



***Appendix PP
Intake/Discharge
Design Modifications***

***Renewal of NPDES CA0109223
Carlsbad Desalination Project***



August 10, 2016

Josie McKinley
Poseidon Water
17011 Beach Boulevard, Suite 900
Carlsbad, CA 92008

Re: **Technical Memorandum: Carlsbad Desalination Plant Intake/Discharge Design Modification**

Dear Josie,

I am pleased to submit HDR's final technical memorandum which provides a description of the revised conceptual design of the initial intake/discharge structure for the long-term, stand-alone Carlsbad Desalination Plant. I look forward to discussing our findings with you at your earliest convenience.

Sincerely,
HDR Engineering, Inc.

A handwritten signature in blue ink that reads "Timothy W. Hogan". The signature is written in a cursive style with a large, sweeping initial 'T'.

Timothy W. Hogan
Project Manager



Final Technical Memo: Carlsbad Desalination Plant Intake/Discharge Design Modification

Introduction

Poseidon Water (Poseidon) developed a proposed conceptual design for the New Screening/Fish-friendly Pumping Structure that would be implemented when the Carlsbad Desalination Plant (CDP) enters long-term, stand-alone operation after the Encina Power Station's (EPS) once-through cooling system goes offline. At that point, the CDP will become subject to the provisions of Chapter III.M of the Water Quality Control Plan, Ocean Waters of California (Desalination Amendment). To meet the requirements of the Desalination Amendment, a New Screening/Fish-friendly Pumping Structure will be constructed using 1-mm modified (referring to the presence of fish protection features) traveling water screens located between the existing EPS intake tunnels and the CDP's existing Intake Pump Station (IPS) (Figure 1).

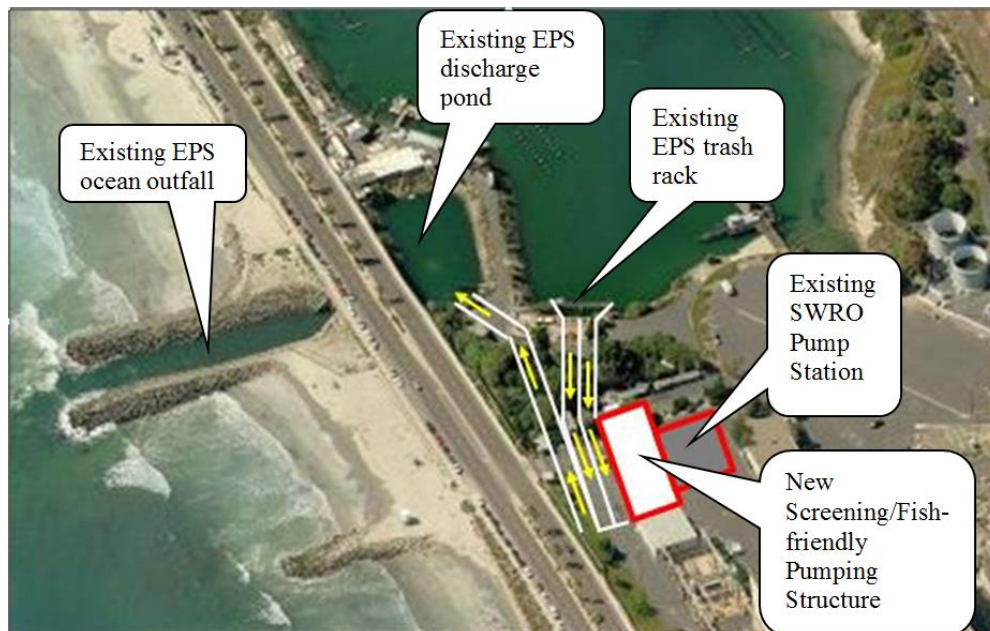


Figure 1. General layout of the CDP and location of the New Screening/Fish-friendly Pumping Structure.

The original conceptual design (as represented in Appendix B, submitted August 27, 2015) has been modified after extensive computational fluid dynamics (CFD) modeling to ensure that the structure will be hydraulically optimized and compliant with the Desalination Amendment. This memo is provided to document the design changes and present the new design for the proposed New Screening/Fish-friendly Pumping Structure for the long-term, stand-alone CDP. The changes that were made and why are listed in Table 1. The original design is shown in Figure 2 and the modified design in Figure 3.



Table 1. Design changes made to the New Screening/Fish-friendly Pumping Structure.

| Feature | Change | Comments |
|--|---|---|
| Ports between existing EPS tunnels and Screening/Fish-friendly Pumping Structure | Increased number of ports and changed spacing among ports | Improved flow distribution |
| Dimension from west to east | Decreased from 68.3 to 65.3 ft | Increased construction clearance around existing structures |
| Upstream T-edge of some screen bay walls | Added half rounds to T | Improved flow approaching screens |
| Traveling water screens (number) | Reduced number of screens from 8 to 7 | Decreased north-south footprint from 128.4 to 110.9 ft |
| Traveling water screens (size) | Increased width of screens from 3.0 to 3.5 m | Maintained screening area needed to keep through-screen velocity at or below 0.5 ft/sec |
| Wall downstream of screens that separates process and dilution side of the structure | Removed wall | Allowed a single redundant screen to be used for either process or dilution side of structure |
| Process manifold intake ports | Reoriented ports to point vertically down instead of horizontally forward | Increased pump bell submergence which reduces risk of vortices and may cause pump cavitation |
| Fish-friendly pump discharges | Decreased discharge piping angle from 90 to 45 degrees in flow direction | Best configuration for minimizing shear |
| Fish-friendly pump discharge manifold | Pipe diameter increased as additional flow enters manifold | Best configuration for minimizing shear |
| Combined brine/dilution pipeline | Separated two pipelines and routed each to its own vault | Improved independent hydraulic function of each by isolating each pipeline from the other |
| Brine pipeline | Portion of pipeline was offset from original alignment | Increased construction clearance around existing structures |
| Existing brine vault | Re-established connection of brine pipe to brine vault | Made use of existing infrastructure |
| Dilution vault | Added new vault for receiving dilution flow | Maintained hydraulic isolation of brine and dilution flows |
| Fish return system | Added potential alternative fish return discharge to pond | May reduce permitting and construction-related impacts |

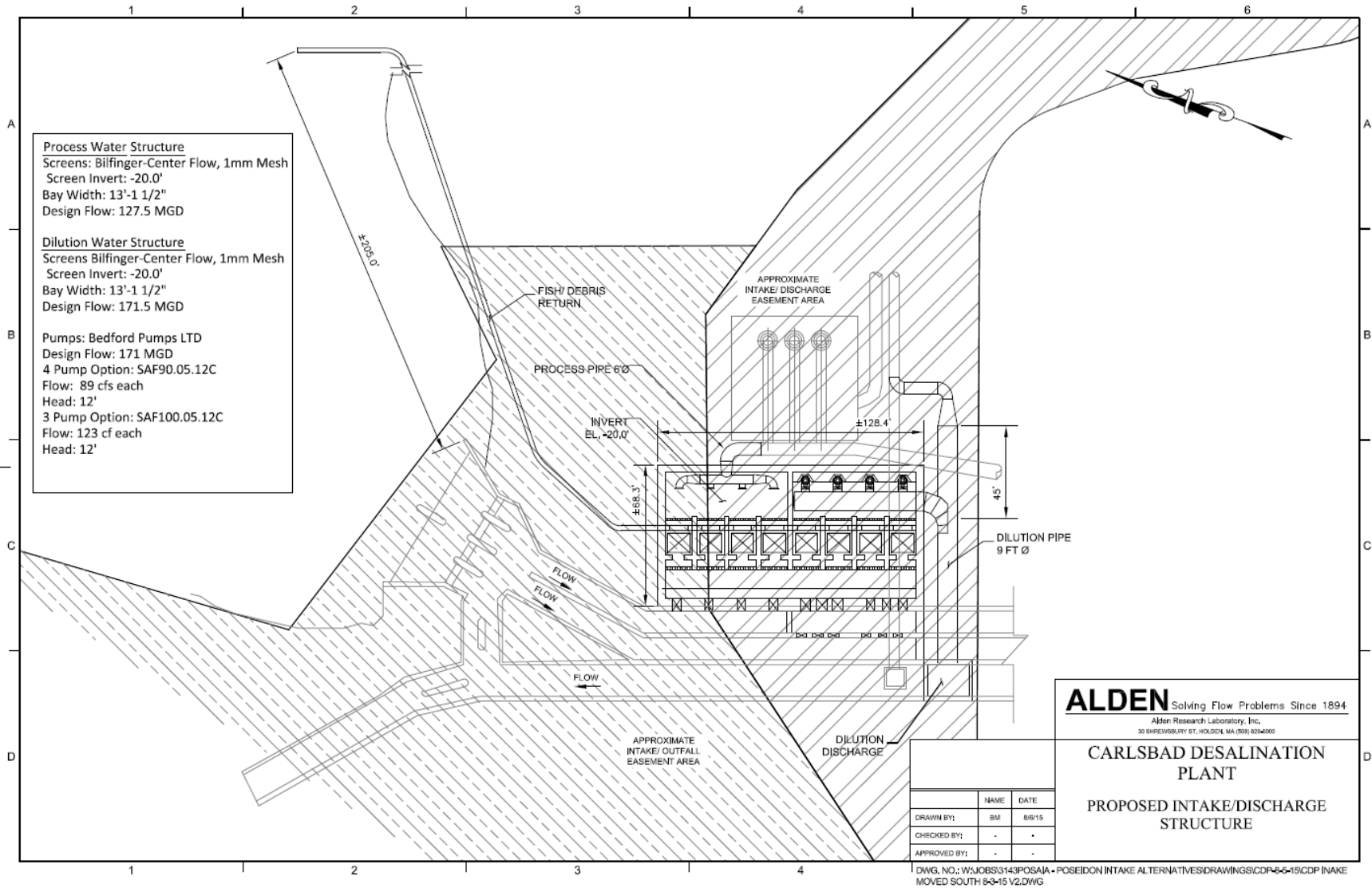


Figure 2. Initial conceptual design for the New Screening/Fish-friendly Pumping Structure, plan view.

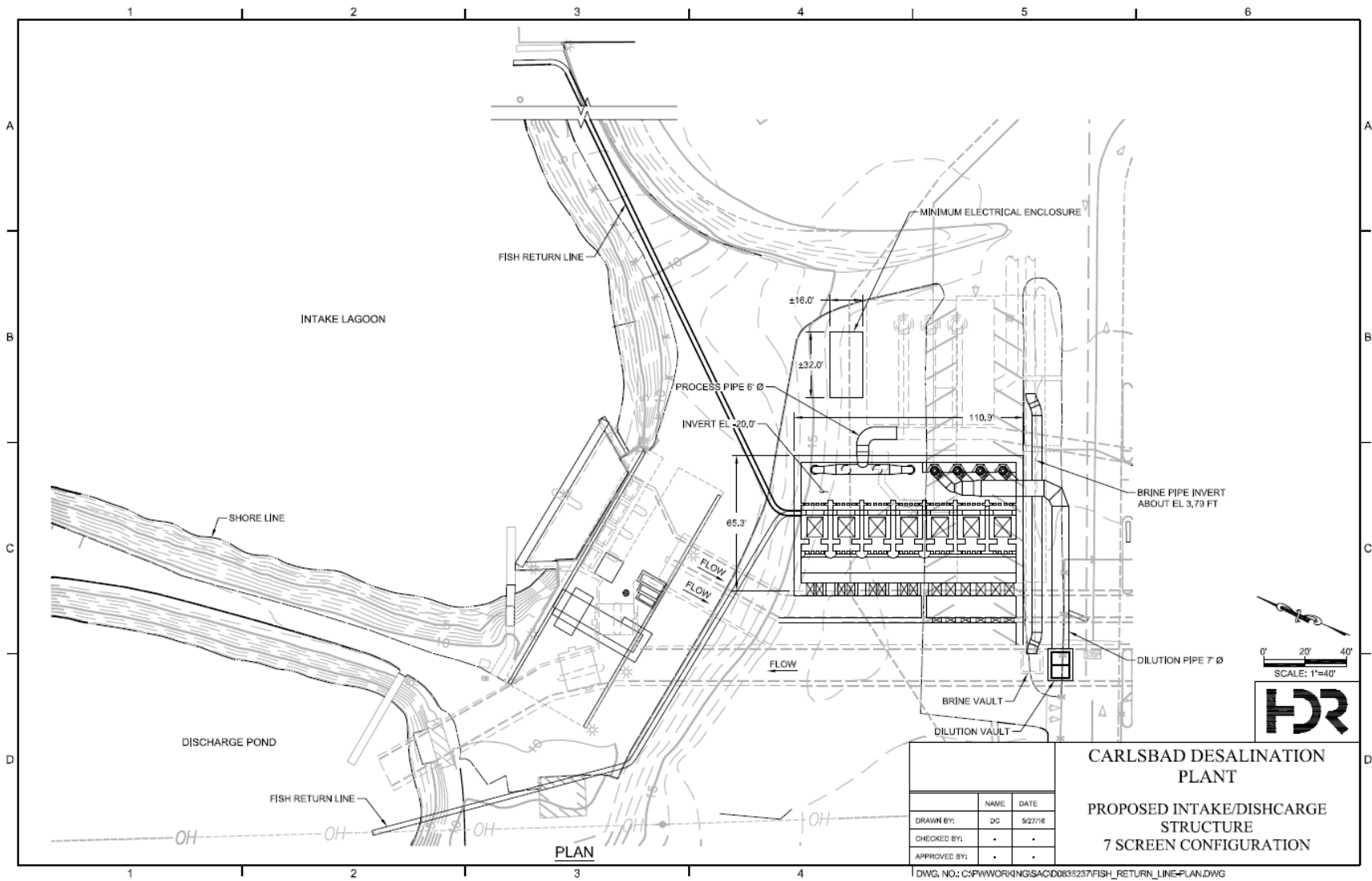


Figure 3. Modified conceptual design for the New Screening/Fish-friendly Pumping Structure, plan view.



Conclusion

This memo documents the design changes made to the CDP's New Screening/Fish-friendly Pumping Structure. The modified design represents one that is optimized for hydraulics, feasible to construct in the footprint available, and compliant with the requirements of the Desalination Amendment.