Huntington Beach Desalination Project
State Lands Commission Lease Application Amendment to Lease No. PRC 1980.1

Response to State Lands Commission March 14, 2017
Request for Additional Information

March 22, 2017

Diffuser Alternatives

1. Please provide information that distinguishes the new proposed diffuser design from the diffuser design alternatives that were reviewed and screened out in the 2010 FSEIR because they were "infeasible from a structural strength and support perspective."

   Response: The analysis of alternatives performed for the 2010 SEIR made certain assumptions, and was based on the guidance in CEQA to assess a reasonable range of alternatives to the proposed project (CEQA Guidelines Section 15126.6). Since certification of the SEIR, the Ocean Plan Amendments were adopted by the State Water Resources Control Board, which, among other things, disallow flow augmentation (unless under specific circumstances), as was proposed for the project in 2010. Because of this new regulatory restriction, a deeper analysis of discharge alternatives was performed for the proposed project refinements.

   The 2010 SEIR's brine diffuser hydrodynamic analysis ruled out "conventional multi-ported diffusers that utilize many small diameter diffuser ports" because of structural limitations of the existing discharge infrastructure. (2010 SEIR at p. 6-38.) However, the 2010 SEIR concluded that a "velocity cap retrofitted to the discharge tower" would be structurally "viable" based on the existing hydraulic design parameters. The currently proposed diffuser design is consistent with the 2010 SEIR's conclusions about the existing discharge facilities structural analysis, which has been updated and reaffirmed through more recent information and analysis provided to the SLC with the lease amendment application.

   As further noted in the responses below, Alden has calculated the backpressures associated with the proposed diffuser design, and has found them to be within the range of pressures associated with the design discharge flows from the HBGS (with all four generating units in operation - combined flow through the discharge line would be 514 MGD and the currently permitted operating conditions for the HBGS (generating units 1 and 2 in operation and generating units 3 and 4 operating in a synchronized condenser mode – 387 MGD) . Additionally, Poseidon has commissioned an engineering study to recommend modifications to the discharge pipe in the unforeseen event that

detailed future inspections find structural deficiencies. Therefore, while concerns over increased pressure in the existing discharge pipeline initially resulted in an infeasibility finding in the 2010 SEIR, those concerns have now been addressed by the specific design of the diffuser that has been proposed along with an engineering review of the design standards for the existing discharge pipe and the inspections of the physical condition of the pipeline to date to find that the proposed diffuser design is indeed feasible.

2. Please explain the purpose of CLSC Application Appendix S (Conventional Diffuser Analysis, March 27, 2015). This letter from Michael Baker International (Scott Jenkins, Ph.D.) describes a four-jet diffuser and its dilution advantages compared with other options identified above (six ports, two ports [six ports with two closed], three ports with an open central port; and three ports with a capped central port). Is this four-jet diffuser design considered as a diffuser alternative by Poseidon?

   Response: **The March 27, 2015 diffuser design analysis (Appendix S of the SLC application) is a hydrodynamic analysis originally submitted to the Santa Ana Regional Water Quality Control Board as part of Poseidon's application for a determination that the proposed project complies with the Stater Water Board's Ocean Plan Amendment pertaining to seawater desalination facilities. The hydrodynamic modeling contained in the March 27, 2015 report concludes that a "Rosetta diffuser" (i.e., retrofitting the existing HBGS discharge cap as opposed to a conventional linear pipe running offshore) can be designed to achieve the Ocean Plan Amendment's brine dilution requirements that salinity levels in the discharge not exceed 2ppt above natural background at 100 meters from the point of discharge.**

   Poseidon is not proposing a diffuser design alternative. Poseidon is proposing a single design, as identified in the Alden February 23, 2017 technical report submitted to the State Lands Commission staff, based on the most current information available regarding the future operation of the HBGS' cooling water system. The current diffuser design can accommodate co-located operation with the HBGS, assuming a discharge of 126.7 MGD (i.e., operation of one HBGS unit), and the long term, stand-alone operation of the desalination facility, assuming a discharge of up to 56.7 MGD (During desalination facility start up or maintenance, the desalination facility may discharge up to 126.7 MGD with a salinity level of ambient seawater).

   The proposed diffuser design as described in the Alden memo incorporates a 4.5 ft. diameter round-opening on top of the diffuser. As was described in the Alden memo, the purpose of the 4.5 ft. center opening was to accommodate operation of the HBGS in the interim phase before the HBGS permanently shuts down one of their two once through-cooled generating units. When two power generating units are operating, the diffuser would have to accommodate 254 MGD. As the Alden memo stated, the desalination facility would not be operated (generating brine and permeate) with the 4.5 ft. hole open, but designing the diffuser with the central port provides schedule flexibility in that it would allow

Poseidon to start wet commissioning which would involve testing pumps and hydrostatic testing of piping systems) before one of the two power generating units is fully decommissioned. While the wet commissioning would not involve the generation of brine (and therefore no brine would be discharged), the ability to start testing mechanical systems in the Plant would be beneficial for the overall project schedule.

The February 25, 2017 Michael baker International technical memo entitled *Dilution Analysis Alden 3-Jet Duckbill Diffuser Retrofit at Huntington Beach Desalination* provides an updated Hydrodynamic analysis that the currently proposed diffuser design can meet the State Water Board's Ocean Plan Amendment salinity standards.

Diffuser Description/Installation

3. The Alden memo dated February 23, 2017 (Huntington Beach Desalination Facility Discharge Diffuser Design) describes the new diffuser design. Please clarify the configuration of the diffuser as initially installed, For example:

   - The Alden memo states that the diffuser would be installed with the center port open (to be capped later, when the AES Huntington Beach Generating Station stops Once-Through Cooling operations).
   - In contrast, the March 9, 2017, email to Commission staff (from Scott Maloni to Cheryl Hudson) suggests that the diffuser would be installed with the center port closed, and indicates that it was doubted that the center port will ever be opened.

   Response: Please see response above. The proposed diffuser design as described in the Alden memo incorporates a 4.5 ft. diameter round-opening on top of the diffuser. As was described in the Alden memo, the purpose of the 4.5 ft. opening was to accommodate operation of the HBGS in the interim phase before the HBGS permanently shuts down one of their operating units. When two power generating units are operating, the diffuser would have to accommodate 254 MGD of flow from the HBGS. The desalination facility will not generate brine and permeate if the power plant is running two generating units (254 MGD), so the central port is being designed into the diffuser strictly as a precautionary measure that allows wet commissioning of mechanical system to in advance of the HBGS permanently decommissioning one of their two operating units. This approach would allow Poseidon to mitigate schedule risk if the HBGS decommissioning date for one of the two operating units is delayed. Once one of the power generating units is permanently decommissioned, the maximum flow would be limited to 126.7 MGD and the cap would be permanently placed over the 4.5 ft opening. Once the HBGS permanently decommissions its cooling water system the brine diffuser would discharge 56.7 MGD (i.e., 50 MGD of brine from the RO process and 6.7 MGD of seawater for filtration backwash and subsequent rinse wastewater).

4. Page 9 (Diffuser Construction) of the Alden memo briefly describes the construction required to install the cap over the 4.5-foot central port (if installed with the 4.5-foot port in an open position). Please provide additional detail on how the cap would be installed (or if the central port was capped upon initial installation and needed to be opened) and its subsequent operation. Specifically:

   a) What vehicles or vessels would be required to install/remove the cap (other than divers)?

   <u>Response:</u> The cap for the 4.5 ft opening central port would consist of a concrete block that would be placed over the hole. The block would be sized to overcome the buoyant force and the maximum pressure inside the diffuser with a suitable factor of safety. If recommended in the detailed design phase of the cap, additional anchors can be included to secure the cap to the top of the diffuser. The placement of the cap over the opening would be completed in one day. The work would require a derrick barge and a diver. The diver would first clean the mating surface and then guide the concrete block into position. Once the block is in place, it would not be removed.

   b) How will Poseidon ensure that the cap maintains its seal?

   <u>Response:</u> The cap (concrete block as described above) will form a permanent closure over the opening and is not intended to be reopened during the operational phase of the HBDP. The seal would be maintained by ensuring that there is a uniform surface between the mating surfaces of the concrete block and the diffuser structure to prevent gaps which could allow leakage. The cap would be held in position by gravity with a suitable factor of safety to overcome the buoyant force and pressure inside the pipe. The construction details of the cap (concrete block) and the top of the diffuser where the central port is located would be defined as part of the detailed design which will be performed after the start of the design/build process.

   c) What would happen if the cap did not completely shut off the center port?

   <u>Response:</u> The scenario of the cap not completely shutting off the center port is speculative and would be addressed as a construction detail. The procedures to eliminate gaps and the possibility of brine escaping from the gaps would be addressed in conjunction with connection of the diffuser body to the existing tower. This will be addressed by ensuring uniform surfaces between the mating surfaces which would then provide a tight seal. Because the duck bill nozzles on top of the diffuser are designed as the designated discharge point, they represent the path of least resistance for the brine flow which essentially negates leakage through other possible leak paths.

5. Please confirm whether the diffuser installation (construction activities) would still occur as described in the following two documents:

   a) Kiewit Intake and Discharge Evaluation (November 4, 2015), Attachment 3 to Response to Incomplete Letter – pages 28-32

   b) Response to Data Request 1 (February 14, 2017), under "Construction," pages 2 through 4

   Response: The diffuser installation (construction activities) described in a) Kiewit Intake and Discharge Evaluation (November 4, 2015) and b) Response to Data Request 1 (February 14, 2017) remain valid. As described in question 4 above, there would be an additional day for a derrick barge and dive crew to permanently install the cap over the 4.5 ft. opening once one of the two operating power generating units is permanently decommissioned.

Diffuser Operation

6. Please submit a revised description of the potential operating scenarios presented on pages 24-27 of your July 2016 application under "Proposed Modifications and Operating Conditions." This information does not appear to match the newly proposed operational scenarios, discharge volumes, and discharge table below (Table 1, Initial diffuser discharge velocities for various operating modes).

   Response: The desalination facility will operate under one of two different operating scenarios: 1) co-located; and 2) long-term (i.e., permanent) stand-alone.

   Poseidon's proposed 1mm wedge wire screening technology, as described in detail in our application, will now be installed prior to commercial operation of the desalination facility. Thus, there will be no "temporary stand-alone" operating condition, as the State and Regional Water Board staff have recently opined that 100% of the ocean water used by the desalination facility must first pass through the proposed 1mm screens prior to use.

   Under co-located operation the HBGS will still be utilizing its Once Through-Cooled generating system and the desalination plant will withdraw water from the HBGS' discharge. It is anticipated that the HBGS will be utilizing one of its generating units (i.e., a discharge of 126.7 MGD) through the year 2020. This anticipated deadline could be extended.

   As described in detail in our applications materials, Poseidon's proposed 1mm screening technology will consist of four screens, of which three screens are duty screens and one screen is a stand-by screen. The use of all four screens can accommodate a maximum intake of 126.7 MGD while still

meeting the State Water Board's Ocean Plan Amendment's requirements that the through-screen velocity not exceed 0.5 feet per second. In this regard the desalination facility will be able to operate seamlessly between co-located and stand-alone mode while meeting the requirements of the State Water Board's Ocean Plan Amendment.

Under the stand-alone operating scenario, the desalination facility would be responsible for pumping water from the ocean. Based on currently available information about the future operation of the HBGS' once through cooling water system, it is anticipated that the desalination facility will function in stand-alone conditions for the majority of its operating life.

As described in greater detail above, the brine diffuser is being designed to accommodate operation of the HBGS in the interim phase before the HBGS permanently shuts down one of their two once through-cooled generating units. When two power generating units are operating, the diffuser would have to accommodate 254 MGD. As the Alden memo stated, the desalination facility would not be generating brine and permeate under this scenario, but designing the diffuser with the central port provides schedule flexibility in that it would allow Poseidon to start wet commissioning (running seawater through the plant without producing brine and permeate) before one of the two power generating units is fully decommissioned andalso allow flexibility in the timing of the construction and installation of the diffuser.

7. Please clarify how Co-Located Operation would occur if the desalination plant would never operate with the center port open (as stated in the March 9 email). The email states that the three duck-bill diffusers can handle the discharge from one generating unit and the desalination facility. Will Co-Located Operation never involve operation of both generation units? Is Co-Located Operation no longer an option?

   Response: **See above response. The proposed diffuser, utilizing only the three duck bill diffusers, can accommodate 126.7 MGD (i.e. the capacity of one HBGS unit) of discharge, thus allowing for the co-located operation of the HBGS when one generating unit is operating and the desalination facility is in operation. The desalination facility would not be operated under the scenario where the power plant is operating two of its OTC generating units and withdrawing 254 MGD from the ocean (as mentioned above, Poseidon is limited by the intake screen system to a maximum of 127 MGD).**

   Based on the AES schedule to decommission its OTC system it is extremely unlikely that the HBGS will be operating two generating units (i.e. 254 MGD) beyond the year 2020.

Table 1. Initial diffuser discharge velocities for various operating modes.

	Design Conditions				
Operating Description	**Flow (mgd)**	**Flow (cfs)**	**Discharge Velocity (ft./sec)**	**Number of Duck-bills & Port**	**Description**
Long-term Stand-alone Desal	56	87	10.1	3 & port closed	36" check valve
HBGS One Unit and Desal	77	119	11.9	3 & port closed	36" check valve
HBGS One Unit – No Desal Brine Discharge	127	196	15.1	3 & port closed	36" check valve
HBGS One Unit - No Desal Brine Discharge	127	196	9.5	3 & port opened	36" check valve & 4.5' port
HBGS Two Units – No Desal Brine Discharge	254	393	15.4	3 & port opened	36" check valve & 4.5' port

Structural Strength and Support Issues

8. Please provide the following:

a) Design information including but not limited to the structural capacity of the existing pipeline (outfall) based on the current conditions.

Response: **Poseidon has commissioned engineering studies of the existing outfall pipeline to compare the structural design capacity of the existing pipeline (and the physical condition of the pipeline as assessed by inspections conducted by AES described below), to the expected internal pressure for the following conditions:**

a) Maximum design flow – all four power generating units in operation – 514 MGD (Refer to attachment 1)

b) Maximum flow, existing conditions – two power generating units in operation and units 3 and 4 operating in a synchronized condenser mode – 387 MGD. (Refer to attachment 1)

c) Proposed maximum flow with the diffuser installed – 127 MGD. (Refer to attachment 2). (For the scenario when both HBGS generating units are in operation - prior to HBDP operations - the 4.5 ft port would be open which would produce the same or less back pressure in the discharge system as the scenario of 127 MGD with the port closed).

The results of these engineering studies on head loss through the discharge piping show that the internal pressure that result from adding the diffuser with a 127 MGD flow are within the structural design parameters for the discharge pipe and within the pressure ranges that the pipe is subject to under current operating conditions. Also, in the case when both HBGS generating units are in operation - prior to HBDP operations - the 4.5 ft port would be open which would produce the same or less back pressure in the discharge system as the scenario of 127 MGD with the port closed.

b) Most recent inspection reports confirming the current conditions of the pipeline and its fitness for the purpose intended.

Response: **AES, the operator of the HBGS has conducted regular inspections of the cooling water system during the operation of the facility. AES has made inspection records and videos available to Poseidon which includes the following reports:**

- **"End Structure Inspection", 30 March 2010 – Parker Diving Service**
- **"Circulating Water System Inspection" 09 – 15 February, 2011 – Parker Diving Service.**

- **“Intake Velocity Cap, Mammal Bars Modifications”, 17-18 September 2011, - Parker Diving Service.**
- **“Unit #3 and #4 Outlet, Pipe Interior Inspection”, 19 June 2012, Parker - Diving Service**
- **“Outfall Inspection – letter report”, November 1, 2013, - Parker Diving Service**
- **“Mammal Barrier Installation, Outfall Inspection”, February 13 and 14, 2014, - Parker Diving Service**
- **“Inspect Valve at Northwest Side of Forebay”, 10 July 2015 – Parker Diving Service**
- **“Mammal Barrier Installation”, December 21 to 28, 2016 – Subsea Global Solutions.**

The reports are available via the link listed below:

https://poseidon1.box.com/s/0580li1kd8lz0fwp2xc3sx4dpn2mig1e

After reviewing the information provided by AES regarding their assessment of the condition of the cooling water circuit, Poseidon has not identified any deficiencies in the system which would indicate that the existing system is unsuitable for use for the HBDP.

9. On page 10 of the Alden memo, under Structural Considerations, statements are made that imply the likely future development of modified design and construction activities. The remedial measures referenced appear to be reasonably foreseeable, given that the 2010 FSEIR found that the addition of the diffuser was infeasible due to the increase in back pressure. In order to adequately evaluate impacts of the diffuser, please provide the following:

    a) Please specify the range of remedial measures that may be required after a future evaluation of the structural integrity of the tunnel and effects of the change in back pressure on tunnel features such as man-hole covers and the top cover of the discharge.

__Response:__ **Poseidon has organized an engineering evaluation of the expected back pressure in the discharge pipe caused by the diffuser for a maximum flow of 127 MGD. As described in the response to question 9 below, the back pressure caused by diffuser at 127 MGD is consistent with the back pressure that the discharge line is subjected to in its current operating condition. Therefore, the introduction of the diffuser into the discharge system will not cause structural integrity issues or cause the manhole cover to become dislodged. The existing discharge system has been operating since it was first commissioned, and the discharge system has been inspected regularly by the operator of the HBGS. There are no indications of major structural failures in the existing discharge pipe as a major failure would have created blockages and would have disrupted the operation of the cooling water circuit which would have immediately been detected by the HBGS operator.**

Nevertheless, Poseidon commissioned an engineering study from Brierley Associates to provide recommendations for remedial measures to the discharge pipe in the unforeseen event that future inspections identify deficiencies. Once finalized, the recommendations from Brierley Associates will be provided to the State Lands Commission staff.

b) Specify the range of changes that may be required if the cap is found not to be heavy enough to withstand the upward force of the discharge.

__Response__**: As was described in the Kiewit Intake and Discharge Evaluation (November 4, 2015) memo, several of the existing rings on the discharge tower would be removed prior to placing the diffuser. The diffuser would then be set on the remaining rings. The submerged weight of the diffuser would be designed to counter the upward pressure in the discharge line with a suitable factor of safety for the proposed discharge system. There are no concerns that the diffuser would be unable to withstand the upward force of the internal pipe pressure at the end of the discharge line.**

9. The 2017 memorandum attached to the March 1, 2017 email indicated that there will be a “small” increase in backpressure in the discharge pipeline, however, no supporting calculations are provided. Please provide the supporting detailed calculations including, but not limited to:

    a) The increased backpressure and the ability of the existing pipelines to withstand the increased pressure for different scenarios with flow rates of 56 MGD, 127 MGD and 254 MGD and any other proposed flows.

<u>Response:</u> Back pressure calculations were performed by Alden for the existing discharge line fitted with the proposed diffuser – i.e., three Tideflex (duck bill) check valves with the center 4.5 ft. opening closed for the maximum flow condition of 127 MGD. Alden estimated that with the diffuser and the expected flow condition, the combined head loss would be 4.1 ft. This is less than to the calculated head loss in the discharge line for all four power generating units in operation. For all four units in operation, the combined flow through the discharge line would be 514 MGD. For a flow of 514 MGD, the combined head loss is approximately 5.45 ft which creates more internal pressure in the pipe than the condition of 127 MGD with the diffuser. The head loss was also calculated for the currently permitted plant operating conditions of 387 MGD (approximately 254 MGD from, units 1 and 2 and 133 MGD from units 3 and 4 operating in a synchronized condenser mode). For this scenario, the head loss was calculated to be 4.88 ft.

b) The back-pressure rating for the duck-bill check valves.

<u>Response:</u> As part of the proposed diffuser design prepared by Alden, the manufacturer's design information on the duck bill check valves was utilized for calculating head loss in the discharge system. The calculations prepared by Alden were based on Tideflex series 35 – i.e., flanged check valves, 36-inch flange size, with a submerged discharge. The duck bill valves were sized to provide the required velocity for the nominal discharge flow condition, which is 56 MGD. Then, to calculate the head loss for the maximum flow, the manufacturer's data for head loss versus flow was utilized to estimate the head loss for the maximum flow of 127 MGD. Both the nominal and maximum flow conditions are within the design parameters for the Tideflex series 35 – flanged check valves.

<u>Project Schedule</u>:

10. Please provide an updated schedule for the project's construction and operation. The most recent schedule received was Attachment A found in *Huntington Beach Desalination Plant Updated Criteria Air Pollutant Emissions* (Dudek, August 15, 2016). This document was provided to CSLC following a conference call on 8/10/16.

    <u>Response:</u> The Project's construction and operation schedule has not changed since the Dudek report was submitted in August 2016.

11. Regarding the Tenera Report (Estimated Effectiveness of Wedgewire Screens at Reducing Huntington Beach Desalination Facility Entrainment of Larval Fishes), dated February 2015 please provide the following:

    a) On page 5 there is a mention of a report in progress. Is the report completed? If so, please provide a copy.

    b) On page 10 there is the following statement:

"To account for the effects of variation on head capsule dimension at each length, 10,000 estimates of head width and head depth for each mm NL (from a minimum up to a maximum NL determined for the taxon) were computer-generated using the estimated standard errors for each regression parameter."

The key potential issue is the last part of the statement (underlined). Dr. Raimondi assumes these data come from the general equation y=aX^b (Table 4). The standard errors and for the parameter estimates for the line equation and can yield an estimate of the confidence interval of the best fit line (non-linear). Dr. Raimondi is not sure this is appropriate for the task, which is not about the line but rather about the spread of data (e.g., head capsule width) for given NL values. He thinks what is important is more associated with a prediction distribution for data (Probability Density Function (PDF)), rather than confidence distribution (PDF) for the line at that NL. Perhaps the prediction distribution was used, but it is not apparent, please clarify.

Response: Please see the written response prepared by Tenera Environmental and submitted to the State Lands Commission on Thursday, March 16, 2017.

Attachment 1

GHD Memorandum
Huntington Beach Outfall
Head Loss Review
(Existing Conditions)

Attachment 2

Alden Memorandum
Head Loss Summary
(Proposed System with Diffuser)