MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

Street Address:
18700 Ward Street
Fountain Valley, California 92708

Mailing Address:
P.O. Box 20895
Fountain Valley, CA 92728-0895

(714) 963-3058
Fax: (714) 964-9389
www.mwdoc.com

September 24, 2014

Scott McCreary
CONCUR

via email: scott@concurinc.net

Re: Comments on Draft Phase 1 Report Technical Feasibility of Subsurface Intake Designs for the Proposed Poseidon Water Desalination Facility at Huntington Beach, California, Independent Scientific Technical Advisory Panel, CONCUR, September 22, 2014

We offer the following clarifying comments on the referenced draft report.

In general, it does not appear that the ISTAP reviewed the full suite of project reports for the Doheny Ocean Desalination Project, Phase 1 Hydrogeology Investigation, Phase 2 Test Slant Well Design/Construction and Subsurface Intake Feasibility Investigation and Phase 3 Extended Pumping and Pilot Plant Test, but only relied on one report prepared by Geoscience and some articles prepared by Geoscience. These reports can be found at our website under Ocean Desalination, Doheny Ocean Desalination Project. We suggest a first read of the Project Summary Report. Our concern is that your report has made findings regarding slant wells that we strongly believe are not supported by our research.

Our comments are mainly directed to the generalized statements made regarding slant wells.

ISTAP Findings

The Draft Report provides the following findings and conclusions for slant wells in the Talbert Aquifer as generalized in the Summary Matrix (page 14) which we find to be misleading and incorrect as explained below.

Response to ISTAP Draft Report Findings and Conclusions

Section 3.3.6 Slant Wells

Design/Construction Considerations. The report is correct in noting that Dual Rotary drilling is a proven water well technology and its application to angle installations has also been proven in mining applications, but only in a few water supply projects (Hudson River and Missouri River, projects constructed by Layne) prior to our Test Slant Well project on Doheny State Beach in 2006.

However, the report is incorrect in drawing conclusions regarding the performance of the test slant well and extrapolating those results to a full scale production well, as many trade-offs were made in our test work, due to monetary and time constraints.

Due to limited funding, our Test Slant Well project was designed as a uniform 12-inch diameter well (blank casing and screened interval) without a larger diameter blank pump housing. Consequently, the largest diameter submersible pump that could be installed in the well was a 10-inch pump. The well was developed at about 1,700 gpm. A key objective of our test work was to stress the aquifer as much as feasible over a subsequent 18-month extended pumping test period so that we could gain as much information on the ability of the well to connect to the ocean and to evaluate pumped water quality as the old marine groundwater was being pumped out and replaced by ocean water.

This led to a decision to use a high speed, high capacity pump. The well was subsequently equipped in 2009 with a high speed, 2480 rpm, 2,200 gpm pump. We anticipated sand clogging of the gravel pack and expected a drop off in the well efficiency over the extended pumping test since it was not possible to fully develop the well at the required 3,300 gpm pumping rate, as a pump at this capacity was not available from manufacturers. It is industry standard practice to develop wells at 1.5 times the design discharge rate. To do that for the Test Slant Well would have required a pump capable of approximately 3,300 gpm (2,100 gpm x 1.5). As this was not feasible due to pump house casing diameter limitations, the Test Slant Well was never fully developed. As such, over time material entered the well during the approximate two year pilot pumping test which contributed to higher well losses and lower efficiency near the end of the test. This would not occur with a full scale well.

Development pumping at a rate 1.5 times the desired production rate is typically performed to fully entrain and remove finer grain materials from the near well zone. At the normal production rate, these materials are no longer entrained and a clear producing well is developed. This was not possible with our decision to use the high capacity pump and consequently it was expected that sand clogging and well deterioration was experienced over the extended pumping test.

For the full scale project, the well will be designed with a larger diameter pump blank housing casing, which will enable development pumping at 4,500 gpm to produce a clear production well at 3,000 gpm. We are certain that a thoroughly developed well can be constructed which will minimize well deterioration over time. In addition, the use of 2507 Super Duplex Stainless Steel should show very low rates of corrosion and biofouling, based on our pilot testing work, which will allow long periods between well maintenance (estimated at 5 to 10 yrs to perform major re-development work).

Slant well maintenance is not complex nor is it much more difficult than what is required for conventional vertical wells, but it is just done at an angle. Proven well development methods of jetting, brushing, swabbing/bailing, air lifting, and development pumping would be used for the full scale production well and any future re-development work. We learned a great deal on how to work at an angle and we don't see any significant difficulties in construction, development and maintenance of the full scale production wells. At Doheny, we plan to install 9 wells, 7 would be operational at any one time and 2 would be in standby rotational status. This allows the operation to continue through the summer period when beach access is not permitted should a pump fail. The ITSAP conclusions regarding design consideration and maintenance should show a low risk rather than medium risk, as the medium finding was based on incorrect interpretation of our test work.

Comment on Geochemical Issues (Page 50 and 61)

The report states that the greatest risk of clogging occurs where there is mixing of dissimilar waters or a change in water chemistry (e.g. introduction of dissolved oxygen) and clogging is of greatest concern where rehabilitation is complex and expensive. These challenges are primarily related to old marine groundwater that is anoxic and can contain elevated levels of dissolved iron (Fe) and manganese (Mn). This is the case in the marine aquifer offshore of Doheny State Beach. Over the 18 month extended pumping test, the produced water remained anoxic as the fraction of ocean recharge increased rapidly into the upper screen sections. In this location there is an abundance of organic matter in the shallow sediments that will likely allow the uptake of dissolved oxygen to continue for a long period of time.

Modeling (flow, variable density and geochemical) is currently being conducted to provide an estimate of the time to pump out the old marine groundwater that is enriched with dissolved Fe/Mn and to estimate the steady state water quality conditions. The plan is to first pump out the old marine groundwater before using this water for feedwater for the desalination facility, a process that is estimated to take about one year. This will allow a better determination of steady state conditions, whether or not the aquifer will be fully oxidized with ocean water, and will allow final pilot testing to determine if any pretreatment is required to remove any residual low levels of Fe/Mn and minerals. A small amount of mixing in the range of 5% of fresh groundwater compared to 95% ocean water (based on modeling work) is not expected to cause any significant issues with process treatment and membrane fouling.

Section 5.2.5 Slant Wells Completed in the Talbert Aquifer

Current slant well technology utilizing the telescopic method of design and construction can result in angled wells (slant wells) extending 1,000 lineal ft. With long screen sections extending beneath the ocean floor, onshore drawdown impacts would be minimized, The statement that slant wells "would draw large volumes from the Orange County Groundwater Basin" as a fatal flaw has not been demonstrated by defendable modeling and or pilot testing. A simple pilot test using a vertical well completed in the Talbert aquifer on the Project site could demonstrate impacts on water level changes in the Talbert aquifer and the overlying semi-perched aquifer. Monitoring wells in the Talbert aquifer and shallow layers would provide the necessary interference information to confirm if there were impacts to the OCWD groundwater basin.

Water quality parameters analyzed during the testing would allow estimates of percentage of ocean water and inland water recharge. With the well screen well out under the ocean, under a constant head boundary, the maximum rate of draw from the inland aquifer would be no greater than about 5%, based on modeling conducted for the San Juan Creek confined alluvial offshore aquifer system. At this rate, about 6 mgd of injected well water would be produced by the slant wells compared to production of 120 mgd from the slant wells. The project would only have to provide the replacement supply to OCWD in this amount, as most of the injection well barrier is recharged to the basin and subsequently produced. This is a relatively small impact on supply. The impact to the barrier would be eliminated if the slant wellfield were situated across the full width of the Talbert Aquifer and provided a sufficient cone of depression to control seawater intrusion. This could be an added benefit of using slant wells, especially under future sea level rise conditions.

Comment on Sea Water Intrusion

Contrary to what the ISTAP panel implies, wells pumping at the coast or from subsea aquifers beneath the ocean floor do not contribute to sea water intrusion but on the contrary, help prevent sea water intrusion through the creation of an extraction trough that intercepts seawater. Modeling studies of the full scale slant well project at Doheny State Beach, Dana Point show that the slant well pumping trough will provide seawater intrusion control. It should be noted that the gold standard in seawater intrusion control once was considered to include both an extraction trough and an injection barrier. OCWD found that it could operate just the injection barrier to provide effective seawater intrusion control, which has been utilized for many years. However, in the future with sea level rise, the use of injection wells will become less effective and problematic and a shift to extraction wells will be required to prevent sea water intrusion. A recent OCWD study (Technical Memorandum, February 2013) evaluated potential effects from sea level rise to determine protective levels, impacts on groundwater conditions and seawater intrusion, and how long injection wells could be utilized before it would be necessary to shift to an extraction trough.

In conclusion, we have no issue if you eliminate slant wells from consideration at the Huntington Beach location; but if you do so, they need to be for fully supportable and technically covered reasons. We would request that the report be modified with the following revised matrix and appropriate changes to the text of the report.

Criteria	**Subfactor**	**Slant Wells in Talbert Aquifer**
Hydrogeology	Impact on freshwater aquifers	Yes, but minor at 5% of produced water
Design Considerations	Complexity of Construction Performance Risk – degree of uncertainty of outcome Reliability of Intake System Frequency of Maintenance Complexity of Maintenance	Medium Low High Low Low
Oceanographic	Sensitivity to sea level rise	Low – Actually a positive benefit
Geochemistry	Risk of adverse fluid mixing Risk of clogging Risk of significant change in inorganic chemistry	Low Low Low
Precedent on large scale in similar geologic conditions		No precedent
Key considerations/fatal flaws		None
Technically feasible? Yes or No		Yes

This letter was jointly prepared with Dr. Dennis Williams, Geoscience and reviewed and concurred to by Dr. Matt Charette, Coastal Geochemist, WHOI and Mr. Gerry Filteau, President, SPI (Desalination Process Treatment). We would be most willing to meet with the ISTAP to go over our findings, answer questions, and to provide clarifications to their report.

If you should have any questions or need additional information, please do not hesitate to contact the undersigned at (714) 593-5003.

Sincerely,

Richard B. Bell, PE
Principal Engineer and Project Manager

cc: Mr. Tom Luster
Dr. Dennis Williams, Geoscience
Dr. Matt Charette, WHOI
Mr. Gerry Filteau, SPI
Mr. Ron Davis, CalDesal