are entrained, and therefore the mean of several of these samples can be used to represent the loss rate for all entrained taxa (Steinbeck et al., 2007). However, the average PM is difficult to interpret when the size of the SWA differs by species. The situation is analogous to the problem of averaging several ratios when the denominators are different. This kind of averaging strongly influences APF estimates of the area of replacement habitat needed to offset losses.

Another consequence of averaging is that the amount of restoration may be insufficient to offset the losses of any species requiring more habitat than the average. In these cases, it is appropriate to scale restoration based on the species requiring the maximum.

Moreover, although it is usually possible to determine the SWA for estuarine species in enclosed and semi-enclosed water bodies with reasonable accuracy, it is difficult to develop a reliable estimate of the SWA for ocean species. Estimated SWAs of coastal taxa depend on the estimated age of entrainment, the duration of larval exposure to entrainment, and the complex hydrodynamics of ocean waters. The uncertainty associated with these factors can lead to significant uncertainty in estimated SWAs and therefore APF estimates for these taxa.

4. Estimating Restoration Gains

4.1 Estimating Increase in Baseline Production in Replacement Habitat

The goal of restoration is to increase baseline production in a replacement habitat at a scale that will *augment* production sufficiently to offset biological losses at the impacted site. To achieve this, the replacement habitat must be able, as a result of restoration actions, to produce an *increase* in fish production above the baseline production that would be achieved in that habitat absent the restoration actions. Therefore, an appropriate metric to compare losses and gains for restoration scaling includes both area and time (NOAA, 1997). Such scaling metrics include measures of *recruitment* (the addition of new recruits to the population per unit area per time) or *productivity* (the rate of biomass production per unit area per unit time; Strange et al., 2004a).

Measures such as the abundance or biomass of organisms within a unit area do not take into account time and rates of population change. The underlying data for APF scaling is catch-per-unit-effort data from sampling conducted for the ETM. Fish per unit area is not a measure of the rate of change in fish recruitment or productivity.

In many situations data limitations may require use of abundance or biomass estimates as a proxy for recruitment or the rate of production. However, this will produce a valid estimate of the amount of restoration only if:

- Those individuals observed at the time of abundance sampling are all the individuals of the age sampled that will be produced that year
- There is no turnover
- There is no immigration or emigration
- Abundance and biomass are comparable in the habitat sampled and the habitat targeted for restoration, or scaling can be adjusted to account for differences.

Abundance may be less than production if there is immigration, multiple spawning bouts not covered by the sampling regime, or significant sampling inefficiency (including gear inefficiency or failure to adequately sample a patchy habitat). Abundance may be greater than production if there is emigration. The MLMP fails to address these issues.

4.2 The Key Habitat Services are Those Needed to Produce Replace the Fish Lost to Entrainment

Poseidon Resources (2008a, 2008b) argues that because the proposed project will generate numerous ecological benefits in addition to the production of fish, credit should be assigned for these "extra" services. However, restoration should replace the organisms lost to entrainment (and impingement), regardless of any ancillary benefits of the restoration. The fundamental purpose of Section 316(b) of the Clean Water Act is to prevent adverse environmental impacts such as entrainment. Replacing the same species and life stages as those lost to entrainment (and impingement) is appropriate to address unpreventable losses with the "best technology available."[6] Restoration of other services and values may be beneficial to society but misses the key purpose of the statute. Furthermore, even if the Clean Water Act allowed "acquisition of the

6. "Best Technology Available" or "BTA" is a term of art under the Clean Water Act, which applies under Section 316(b) to minimizing adverse environmental impacts by cooling water intake structures.

equivalent,"[7] services and values would need to be analyzed for equivalence, requiring more complex ecological and economic analyses than provided by APF.

5. Discounting and Time Preference

The APF method does not include discounting, which is required when comparing restoration that occurs after losses. Furthermore, it is often mistakenly assumed that there is a linear path between an impacted and restored ecosystem state; in fact, there is usually a lag until restoration benefits begin to accrue (Strange et al., 2002; NOAA, 2006). Indeed, the restoration plan for San Dieguito Lagoon assumes that equivalence will not be achieved until at least four years after restoration begins (SCE, 2005). Because of such time lags, discounting is required. Discounting is also needed to account for restoration gains expected to continue in perpetuity (i.e., longer than the time of the required restoration; Julius, 1999; NOAA, 1999).

Discounting converts losses and gains into "present value equivalents." This is done to account for the fact that gains in fish production in the future as a result of restoration are less valuable to the public than fish available now, much in the way a dollar now is worth more than a dollar later. Both the loss and gain side of a scaling equation are discounted to express results in terms of a common year, making it possible to compare the timing and duration of losses with the predicted timing and trajectory of restoration gains (Julius, 1999; NOAA, 1999).

The lack of a discount term in APF scaling implies that a restoration project that begins several years from now is as valuable as the same project beginning today. Discounting would lead to a larger estimated restoration project because future resource gains from restoration are less valuable (due to discounting) than the resources lost.

The discount factor is expressed as:

$$(1 + d)^y$$

where:

d is the discount rate and y is the years before or after entrainment.

7. "Acquisition of the equivalent" is a term of art under the natural resource provisions of the Comprehensive Environmental Response, Compensation, and Liability Act, which specifically allows for scaling of natural resources based on services and values, particularly when natural resources cannot be fixed or replaced, practically or cost-effectively.

For example, to account for the delay between the time of entrainment loss and the time that restoration achieves the targeted level of fish production, discounting is used to express the total value of restoration gains over all years (TV) in terms of the year of the loss:

$$TV = \sum V_y \, [1 / (1 + d)]^y$$

where:

V_y is the value y years after the loss.

The National Oceanic and Atmospheric Administration (NOAA) and other resource agencies typically use a discount rate of 3% (Julius, 1999; NOAA, 1999) when discounting natural resources or their services.

6. Alternative Scaling

Strange et al. (2004b) discuss a number of scaling metrics that can be used to estimate losses of organisms from entrainment, and gains in restored habitat for offsetting these losses. It has been argued that the APF approach to scaling is necessary because the data needed for other approaches is not available. While it is true that we generally lack estimates of rates of fish production in California's coastal habitats, some estimates are available that can be used to illustrate a scaling approach that uses a direct estimate of annual fish production.

For example, production data for the CIQ goby complex are available in Allen (1982) from sampling of shallow mudflat habitat in upper Newport Bay, and these data can be used to scale the amount of goby restoration required to offset entrainment losses. For this example, scaling proceeds as follows:

Step 1: Estimate Annual Entrainment as Numbers of Age-1 Equivalents. Page 5-12 of Poseidon Resources (2008b) indicates that the maximum feedwater withdrawal for the proposed Carlsbad desalination project operated as a stand-alone facility would be 304 million gallons per day (MGD). Multiplying this value by the estimated entrainment of CIQ gobies at the Encina Power Station of 8,846 larvae per day yields an estimated daily entrainment of 2,689,184 or 981,552,160 goby per year.[8] Converting this estimate to age-1 equivalents using the life history data for gobies in U.S. EPA (2006), results in an estimated age-1 equivalent loss of 3,217,720 gobies per year.

8. The estimated goby loss per day is based on maximum flow at the Encina Power Station (857 MGD) reported in Tenera (2008). The loss rate may be different under actual flow but this flow rate was not reported.

Step 2: Convert Age-1 Equivalent Losses to Grams. Based on the total annual abundance (1,419) and weight of CIQ gobies [345.9 grams wet weight (gm ww)] in Table 2 of Allen (1982), the average weight of a goby sampled by Allen (1982) is 0.24 gm ww. Allen (1982) reports that most of the sampled gobies were young-of-year (YOY) and juveniles. The product of the annual entrainment of age-1 gobies (3,217,720) and the average weight of (YOY) and juvenile gobies (0.24 gm ww) yields an estimated total weight of annual goby entrainment of 772,253 gm ww per year or 193,063 grams dry weight (gm dw) per year.

Step 3: Determine the Present Value (PV) of the Estimated Entrainment Loss. Using a 3% discount rate and assuming a 30-year operating life of the desalination plant, the PV of the entrainment loss is 3,784,124 gm dw.

Step 4: Determine the PV of the Estimated Production per Littoral Zone Acre. Based on Table 3 in Allen (1982), the estimated rate of goby production is 0.2026 gm dw per square meter per year (gm dw m^{-2} yr^{-1}) or 820 acres gm dw per year (gm dw ac^{-2} yr^{-1}). Using a 3% discount rate and assuming a 30-year operating life of the desalination plant, the PV of the production per restored littoral zone acre is 27,331 gm dw.

Step 5: Estimate the Amount of Restoration Needed to Offset Entrainment. In the final step of the analysis, the estimated littoral zone acres to be restored is given by the ratio of the PV dry weight loss over 30 years and the PV dry weight produced. Thus, for this example the estimated scale of restoration is 3,784,124 / 27,331 = 138 acres. Details of this analysis are provided in the appendix to this review.

This example does not imply that the underlying data are without error, due to factors such as natural variability or sampling limitations, or that the analysis does not require a formal uncertainty analysis. Rather, it illustrates scaling using a direct measure of fish production. As indicated by Dr. Raimondi for the APF estimates, and widely acknowledged by the scientific community, uncertainty analysis is a critical part of restoration scaling. Approaches for addressing scaling uncertainty are discussed at length in a report by NOAA (1999), and are therefore not a topic of this review.

A key advantage of this alternative approach, compared to the APF is that it is based on actual fish production rates rather than an indirect estimate that depends on the special circumstance of relatively uniform habitat in an easily defined SWA and sampling of both larval entrainment and the larval population at risk of entrainment.

The obvious disadvantage of the approach is that site-specific and species-specific rates of fish production are generally lacking for estuarine habitats in California. The necessary data for estimating rates of fish production could be obtained from restoration monitoring or ongoing studies of reference habitats (e.g., SCE, 2005), particularly by requiring such monitoring as a

condition of permits. Unless the need for such data is acknowledged and made explicit in restoration scaling discussions, we will lose the opportunity to fill these important data gaps.

7. Summary

This review suggests that the scale of restoration proposed in the MLMP is not conservative, as asserted by Poseidon Resources, for the following reasons:

- The scaling proposal does not consider impingement losses (the ETM upon which the APF is based assesses entrainment only)
- Use of the APF to scale offsite restoration implicitly assumes that habitat quality is the same in the Agua Hedionda Lagoon and the proposed restoration site; the available evidence suggests that habitat quality for CIQ gobies, which make up most entrainment losses, is much higher in Agua Hedionda Lagoon
- The MLMP does not demonstrate that all the species whose losses are to be offset through habitat restoration are, in fact, habitat-limited; if this assumption is not valid for some or all entrained species, the proposed restoration will do little to offset entrainment losses
- The scaling proposal assumes that the production of ocean species will increase as a result of lagoon restoration, which is highly unlikely; there is no reason to believe that these species are limited by the availability of lagoon habitat
- The APF scaling is not based on the species requiring the maximum amount of restoration, as is common practice for restoration scaling; therefore the proposed amount of restoration may be insufficient to offset the losses of species requiring more than the average
- It is incorrect to attribute restoration credit for services or values other than replacement of the organisms lost to entrainment (and impingement)
- Lack of discounting to account for restoration "ramp up" and the net PV of the affected resources results in an underestimate of the scale of restoration.

8. Conclusions

The APF method can be useful as a first approximation of the scale of restoration when there is a lack of species' life history data and other information needed to estimate rates of fish

production. However, when such data are available or can be obtained from habitat monitoring, scaling based on species-specific production rates may be expected to provide a more accurate and reliable estimate of the scale of restoration.

This points to the critical need to conduct more comprehensive studies of the life histories of species impinged and entrained and rates of fish production in both natural and restored habitats, including as requirements in permits (particularly where restoration is part of permit requirements). In the meantime, the use of multiple scaling methods (described in Strange et al., 2004b) to scale restoration for the MLMP would increase confidence that the proposed restoration will actually offset entrainment losses, at least to some extent. Mitigation ratios are also sometimes used to provide a "safety factor" to help increase the possibility that proposed restoration will be sufficient when habitats differ in type or quality or when there are significant uncertainties about habitat productivity. However, if mitigation ratios are selected without a formal analysis using suitable ecological data, uncertainties about whether a proposed restoration will offset entrainment losses will not be resolved.

Despite such contingency measures, experience has shown that aquatic ecosystem restoration is difficult and complex, and that success is highly uncertain (NRC, 1992, 2001). It is almost never the case, for example, that the ecological quality of a restored salt marsh is comparable to that of the original habitat (Strange et al., 2002). As a result, monitoring and adaptive management are considered necessary components of any restoration plan. The MLMP contains few details of its proposed monitoring plan, and this is a significant shortcoming. By contrast, considerable effort has gone into the development of the monitoring plan for the proposed restoration of the San Onofre Nuclear Generating Station (SCE, 2005). This information may help in the design of monitoring for the proposed MLMP.

Viewed together, the significant ecological uncertainties identified in this review suggest that even if resource agencies conclude that habitat restoration has a role in offsetting "residual" entrainment losses, the success of restoration is not assured, and preference should be given to avoiding losses. For many years, this has been the position of agencies involved in fisheries management and habitat restoration (e.g., agencies involved in mitigation decisions under Section 404 of the Clean Water Act).

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Appendix. Example of Restoration Scaling Using Entrainment Rates for the Encina Power Station and Rates of Fish Production in Allen (1982)

Table A.1. Estimated entrainment loss for a stand-alone desalination facility in Agua Hedinoda Lagoon based on data in Tenera (2008) for the Encina Power Station

Calculation		Source of data and calculation notes
Estimated annual entrainment of gobies, expressed as age-1 equivalents	3,217,720	Calculated as: the estimated maximum feedwater withdrawal for a stand-alone desalination facility (304 MGD, from p. 5-12 of Poseidon Resources, 2008b) multiplied by the average daily entrainment of gobies at the Encina Power Station under max flow (8,846) = 2,689,184 larvae per day or 981,552,160 larvae per year. 981,552,160 larvae converted to age-1 equivalents based on life history data in U.S. EPA (2006) = 3,217,720.
Average goby weight in gm ww	0.24000	Based on annual total abundance and weight of gobies from Table 2 of Allen (1982) (1,419 gobies weighing a total of 345.9 gm ww).
Estimated total weight of entrained goby (gm ww)	772,253	Product of annual entrainment and average goby weight (gm ww).
Dry weight as share of wet weight	0.25	Conversion factor.
Estimated annual entrainment in gm dw	193,063	Product of annual entrainment in gm ww and dry weight conversion factor.
PV of entrainment loss over next 30 years, in gm dw	3,784,124	PV calculation for assumed 30 year operating life — more restoration acres if longer, less if fewer years.

Table A.2. PV calculation for annual entrainment loss (gm dw yr^{-1})

Years from present	PV factor – year 1 discounted	Annual grams lost	PV of grams lost
1	0.97	193,063	187,440
2	0.94	193,063	181,981
3	0.92	193,063	176,680
4	0.89	193,063	171,534
5	0.86	193,063	166,538
6	0.84	193,063	161,687
7	0.81	193,063	156,978
8	0.79	193,063	152,406
9	0.77	193,063	147,967
10	0.74	193,063	143,657
11	0.72	193,063	139,473
12	0.70	193,063	135,411
13	0.68	193,063	131,467
14	0.66	193,063	127,638
15	0.64	193,063	123,920
16	0.62	193,063	120,311
17	0.61	193,063	116,806
18	0.59	193,063	113,404
19	0.57	193,063	110,101
20	0.55	193,063	106,894
21	0.54	193,063	103,781
22	0.52	193,063	100,758
23	0.51	193,063	97,824
24	0.49	193,063	94,974
25	0.48	193,063	92,208
26	0.46	193,063	89,522
27	0.45	193,063	86,915
28	0.44	193,063	84,383
29	0.42	193,063	81,926
30	0.41	193,063	79,539
Total		**5,791,896**	**3,784,124**

Table A.3. Increased production from littoral zone restoration

Calculation		Source of data and calculation notes
Estimated goby production, in gm dw m^{-2}	0.2026	Sum of reported results for gobies from Table 3 in Allen (1982).
Square meters per acre	4,047	Standard conversion factor for number of square meters per acre.
Estimated production per acre (in gm dw fish)	820	Product of square meters per acre and dry weight production per square meter.
Discount rate for present value calculations	3.0%	3% is common discount rate assumption.
Present value multiplier for an infinite annual series of returns that start immediately	33.33	This multiplier is calculated at the given interest rate as $1/r$, where r is the discount rate.
PV production per restored littoral zone acre (in gm dw per year)	27,331	PV production per acre dry weight = PV factor × adjusted dry weight production.
Required scale of restoration work (acres)	138	Littoral zone acres to be restored = PV dry weight loss over 30 years / PV dry weight produced.