CITY OF SANTA BARBARA

SUBSURFACE DESALINATION INTAKE AND POTABLE REUSE FEASIBILITY STUDIES

WORKSHOP #2
RESPONSES TO TAP COMMENTS

DRAFT
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City of Santa Barbara

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RESPONSES TO TAP COMMENTS

1.0 BACKGROUND

On Wednesday, January 27, 2016, Technical Advisory Panel (TAP) Workshop #2 was held at Santa Barbara City Hall. Stakeholders and interested parties were invited to attend the TAP meeting. As presented in the Work Plan documents, the TAP consists of five technical experts in fields related to subsurface desalination intakes and potable reuse. Following the meeting, the panel met to discuss work products and current project status. Findings were summarized in in the Draft Final Panel Report for Meeting #2, presented in Appendix 1. The report is divided into three sections and four appendices:

1. Purpose and History of the Panel
2. Panel Meeting #2
3. Findings and Recommendations

Appendix A: Panel Background

Appendix B: Panel Biographies

Appendix C: Panel Meeting #2 Agenda

Appendix D. Panel Meeting #2 Attendees

2.0 OBJECTIVE

The objective of this document is to present responses to each of the TAP comments received regarding material presented at TAP Meeting #2.

3.0 CITY RESPONSES TO TAP COMMENTS

Refer to Appendix 1 for the Draft Final Panel Report for all comments that were received. Responses to the TAP comments presented in the following section. TAP comments have been restated and City responses follow in **red font**.

3.1 General Comments

The following comments pertain to the overall Panel review process as related to the materials, presentations, and discussions resulting from Panel Meeting #2.

3.1.1 Overall Thoughts

- The Panel appreciates that the pre-meeting materials and presentation provided at Panel Meeting #2 were well-prepared and informative.

CITY RESPONSE: Noted.

- In general, the methodologies and results presented in TM-3 were conducted in a manner to address the needs of the Work Plan that was approved by the RWQCB. In addition, the analyses used are consistent with current industry practices. The panel does provide specific recommendations in this panel report to clarify and/or enhance the methods and analyses.

CITY RESPONSE: Noted.

3.1.2 Subsurface Desalination Intake Feasibility Study

- The conceptual designs in the Subsurface Desalination Intake presentation were useful in portraying the anticipated visual impact of subsurface intake installations on the beaches in Santa Barbara.

CITY RESPONSE: Noted.

- Recognizing that the SSI Technical Memoranda will serve as chapters in the final report, the information should be provided in such a manner that a reasonable reviewer would be able to follow the logic and draw similar conclusions. TM-1 presented the Introduction, Background, and Project Alternatives, and TM-2 presented the Regulatory and Permitting Requirements; therefore, TM-3 should present the following (which is similar to the flow and logic of the January 27, 2016, presentation):
  - Summary of Alternatives and Conceptual Design.
  - Sediment Transport and Coastal Hazards.
  - Hydrogeological Analysis of Subsurface Intake Alternatives.
  - Initial Screening.
  - Conclusions and Recommendations.

CITY RESPONSE: Noted. The City has evaluated flow and logic of TM 3 and has selected to present the material in the following order:

- Basis of Design
  - Subsurface Properties
  - Coastal Hazards and Sediment Transport Analysis
  - Hydrogeological Analysis of Subsurface Intake Systems
- Conceptual Design Summary
- Initial Screening Analysis

- Conclusions and Recommendations

Presentation of material in this order follows the sequence of work presented within the Work Plan and provides the basis of design information that is common for each alternative once, rather than repeating this information for each alternative.

Using a combination of established constraints and analyses performed as part of the basis of design (e.g., Coastal Hazards and Sediment Transport Analysis; Hydrogeological Analysis), conceptual designs are developed and presented.

The City has updated the TAP Workshop presentation to follow the order suggested by the TAP. A copy of the presentation will accompany the report on NWRI's website that can be used as an additional reference.

- Do not comingle the conclusions with background material. For example, the last sentence in the first paragraph of the Sediment Transport Evaluation beginning on page 3-33 of TM-3 states, "Key findings are presented for each beach site [emphasis added] considered in the following sections." This section, therefore, should describe the characteristics and physical processes of each beach site, and any bullets that draw a conclusion should be reserved for the initial screening discussion section.

CITY RESPONSE: Conclusions made in these sections pertain directly to the analysis that is the subject of the section. These analyses were performed as part of the current feasibility study (i.e., are not background material), and results presented in these sections are used as the basis for the conceptual design. The presentation order follows a logical progression from background, the basis of design, supporting technical analyses performed for this study, all of which providing information to produce conceptual designs. Conceptual designs are then subjected to initial screening analysis.

- Correct the pagination in TM-3, starting at Table 3.13 (it should be page 3-66, not 3-57).

CITY RESPONSE: Noted. Pagination has been updated.

- The Panel recommends the following information be included to provide better context regarding the SSI study:
  - An explanation as to why the City received the Coastal Development Permit from the California Coastal Commission in 1996 even though the desalination plant had already been operated and put into standby in 1992.
  - Clarification that the Coastal Development Permit was for the existing open ocean intake system.
  - A clear statement as to why the City's desalination facility is exempt from regulatory and permitting requirements in the California Ocean Plan.

- Include background information provided by Rebecca Bjork, City Public Works Director, about the current permit for the City's desalination facility, which has an open ocean intake.

– Any consideration given to streamlining the evaluation process since this facility is exempt from the Ocean Plan. For example, costs, land use conflict, or other factors could possibly be included earlier in the assessment.

– A description of the requirements of the RWQCB amendment to the Waste Discharge Requirements for the El Estero Wastewater Treatment Plant as related to the study.

CITY RESPONSE: A "Facts Sheet" will be added to TM3 as an appendix that addresses the history of the City's permits and applicability of Ocean Plan Amendment Requirements.

– Although this facility may be exempt from the California Ocean Plan, the Ocean Plan states that the RWQCB shall require the owner or operator to: "Consider whether the identified need for desalinated water is consistent with an applicable adopted urban water management plan prepared in accordance with Water Code section 10631, or if no urban water management plan is available, other water planning documents such as a county general plan or integrated regional water management plan." (Chapter III.m.2.b.[2]). Based on this requirement, the demand projections in the Long-Term Water Supply Planning process may need to be updated to justify the 10,000 AFY that is stated. To do so, the Panel suggests:

– Providing a description of the current baseline water use.

– Providing stacked bar or pie charts showing what comprises the 10,000 AFY of demand; one chart should be for drought conditions and another for non-drought conditions. Clearly document the source of the demand projections.

– Ensuring the potential use of desalination for drought and non-drought conditions is not lost in the presentation.

CITY RESPONSE: The objective of this study, as stated in the Work Plan that was approved by the RWQCB, was to identify the maximum capacity of SSI alternatives. This information can then be used to support future water supply planning efforts, including an update to the City's Long Term Water Supply Plan and Urban Water Management Plan. The City's Urban Water Management Plan refers to the desalination plant as an emergency facility. The City's desalination plant is permitted by a 1996 Coastal Development Permit to operate according to 4 different scenarios, including continuous operation as a regional supply.

The Ocean Plan Amendments do not apply to the City's SSI study since the City's desalination plant is not "new or expanded".

The severity of the current drought has changed many of the drought planning

assumptions presented in the City's 2011 Long Term Water Supply Plan, which includes desalination as a drought supply for the City at capacity of 3,125 AFY. Recent updates to the drought planning assumptions presented to the City Council indicate that, contrary to the 2011 Long Term Water Supply Plan: (1) the City cannot rely on State Water during severe drought; (2) drought may persist longer than the 6-year design-drought that was assumed; (3) the initial severity of a drought cycle may result in steeper reduction in non-drought supplies; (4) extraordinary conservation that has been achieved during the present drought exceeds expectations. Furthermore, reductions in the supply of water from the Cachuma Reservoir are anticipated, which will require additional non-drought and drought supply planning that may include desalination, potable reuse, or other alternatives.

The City plans to proceed with the current approved Work Plan that identifies the maximum capacity of SSI capacity that may be achieved and update the Planning documents referenced once the long-term safe yield of the Cachuma Reservoir is known.

3.1.3 Final Report

- The Panel encourages the preparation of an Executive Summary for the final report, as discussed during Panel Meeting #2, and recommends the following:
  - Define the permit deadline driving the project schedule. Is it CCRWQCB Order No. R3-2010-001?
  - Clarify the possible roles of desalination (using subsurface intakes or open ocean intakes) and potable reuse in the Long-Term Water Supply Planning process. Explain the timing of the planning process and how these studies will fit into that process.

CITY RESPONSE: Noted. An executive summary will be prepared with the Final Report. Along with background on the RWQCB permit's deadline for this study, a summary of possible roles for desalination and potable reuse will be included - similar to what is stated in the Work Plan (Section 1.5) and TM1.

3.2 Update on Activities since Panel Meeting #1

The Panel requests that the City and project team provide a written response to the Panel Report for Meeting #2 that includes brief comments on how the Panel's findings and recommendations will be addressed.

CITY RESPONSE: Noted. Comment responses are the purpose of this document.

3.3 Subsurface Desalination Intake Feasibility Study

The following comments pertain to the Technical Memoranda (TM-1, TM-2, and TM-3) and information presented on the *Subsurface Desalination Intake Feasibility Study.*

3.3.1 Regulatory Summary for Subsurface Intakes

TM-2 does not refer to the California Ocean Plan or the National Environmental Policy Act (NEPA). Reiterate why the California Ocean Plan does not apply to this desalination plant. If NEPA is not applicable and the City will need to consult with the U.S. Fish and Wildlife Service (USFWS) under the Federal Endangered Species Act (FESA), then please revise the FESA "Section 7" consultation process with the USFWS that is described in Section 2.5.2 of TM-2, to reflect how consultation under the FESA would work (as well as the scheduling implications) without a federal lead agency ("Section 10" consultation).

CITY RESPONSE: TM2 will be updated to explain the following:

- The California Ocean Plan does not apply to the project, because replacement of the existing screened surface intake with a subsurface intake system of any kind, with no increase in intake or water production capacity, would not change the definition of the desalination facility as "existing" under the Water Code, and as further defined in the Ocean Plan. As noted in the Water Code and Ocean Plan, Section 13142.5(b) of the Water Code does not apply to existing facilities.

- With respect to federal consultation under FESA, subsurface intake systems may or may not require federal permitting for construction – specifically related to dredge and fill in navigable waters that are regulated by Section 404 of the Clean Water Act, and Section 10 of the Rivers and Harbors Act. Through the federal permitting process, there would likely be a sufficient federal nexus for consultation with the USFWS or NMFS under FESA, thereby allowing issuance of take under FESA (if needed), through a Section 7 Consultation, rather than a Section 10 (FESA) permit process.

3.3.2 Basis of the Design for Subsurface Intakes

- Identify how SSI alternatives would work for both drought and non-drought conditions.

  CITY RESPONSE: If implemented, an SSI would function as part of the desalination plant's operation. However, the City's 2011 Long Term Water Supply Plan and 2010 General Plan EIR currently only refer to desalination as a drought/drought recovery supply. Operating the desalination plant as a non-drought supply would require an update to the Long Term Water Supply Plan and an addendum to the General Plan EIR. Desalination and potable reuse will be considered in a future Long Term Water Supply Plan update as a result of the pending Cachuma safe yield decisions that will

affect the City's non-drought supplies. Subsurface intakes would be revisited as part of that discussion about the long term water supply for the South Coast.

- Consider including a sensitivity analysis that would result from releasing some of the design constraints (e.g., property ownership, half-mile boundary).

CITY RESPONSE: Noted. The purpose of this study, as approved by the Work Plan submitted to the RWQCB, was to evaluate the maximum capacity attainable for each subsurface intake technology. There is a potential that a sensitivity analysis should be evaluated during a later study (e.g., Long Term Water Supply Plan update). When the Long Term Water Supply Plan is updated, if desalination plays a role in the City's future supply, subsurface intakes at the required capacity (including combinations of alternatives, with potentially different design constraints) can be re-evaluated using the information and methodology developed through this study to build upon.

- On Presentation Slide #14 ("Design, Construction, and Operational Criteria that must be evaluated when implementing a subsurface intake project"), a blend of seawater and groundwater was listed as a design requirement. Clarify what is meant by a "blend of seawater and groundwater."

CITY RESPONSE: Noted. The Work Plan, Section 2.7, requires us to determine the percentage of seawater captured by a subsurface intake and the influence on local groundwater supplies. Impact of subsurface intake design and operation on local groundwater supplies was also an initial screening criteria (see Work Plan, Table 3.2, Hydrologic Factors). The purpose of Slide 14 was, in part, to convey this study requirement. Therefore, the design requirement is to evaluate the percentage of seawater and groundwater to be obtained by the alternative, and determine if this meets the initial screening criteria.

3.3.3 Summary of Alternatives and Conceptual Design

- In TM-3, Table 3.4 (Feasible Yield and Ocean/Inland Water Contribution Summary) and Table 3.6 (Conceptual Design: Vertical Wells) have similar but inconsistent information. For example:
  - The "capacity, total" for vertical wells is 1,500 gallons per minute (gpm) in Table 3.4 and 1,400 gpm in Table 3.6.
  - The Well Spacing is 560 feet for the low k value in Table 3.4 and 600 feet in Table 3.6.

Please be consistent.

CITY RESPONSE:

- Noted. TM-3, Table 3.4 shows the maximum capacity and assumes all 15 wells would provide 1,500 gpm total. However, in accordance with the Work Plan Section 2.9, TM-3, Table 3.6 shows the conceptual design, which includes provisions for one redundant well. Therefore, the capacity has been reduced by

100 gpm (i.e., 1 well) to 1,400 gpm. A footnote has been added to TM-3 to clarify this difference.

  - Noted. Table 3.4 provides the minimum spacing needed to avoid interference between wells. Table 3.6 shows the conceptual design that establishes site layouts on the beaches. A footnote has been added to TM-3 to clarify this difference.

- TM-3 is inconsistent as to whether the drilling equipment required for slant wells is specialized or not:
  - Page 3-17 states: "Specialized drilling equipment must be employed...."
  - Page 3-20 states: "Although the drilling equipment is the same used for vertical wells...."
  - Page 3-21 refers to "...the custom drilling equipment that is required."

  Please be consistent.

  CITY RESPONSE: Noted. Refer to updated text in TM 3, pages 3-17, 3-20, and 3-21. The basic equipment for drilling of slant wells is the same for slant wells and vertical wells. However, drilling of slant wells requires the use of additional guidance equipment for inclined drilling that is not used for slant wells. The drilling rate for slant wells is approximately two times slower than that for vertical wells.

- On Slide #46 ("Construction of a Subsurface Infiltration Gallery is more complex than any subsurface intake alternative"), reference is made to greenhouse gas (GHG) emissions during the construction phase. The Panel feels it is not necessary to discuss GHG emissions for one alternative unless it is discussed for all alternatives.

  CITY RESPONSE: Noted. Construction phase GHG emissions are incrementally greater than the construction phase GHG emissions from other subsurface intake alternatives due to the extended duration of construction, as well as the type of equipment required. TM3 will be updated to make certain that the discussion of GHGs and SIG is specifically referencing construction phase GHGs.

3.3.4 Sediment Transport and Coastal Hazards

The following comments pertain to the final report titled *Coastal Hazards and Sediment Transport Analysis for the City of Santa Barbara Subsurface Desalination Intake Study*, dated December 29, 2015, and submitted by Scott A. Jenkins, Ph.D., of Michael Baker International. The report was provided as Appendix C in TM-3. An overview of the report was also presented at Panel Meeting #2.

- The Panel felt the study and overview of sediment transport and coastal hazards were informative and useful.

  CITY RESPONSE: Noted.

- The Panel would like clarification as to where the City's future shoreline will be located. Please see the "City of Santa Barbara Sea-Level Rise Vulnerability Study" prepared for the California Energy Commission by the University of California, Santa Cruz (July 2012) at http://www.energy.ca.gov/2012publications/CEC-500-2012-039/CEC-500-2012-039.pdf, which includes a discussion of the vulnerability of and previous damage to City beaches and facilities from high tides and winter storms (e.g., impacts to West Cabrillo Boulevard from overtopping waves in 1914 and 1983).

CITY RESPONSE: Impact of sea level rise is addressed in TM-3, and more extensively in TM-3 Appendix C entitled "Coastal Hazards and Sediment Transport Analysis for the City of Santa Barbara Subsurface Desalination Intake Feasibility Study". Using a 50-year sea level rise projection per CAT-OPC guidance, estimates of 7 inches (low estimate) and 35 inches (high estimate) were projected. Refer to TM-3 Appendix C for additional information regarding this topic.

The impact of sea level rise was evaluated during the initial screening process under criteria #6a. All six SSI alternatives were given a potentially feasible (PF) designation under this criteria. A footnote has been added to Table 3.12 stating that "Beach facilities would be susceptible to inundation and erosion as a result of tsunami and would also be increasingly impacted by seawater rise over the 20 year project life. Electrical buildings and wet wells will need to be constructed in a manner that provides flood protection." For the purpose of this study, it was assumed that such flood protection could be adequately designed.

- Please explain the 150-foot setback to protect against erosion and how it was determined.

CITY RESPONSE: Noted. The 150-foot setback was assumed for the purpose of protecting structures from erosion during storm events, reducing impacts to recreational activities on the beach, while keeping the facilities within a reasonable distance to the shoreline and within the strip of City owned land along the shore.

3.3.5 Hydrogeological Analysis of Subsurface Intake Alternatives

- The hydrogeologic analysis approach and methods of evaluating the yield of the proposed SSI alternatives and then addressing the land requirements within the limitations of the available land are appropriate.

CITY RESPONSE: Noted.

- Analysis of the groundwater-based SSI alternatives (i.e., vertical wells, slant wells, collector wells, and infiltration galleries) was performed with a groundwater model created for this purpose. Although details of the model in the report are limited, it appears that the model uses overly optimistic hydraulic parameters and boundary conditions; therefore, it likely overestimates the hydraulic connection between the

nearshore groundwater system and the ocean. This overestimation increases individual SSI yields and reduces inland impacts.

CITY RESPONSE: Noted. Modeling was performed using optimistic hydraulic conditions and boundary conditions in an effort to provide each alternative the best chance on not failing initial screening based on capacity. It was felt that if the alternative fails to pass the initial screening for meeting the yield requirement even with optimistic hydraulic properties, it would surely fail the screening with less optimistic values. If any alternatives are carried forward for additional analysis in the future as part of a water supply planning effort, it will likely be necessary to collect additional subsurface data to develop predesign quality estimates of hydraulic properties and boundary conditions. The City's team will qualify the results as optimistic in the revised final TM3 and hydrologic report (i.e., Appendix to TM3).

- It is understood that the overly optimistic hydrogeologic assumptions were used to provide a “best case” estimate for the performance of SSI alternatives. This may be appropriate if only one SSI alternative is to be implemented to meet demand; however, the Panel understands that the rejected alternatives may survive to be reevaluated as part of future water supply planning. If the rejected approaches are to survive as possible components of future supply, it is recommended that the SSI alternatives be evaluated with more realistic hydrogeologic parameters.

CITY RESPONSE: The purpose of this study was to evaluate the maximum capacity attainable for each subsurface intake technology. The potential of combining multiple alternatives to meet future can be evaluated during a later study. When the Long Term Water Supply Plan is updated, if desalination plays a role in the City's future supply, subsurface intakes at the required capacity (including combinations of alternatives) can be re-evaluated using the information and methodology developed through this study.

- The Panel had several concerns with the modeling assumptions:
  - The offshore geology is unknown; however, given that seafloor materials were deposited during a transgressive period, it can be assumed that the offshore/seafloor materials are, at least in part, finer grained and certainly significantly more heterogeneous and stratified than the beach deposits. The assumption that offshore hydraulic conductivities are similar to beach hydraulic conductivities is unsupported and may significantly overestimate the volume of seawater that will infiltrate and the amount of water that will move horizontally from the constant head boundary.

    CITY RESPONSE: Noted. We agree that the offshore deposits are likely to be finer grained. In addition, the aquifer materials that underlie the seabed are also finer grained and stratified compared to beach sand. If any alternatives are carried forward for additional analysis in the future as part of a new water supply planning effort, it will likely be necessary to collect additional subsurface

data to develop better estimates of hydraulic properties and boundary conditions. This updated information would then be incorporated into a revised analysis of yield, percentage of seawater versus groundwater, and potential impacts. The City's team will qualify the model assumptions in TM-3.

– The assumed horizontal/vertical hydraulic conductivity ratio (K_h/K_v) is very low and likely significantly overestimates the amount of water that is moving vertically through the seafloor. The ratio of 5 that is used is much lower than default textbook values, which are typically around 100 for heterogeneous layered systems (Freeze and Cherry, 1979, Anderson and Woessner, 2002). The ratio of 5 is also significantly lower than the values (10 to 100) used by the U.S. Geological Survey (USGS) for the existing model of the Santa Barbara basin. For Huntington Beach SSI analyses, ratios between 10 and 100 were used in sensitivity analyses. In the calibrated groundwater model developed for the Marina slant well analyses, ratios between 34 and 450 were adopted for dune sand and terrace deposit layers, respectively. Given the sensitivity of the results to this ratio, the use of the very low ratio of 5 should be justified. Also, sensitivity analysis should be performed over a greater range for this parameter. If further refinement of the vertical conductivity value is considered important, a series of vibracores should be taken from the seafloor and evaluated for vertical conductivity.

  CITY RESPONSE: Noted. If any alternatives are carried forward for additional analysis in the future as part of a new water supply planning effort, it will likely be necessary to collect additional subsurface data to develop better estimates of hydraulic properties, including vertical hydraulic conductivity ratio, and boundary conditions. This updated information would then be incorporated into a revised analysis of yield, percentage of seawater versus groundwater, and potential impacts. The City's team will qualify the model assumptions in TM-3.

– Equivalent freshwater heads should be used offshore to account for the greater density of seawater.

  CITY RESPONSE: Noted. Refer to prior response above.

– The use of a constant-head boundary in the lower layers offshore needs justification. The shallow offshore geology is poorly understood. Whether and where the lower layers outcrop on the seafloor are unknown. It is possible these layers are truncated by offshore faulting. The use of the constant-head boundary condition at this location results in unlimited horizontal flow of water into the model. A general-head boundary condition with a conductance that approximates the geometry of the flow path may be preferred. The conductance could be adjusted to approximate differing assumed geometries.

  CITY RESPONSE: Noted. Refer to prior responses above. This boundary condition was established to be consistent with the USGS groundwater model.

- Although it is implied that the groundwater-based SSI alternatives derive their offshore flow from vertical leakage through the seafloor, the use of constant-head boundary conditions offshore may result in unlimited horizontal water flow. A detailed narrative is needed to describe and quantify the anticipated horizontal and vertical offshore flows.

  CITY RESPONSE: Noted. Refer to prior responses above.

- In general, more documentation of the model assumptions and configuration is needed. An appendix that includes the following information would help the reader understand how the analysis was performed:
  - A generalized conceptual hydrogeologic model and how it was captured in the grid/layer configuration.
  - A map of the model domain that shows boundaries (e.g., constant-head, no flow).
  - A cross-section of the model showing the layers, layers thickness, and relationship to seafloor.
  - A water budget that details the volume of water derived from leakage through the seafloor vs. the volume of water supplied from the offshore constant-head or general-head boundary. (i.e. constant-head fluxes)
  - Particle tracking and presentation of these results to visualize sources and sinks and to help explain to the reader the nature of the flow regime.

  CITY RESPONSE: Noted. The City team will prepare an appendix that includes some of the above information.

- With the exception of the use of equivalent freshwater heads, the adoption of more realistic assumptions (as discussed above) will reduce the hydraulic connection of the subsurface groundwater system with the ocean. It will also reduce estimated yields and increase onshore impacts. Model results, however, will be more realistic and defensible and have residual value to the City.

CITY RESPONSE: Noted. We concur that this will likely be the case. As stated previously, the approach taken is considered optimistic from a yield point of view. With the optimistic assumptions, most of the alternatives did not meet the yield requirement. If any alternatives are carried forward for additional analysis in the future as part of a water supply planning effort, it will likely be necessary to collect additional subsurface data to develop better estimates of hydraulic properties and boundary conditions. This updated information would then be incorporated into a revised analysis of yield, percentage of seawater versus groundwater, and potential impacts.

3.3.6 Initial Screening

- Please number the screening criteria in Table 3.11, in a similar fashion to how they are numbered in Table 3.12.

CITY RESPONSE: Noted. Refer to updated TM 3. Screening criteria in Table 3.11 are now numbered to be consistent with Table 3.12.

- There are three screening criteria that seem to use the same logic to draw the same (infeasible) conclusion. In fact, two of the screening criteria listed in Table 3.11 (Initial Screening Criteria) and Table 3.12 (Subsurface Desalination Intake Initial Screening Results) are essentially the same:
  - Hydrogeologic Factors
    - Criterion 4: Insufficient length of beach available for replacing full yield derived from existing open ocean intakes.
  - Design and Construction Constraints
    - Criterion 9: Lack of adequate linear beach front for technical feasibility.

"Criterion 8: Adequate Capacity" states that "subsurface material lacks adequate transmissivity to meet target yield of at least 15,898 gpm (i.e., build-out intake capacity necessary to produce 10,000 AFY)." While the failure to meet this criterion is stated to be transmissivity, it appears the conclusion is really being drawn because there is insufficient beach (criterion 4) or lack of adequate linear beach front (criterion 9) that causes the lack of adequate capacity, not the transmissivity of the aquifer. Consider how this criterion is used for drought versus non-drought needs, especially since the Ocean Plan states that "design capacity in excess of the need for desalinated water . . . shall not be used by itself to declare subsurface intakes as not feasible."

CITY RESPONSE: Noted. Transmissivity of the aquifer is indeed the limiting factor that controls yield and dictates the appropriate SSI facility spacing. Because the transmissivity is relatively low, individual SSI facility yields are lower and so many more are necessary to achieve the target yield of 10,000 AFY. With adequate spacing between SSI facilities to reduce interference effects on yield, the length of available beach is insufficient to accommodate the large number of required SSI facilities. Work Plans for both SSI and Potable Reuse studies were presented during TAP Workshop #1. Public comments and TAP comments were received during the process. No comments regarding these three initial screening criteria were received. It is the City's position that - to maintain the integrity of the study - the Work Plan's initial screening criteria cannot be changed at this point in the studies. However, some rare circumstances may occur (e.g., refer to public comments regarding ownership of 103 Calle Cesar Chavez).

The following clarifications will be used in the updated TM3 to differentiate between initial screening criteria:

Criterion 4a: This is a hydrogeological factor. When analyzing the alternatives, the hydrogeological factors result in either an individual facility yield that is too small (e.g., low aquifer transmissivity) or that the minimum spacing between facilities is too large

(e.g., interaction between wells). If hydrogeological factors were more favorable, the SSI alternative could supply the necessary capacity given the available shoreline.

Criterion 8a: This is a design constraint. Given the state of current technology, the facilities cannot be designed to meet the target yield.

Criterion 9a: This is a design constraint. Given the set hydrogeological conditions, there is not enough linear beachfront available to construct the required number of sites. If additional beachfront was available, the alternative could supply the necessary capacity give the site's hydrogeological makeup.

- The screening table could be misinterpreted. Regardless of what conclusions are reached for meeting current project goals (with 10,000 AFY demand), the conclusions should also include alternatives to meet partial demand.
  - Create another table that addresses the potential feasibility of the SSI alternatives to be components of a long-term future water supply.

    CITY RESPONSE: The initial screening evaluation presented in Table 3.12 will reclassify the alternatives presented from "NF" to "PF*" for initial screening criteria No. 3, 8 and 9. The only "NF" assessed will be for the HDD wells for initial screening criteria No. 12. Furthermore, the explanation provided in Tables 3.13 through 3.18 will be updated to reflect this reasoning. Note that the purpose of Tables 3.13 through 3.18 is to explain why the alternative is not simply "PF", and thus is either not feasible or doesn't meet the study goals.

    These changes should address the sentiment expressed by this comment - that the alternative can meet a partial demand.
  - The unclear terminology in the tables is likely to become clearer once the table is broken up into two tables.

    CITY RESPONSE: Noted. Refer to prior response - and again, the purpose of Tables 3.13 through 3.18 provides the explanation that the commenter is seeking.
  - The first sentence of TM-3 Section 3.6 states that, “This section presents the basis of design, conceptual design, and initial screening analysis for each of the six SSI alternatives considered in this study.” This sentence may be misplaced since the section does not do that.

    CITY RESPONSE: Noted. As discussed in prior conversations with the TAP, the end result of Technical Memoranda's will be as sections in the Final Feasibility Study Report. All TMs were written with this in mind. Section 3.6 is a summary of TM 3, which will be Section 3 of the final report. Thus, the opening sentence of TM 3 correctly states that Section 3 of the final report presents "…the basis of design, conceptual design, and initial screening analysis for each of the six SSI alternatives considered in this study.”

– The Panel agrees there are significant risks associated with moving forward with Neodren due to the lack of precedent studies and unproven constructability. One city should not take the risk on an unproven technology. If pursued, the City should seek grant funding and collaborate with Montecito and others to construct a demonstration project.

CITY RESPONSE: Noted.

3.4 Potable Reuse Feasibility Study

The following comments pertain to the *Potable Reuse Feasibility Study*.

3.4.1 General Comments from Panel Report #1

Please address the potable reuse questions and comments in the Panel report from Meeting #1. General comments from the Panel begin on page 4 of the report (and are repeated here):

– "The pursuit of solutions to the City's drought and long-term water supply provides a great opportunity to evaluate the best uses of water. The City of Santa Barbara was an innovator, when it came to developing desalination in the 1990s. Twenty-plus years later, the City has another opportunity to be an innovator in its efforts to find alternative water supply sources. The path forward is currently framed around feasibility and is defined by a series of constraints; another option is to frame the path around opportunities, finding and developing realistic and implementable solutions. For example, based on the State's Recycled Water Policy, the City could explore potable reuse options and meet the balance of need with subsurface intakes. Although the current studies are intended to meet the direction from City Council and RWQCB, a broader view could be taken in exploring alternatives that avoid or minimize environmental impacts associated with open ocean intakes while ensuring the City meets its water supply needs."

CITY RESPONSE: Noted. The City understands that a combination of subsurface intakes, surface intakes, and potable reuse alternatives may be used to meet water supply needs in the future. However, this study will identify what subsurface intake alternatives are technically feasible, and the maximum yield possible, which can inform future evaluations. The City can revisit combinations of intake and potable reuse alternatives when it updates its Long Term Water Supply Plan. As indicated in the final Work Plan and Technical Memorandum No. 1, changes in the Cachuma water supply may affect the amount of water available to the City in the future. When those changes are known, it will be necessary for the City to update its Long Term Water Supply Plan. At that time, as acknowledged by the RWQCB in their acceptance of this study's Work Plans, the feasibility information developed during this study (e.g., maximum yields from subsurface intakes and potable reuse alternatives) can be used to inform these future supply alternatives evaluations.

- "The objective of the subsurface intake study is to identify subsurface intake alternatives that could replace the open ocean intake volume. The basis of the design criteria should specify if seawater desalination operations would occur under drought conditions or full time (as a base supply). Technical constraints will determine if the intake alternatives survive the "fatal flaw" analysis. But it is known that potable reuse options will not meet the goal of replacing the permitted intake volume (i.e., <10,000 AFY) because the City does not generate enough wastewater to do so, especially during a drought. The potable reuse options, therefore, could be approached differently, perhaps by looking at realistic potable reuse opportunities, rather than attempting to meet a goal that cannot be achieved in the feasibility study."

CITY RESPONSE: The term "fatal flaw" has been updated to "initial screening" to better represent the goals of this study. Terminology has been updated in the Final Work Plans. Results of this study (even if alternatives do not meet the objectives of this study [initial screening criteria]) will present the maximum capacity that is technically feasible for all subsurface and potable reuse alternatives. For the reasons stated in Section 1.5 of the Work Plan and in Technical Memorandum 1, the City's position is that it is premature to perform a combined alternative analysis at this time. However, a combined alternative analysis may be included as part of a future study, that will be completed when the City is certain how its water supply needs will be affected by pending environmental and operational decisions that could reduce the availability of water from the Cachuma Reservoir.

- "While the feasibility studies are being prepared in direct response to City Council and RWQCB direction to look at two options (i.e., subsurface desalination intakes and potable reuse), the information gathered for these feasibility studies will have a secondary use: to inform the City's long-term water supply planning efforts. Although an alternative may be flawed in its ability to meet the basis of design criteria for these specific feasibility studies, the same alternative may have utility if the objectives or basis of design criteria are different in future studies; therefore, the Panel recommends the use of another term for "Fatal Flaw," such as "Held from Further Consideration," "Not Carried Forward," or "Does Not Meet Project Objectives."

CITY RESPONSE: Please refer to the final Work Plan language (specifically Section 1.5), clarifying the goals of the study, which addresses the sentiment of this comment. Results of this study will be useful to inform future studies. This language has been carried forward throughout the currently drafted Technical Memoranda (1 - 3). The term "Fatal Flaw" has been replaced with an "Initial screening criteria". According to the final Work Plan, alternatives can be categorized as "not feasible" (NF), "potentially feasibly, does not meet current Study goals" (PF*), or "potentially feasible" (PF). Alternatives deemed to be "potentially feasible, does not meet current Study goals" shall not be considered further as part of this study, but are potentially feasible and

may be considered in future studies. Information collected during the screening process is useful to inform future studies, such as the City's Long Term Water Supply Plan update.

- "It is the Panel's understanding that the City will undertake the technical feasibility "fatal flaw" evaluation first (rather than evaluate obvious constraints, such as the lack of appropriate real estate and conflicting land uses) because (1) it addresses regulatory requirements set by the RWQCB, and (2) it follows the example set by the evaluation of subsurface intakes for a proposed desalination plant in Huntington Beach, California. Undertaking the technical feasibility evaluation first may be appropriate for the subsurface desalination intake study, but may not be most appropriate for the potable reuse study because the potable reuse study is being performed solely for the City – not for regulatory needs. Although it seems logical to have similar structures for the two Work Plans, it could artificially force upon the potable reuse study significant technical work and costs that might be avoided if the screening criteria were applied differently."

CITY RESPONSE: The City's position is that following the same methodology is appropriate because we will obtain useful information that will be used to inform future studies. If an alternative is "potentially feasible, but doesn't meet the Study goals", it will be identified in this way so that it may be considered in the future. The information collected during this study provides the City great value in terms of time and resources saved when the future water supply study is required.

- The City is encouraged to seek further clarification on the basis for the feasibility studies. What are the requirements for the permit issued for the desalination plant by the RWQCB? Based on these requirements, the specific objectives of the feasibility studies need to be clearly stated in the Work Plans. The City and its consultants need to consider adding a narrative to both Work Plans that describes primary and secondary objectives. The primary objective would address fulfilling City Council and RWQCB requirements. The secondary objective would address the development, definition, and exploration of component options that could be considered as part of the City's long-term water supply planning efforts.

CITY RESPONSE: The RWQCB requirements are stated in Section 1.3 of the Work Plans, which defines the scope of the study requirements. A section entitled "Goal of Study" (Section 1.5) has been added to the Work Plans to further clarify the City's goals using the information developed during this study as part of its future water supply planning. This information is also reiterated in Section 1.4 (Technical Memorandum 1) of both the subsurface intake and potable reuse studies. In a letter dated October 20, 2015, the Central Coast RWQCB approved the Work Plansand accepted the 10,000 AFY threshold criteria with the following qualifications:

1. "We understand that this stepwise approach in the Work Plan will allow for initial work to focus on intake capacities of various subsurface intake technologies and

later work would provide further information on potentially feasible options that pass this initial screening."

2. "Central Coast Water Board staff shares the concern with Heal the Ocean that within the confines of this study this 10,000 AFY threshold prevents the potable reuse alternatives from progressing past initial screening feasibility analysis of technical factors into feasibility analysis of non-technical social, environmental, and economic factors. Having said this, we understand that the information from this study will help with future decisions regarding direct and indirect potable reuse by the City that could reduce the need for desalination."
3. "The City will not perform a combined alternative analysis at this time, but the City will pursue this when it knows how its water supply needs will be affected by pending environmental and operational decisions that could reduce the availability of water from the Cachuma Reservoir or new potable reuse regulations."
4. "The studies must evaluate the technical feasibility of the maximum capacity of potable reuse and subsurface intake options in order to provide information on whether the alternatives could independently or combined potentially replace the screened open-ocean intake desalination Facility."

– In the current study, full replacement of the screened open ocean intake is listed as the only option. Subsurface desalination intakes and potable reuse are considered as mutually exclusive rather than combined to develop integrated solutions; however, it is likely that the best solution will include combinations of components and complimentary opportunities. The Panel understands this level of review would be conducted at a later time.

CITY RESPONSE: Noted. The Panel's understanding as stated in the comment is correct - at present, the City intends to limit the scope of this evaluation to the direction given to them by City Council and the RWQCB. However, the City intends to use this information to inform future water supply planning efforts when its water supply needs change. Refer to Work Plan Section 1.5 and Section 1.4 of Technical Memorandum 1 for clarification and further response to this comment. This study will identify the maximum yield of subsurface intake and potable reuse alternatives that is technically feasible, which will be very useful information to inform these future studies.

3.4.2 Specific Comments from Panel Report #1

Specific comments from the Panel on the Potable Reuse Feasibility Study begin on page 9 of Panel Report #1 (and are repeated here):

Section 1.0: Introduction

– More emphasis appears to be given to IPR for groundwater injection than other options for recycled water usage (e.g., DPR, aquifer storage and recovery, or

reservoir augmentation). Are the other options being considered as much as IPR for groundwater injection? For example, the activities to assess and ascertain the feasibility of DPR (e.g., using treated wastewater effluent as desalination feedwater) could present project opportunities for the City.

CITY RESPONSE: As presented in the Work Plan and Technical Memorandum 1, the City will consider the entire range of potable reuse alternatives, including indirect and direct potable reuse (IPR/DPR). At the time of creation of the Work Plan, regulations exist for IPR in California, but do not exist for DPR. There is more information currently with regards to IPR, however, the City intends to consider both IPR and DPR in this study.

Note that the City's team conforms to industry standard nomenclature as we refer to IPR and DPR alternatives. For example - Title 22 refers to two types of IPR applications: "Groundwater Replenishment - Subsurface Application" (Title 22, Article 5.2), which includes Full Advanced Treatment (as defined by Title 22, §60320.201**)** followed by groundwater injection wells; and "Groundwater Replenishment - Surface Application" (Title 22, Article 5.1), which includes advanced treatment (as defined by Title 22, §60301.320) followed by groundwater spreading basins or areas.

- Please clarify who owns the wastewater from the El Estero Wastewater Treatment Plant (e.g., is it the City of Santa Barbara?).

CITY RESPONSE: The City of Santa Barbara owns and operates El Estero Wastewater Treatment Plant (WWTP), the collection system that delivers sewage to the WWTP, and the Title 22 Recycled Water Treatment Plant (that produces 1400 AFY) and recycled water delivery system. The tertiary effluent that leaves the El Estero WWTP is the City's to use.

- Provide a brief summary of precedent studies.

CITY RESPONSE: Section 2.4 in the Work Plan identifies literature that will be reviewed; additionally, the City's team is actively reviewing new literature. Work Authorization 2 (Technical Memorandum 3) will include a critical analysis of this literature data. This technical memorandum will be presented at TAP Workshop #3, which has been tentatively scheduled for Wednesday, August 3, 2016. The critical analysis of literature presented in TM 3 will be similar in detail to that presented in TM 3 for subsurface intake alternatives.

Section 2.0: Basis of Design

- Why is the discharge of advanced treated wastewater into Lauro Canyon Reservoir considered DPR? Is the DPR assumption based on an inability to meet retention time and blending requirements in Lauro Canyon? Could the retention time requirement in the draft surface water augmentation criteria be met by an alternative treatment process to supplement shorter retention time? This question may not be

answerable until after DDW has decided whether to include an alternatives provision in the draft regulations.

CITY RESPONSE: The determination of whether discharge of advanced treated wastewater into a reservoir is considered IPR or DPR is determined by the State Water Resources Control Board, or their delegate agency. Currently, Title 22 does not address this type of potable reuse. These rules are in development - the state has required the Division of Drinking Water (DDW) to develop proposed guidelines by December 31, 2016. However, the state has recognized in the existing Title 22 regulations that an environmental buffer (i.e., travel time) is important for protecting public health and safety when potable reuse is practiced. The presence of an environmental buffer has become, in some circles, the determination between if an application is considered "direct" or "indirect" potable reuse.

Lauro Canyon Reservoir has a capacity of approximately 550 AF and is used primarily to equalize flows before treatment. Because the reservoir may have an uncertain buffer (travel time), for this project, we initially assumed that it will be considered DPR and will require Full Advanced Treatment plus engineered storage. As stated in Section 2.3 of the Work Plan, the City will continue to follow the State's (DDW) DPR regulatory development and update the treatment requirements (and nomenclature) for application of potable reuse water to the Lauro Canyon Reservoir. The panel is correct in their statement that this question is not fully answerable until after DDW has decided whether to include an alternatives provision in the draft regulations.

- Production Capacity: The average daily flow needs to be augmented with an understanding of diurnal flow.

CITY RESPONSE: Acknowledged. Section 2.1 of the Work Plan discusses the diurnal flow characteristics associated with the wastewater plant. Preliminary calculations considering flow characteristics were presented to the TAP during the closed session of Workshop #2. Effluent flow data was analyzed from 2003 until 2015. Full results, including graphical representations and calculations, will be presented in Technical Memorandum 3.

- Equalization can be used to address diurnal flows.

CITY RESPONSE: Noted. Equalization will be used to address diurnal flows, which will be considered during the conceptual design performed in Work Authorization 2. Preliminary equalization calculations were presented to the TAP during the closed session of Workshop #2.

- Include the storage options for buffering or for equalization, conveyance, treatment, and distribution.

CITY RESPONSE: Acknowledged. Storage options for buffering or equalization, conveyance, treatment, and distribution will be considered during the conceptual

design performed in Work Authorization 2. Refer to Work Plan Section 2.1 to see additional information. Storage options will be considered during the conceptual design performed in Work Authorization 2.

- Water Quality: The City will need an appropriate source control program if potable reuse is to be implemented. Please provide a brief narrative on the present source control program for the El Estero Wastewater Treatment Plant.

  CITY RESPONSE: Section 2.3 of the Work Plan states that the water quality and treatment requirements will conform to Title 22. Article 5.1 §60320.106 and Article 5.2 §60320.206 state that a source water control program is required. We believe that the reference to Title 22 provided in Section 2.3 of the Work Plan addresses this question. The Wastewater Source Control Program will be described as part of the basis of design that is completed during Work Authorization #2.

- Optimization of the El Estero Wastewater Treatment Plant process operations and water quality should be considered.

  CITY RESPONSE: Acknowledged. The City is currently implementing a number of upgrades to the El Estero WWTP. These upgrades and their impact to the potential for potable reuse will be addressed as part of the basis of design development - specifically related to the treatment requirements specified in Section 2.3 of the Work Plan. If additional upgrades are recommended, these upgrades will be identified and incorporated into the potable reuse project description and costs.

- Treatment: As proposed in the Work Plan, full advanced treatment (FAT) will be used to produce recycled water for IPR; however, the FAT treatment train needs to be specified in the Work Plan, including a schematic.

  CITY RESPONSE: Acknowledged. Text explaining full advanced treatment was added to Section 2.3 of the Work Plan. Additionally, a conceptual schematic of a FAT train was added. Note that FAT as defined in Title 22 Article 5.2 §60320.201 is required for subsurface application while advanced treatment as defined in Article 5.1 §60301.320 and §60301.230 is required for surface application. This difference is clarified in Section 2.3 of the revised Work Plan.

- Groundwater Recharge (Section 2.5): On Page 13, consider including “impact to other wells” as a feasibility screening criteria.

  CITY RESPONSE: Feasibility Criteria 3 considers impact to freshwater aquifers, local water supplies, and existing water users. Impact to other wells is included under this criteria and will be considered during Work Authorization 2. We have updated definition of Feasibility Criteria 3 in Section 3 of the Work Plan to include “water quality and hydraulic impacts to other wells”.

- Groundwater Recharge (Section 2.5.1): On page 14, the Work Plan suggests an assumed injection rate of 75 percent of the extraction rate. What is the basis for the

75-percent injection rate? Experience has shown that injection well performance in finer-grained sediments can be better maintained with injection rates closer to 50 percent of the extraction rate.

CITY RESPONSE: We have updated Section 2.5.1 to indicate that a range of 50 to 75 percent is possible, and that an estimated rate will be determined when site specific data is available.

- Groundwater Recharge (Section 2.5.2): On page 14, fourth line, should this sentence begin with "This project will *review* available…" and not "This project will *provide* available…"?

  CITY RESPONSE: Noted. Correction made.

- Groundwater Recharge: The existing USGS groundwater model is adequate for the assessment and quantification of the volume of recycled water that might be cyclically stored in a put-and-take operation; however, even though the new USGS model is proposed to have transport capability, the cell size is too large to use the model to simulate flow between wells and defensibly predict residence times. Again, analytical methods might be used as a first cut.

  CITY RESPONSE: The use of analytical methods as a first cut will be explored during the basis of design performed in Work Authorization 2. However, the City has verified that the USGS model referenced in the comment is outdated, and has been through several updates. The new updated model has 250 ft grid spacing with 56 vertical layers and may provide enough information to simulate flow between wells and adequately predict residence times.

- Groundwater Recharge: Consideration should be given to optimizing the management of the groundwater basin to create storage. Further detail on groundwater contamination and seawater intrusion issues will be necessary.

  CITY RESPONSE: Acknowledged. The City realizes that optimization of the groundwater basin to create storage may benefit groundwater replenishment projects. Section 2.4.2 presents additional data collection that may be necessary for potentially feasible alternatives. If groundwater replenishment alternatives are found to be potentially feasible, further detail on groundwater contamination and seawater intrusion may be necessary. The City has the option to obtain additional data as part of Work Authorization 2 for this project.

- Additional Production Wells (Section 2.6, Page 18): The narrative leading up to this section reads as if only IPR (i.e., groundwater injection using treated wastewater) is being considered. This section implies that existing production wells will be used for this concept. The Panel believes it is inconsistent with current regulations to use the same well for injection and production with recycled water.

  CITY RESPONSE: Acknowledged. The wording presented in Section 2.6 was unclear - it was not the City's intent to indicate that recharge wells (i.e., subsurface

application) would also be used for recovery. We have clarified this point in Section 2.6 of the final Work Plan

- Additional Well Sites: The Work Plan should include a preliminary inventory of possible sites for the numerous injection and extraction wells necessary to inject and recover the water.

  CITY RESPONSE: Acknowledged. Section 2.2 of the Work Plan has been updated to discuss location for new production wells. The location for recharge wells (i.e., subsurface application) was already discussed.

- Reliability Features (Section 2.8, page 19): The Panel suggests rewriting the paragraph to provide more clarity about project reliability.

  CITY RESPONSE: Acknowledged. Section 2.8 of the Work Plan has been revised to provide more clarity about project reliability.

Section 3.0: Feasibility Criteria

- The Panel noted that the work authorizations do not include a fatal flaw analysis for potable reuse; however, it is listed in Figure 1.

  CITY RESPONSE: As noted, the subsurface intake and potable reuse studies are delivered through three separate work authorizations to facilitate completion of both studies within the aggressive schedule required by the RWQCB and to allow for peer technical review at key project intervals. For the potable reuse study, both the fatal flaw analysis (renamed “initial screening analysis”) and the feasibility analysis are components within Work Authorization 2. This differs from the subsurface intake study, where the fatal flaw analysis is the subject of Work Authorization 2 and the feasibility analysis is the subject of Work Authorization 3. The purpose of separating the two is because it is anticipated that adequate hydrologic data will be available for assessing the potable reuse alternatives that involve groundwater replenishment and recovery. However, it is possible that additional hydrologic data may be required for the subsurface intake study. Therefore, the City has separated the subsurface intake study feasibility assessment into a separate work authorization so that they can consider the cost and value of collecting this additional information for "potentially feasible" alternatives. Both the subsurface intake and potable reuse studies involve "initial screening" based upon technical feasibility criteria before feasibility (as defined by CEQA) is assessed for those alternatives that are potentially or technically feasible.

- The fatal flaw analysis should consider the treatment train and specific requirements of the Groundwater Recharge regulations.

  CITY RESPONSE: As stated in Section 2.3 of the Work Plan, the treatment requirements will be determined by regulatory requirements such as Title 22, Article 5.1 and 5.2. Refer Section 2.3 and to prior responses herein for further clarification.

- Please clarify how Oceanographic Factors #8 and #9 in Table 3.1 are relevant to recycled water.

  CITY RESPONSE:

  - Oceanographic Factor #8: This factor relates primarily to sea level rise, which can affect potable reuse facilities, depending on the site location. The City cannot receive funding for a facility located in an area susceptible to inundation from rising sea water. Furthermore: (1) sea level rise is a part of a coastal development permit and the areas considered for potable reuse treatment facilities are located in the City's local coastal zone; and (2) sea level rise can affect quality and capacity of groundwater aquifers (i.e., mainly related to IPR by surface and subsurface application).
  - Oceanographic Factor #9: This factor relates to an alternatives susceptibility to tsunamis. Similarly, the City cannot receive funding for a site that is likely to be inundated by a tsunami. Such a site would render the site alternative to be infeasible, that is, if impacts from these threats cannot be mitigated by engineering design.

- For Energy Use #13 in Table 3.1, does the City's 2012 Climate Action Plan provide for mitigation/offsets to meet the Plan's thresholds? Consider providing for this as a way to achieve comparable emissions between alternatives.

  CITY RESPONSE: The City's desalination plant has been evaluated against the City's 2012 Climate Action Plan for compliance. As discussed in the Work Plans, incremental differences in Energy Use and Greenhouse Gas Emissions (positive or negative) will be evaluated where subsurface intakes are considered for use. Potable reuse will be considered by itself for the time being since it is considered a new supply by the City's existing Long Term Water Supply Plan. Costs for mitigation (off-sets) would need to be evaluated (as a line item) for those alternatives that are determined potentially or technically feasible through initial screening.

Additional Recommendations:

- If pursuing potable reuse, the City should begin outreach to the community about recycled water as a water supply option. Water quality and public health concerns raised by some community members will need to be addressed directly in the outreach program.

  CITY RESPONSE: Acknowledged. The City understands the importance of community outreach regarding potable reuse projects and shall investigate implementation plans as reuse alternatives are further studied as part of an update to the City's Long Term Water Supply Plan.

- The implications of using recycled water for brine dilution should be considered. This should include the environmental implications of discharging the mixed

recycled water and brine to the ocean, as well as the reduction in wastewater volume that is available for recycling.

CITY RESPONSE: Acknowledged. As part of the desalination plant reactivation project, the City has already considered the impact of little or no effluent flow. Based upon the City's success in conservation, there are already times of the year when, at night, the City does not discharge effluent. If the Desalination Plant operates, the City has demonstrated to the RWQCB that it can do so without the need for effluent for dilution and mixing.

APPENDIX 1 – DRAFT FINAL PANEL REPORT

NATIONAL WATER RESEARCH INSTITUTE

Draft Final Panel Report for Meeting #2:

Review of the City of Santa Barbara's Subsurface Desalination Intake and Potable Reuse Feasibility Studies

Based on a Technical Advisory Panel Meeting
Held on January 27-28, 2016 (Panel Meeting #2)

Prepared by:
Technical Advisory Panel
for the City of Santa Barbara's Subsurface Desalination Intake
and Potable Reuse Feasibility Studies

Prepared for:
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March 2, 2016
Fountain Valley, CA

http://www.nwri-usa.org/santa-barbara-panel.htm

DISCLAIMER

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ABOUT NWRI

A 501c3 nonprofit organization, the National Water Research Institute (NWRI) was founded in 1991 by a group of California water agencies in partnership with the Joan Irvine Smith and Athalie R. Clarke Foundation to promote the protection, maintenance, and restoration of water supplies and to protect public health and improve the environment. NWRI's member agencies include Inland Empire Utilities Agency, Irvine Ranch Water District, Los Angeles Department of Water and Power, Orange County Sanitation District, Orange County Water District, and West Basin Municipal Water District.

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CONTENTS

ACRONYMS

AFY	Acre foot per year
ASR	Aquifer storage and recovery
CEQA	California Environmental Quality Act
DPR	Direct potable reuse
FAT	Full advanced treatment
FESA	Federal Endangered Species Act
GHG	Greenhouse gas
gpm	Gallons per minute
IPR	Indirect potable reuse
mgd	Million gallons per day
NEPA	National Environmental Policy Act
NWRI	National Water Research Institute
RWQCB	Central Coast Regional Water Quality Control Board
SSI	Subsurface intake
USFWS	U.S. Fish and Wildlife Service
USGS	United States Geological Survey

1. PURPOSE AND HISTORY OF THE PANEL

In 2015, the National Water Research Institute (NWRI) of Fountain Valley, California, a 501c3 nonprofit, appointed water industry experts to a Technical Advisory Panel (Panel) to provide expert peer review of both the *Subsurface Desalination Intake Feasibility Study* and *Potable Reuse Feasibility Study* being undertaken by the Public Works Department of the City of Santa Barbara, California. Carollo Engineers is the lead consultant on this effort.

1.1 Project Background[1]

In the late 1980s, the City constructed the Charles E. Meyer Desalination Plant, a seawater desalination facility, as an emergency supply. The production capacity of the desalination plant was 7,500 acre feet per year (AFY) with the potential for expansion up to 10,000 AFY. In 1991, City voters elected to make desalination a permanent part of the City's water supply portfolio. The desalination plant was operated between March and June of 1992. Due to sufficient supply of freshwater from other sources, the plant was then placed on long-term standby mode for reactivation when water supply demand cannot be met using all other available supplies, including extraordinary water conservation.

An Environmental Impact Report was certified in May 1994 and, with the approval of the Long Term Water Supply Program in July 1994, the City added the desalination plant to its permanent sources of water. In 1996, the California Coastal Commission issued a Coastal Development Permit to the City for permanent desalination facilities up to a maximum capacity of 10,000 AFY. The permit provided for intermittent and base load operation.

On July 24, 2015, the City Council issued a contract to reactivate and operate the Charles E. Meyer Desalination Plant. As part of recommissioning, the desalination plant will use state-of-the-art technology and design practices to reduce its impact on the environment, including possibly replacing the screened open ocean intake.

1.2 Purpose of the Project

The Santa Barbara City Council directed the Public Works Department to evaluate the feasibility of (1) replacing the open ocean intake with a subsurface intake (SSI) and/or (2) implementing potable reuse options, including indirect potable reuse (IPR) and direct potable reuse (DPR).

In addition, the Central Coast Regional Water Quality Control Board (RWQCB) adopted an amendment to the City's Waste Discharge Requirements for the El Estero Wastewater Treatment Plant that included a condition that the City should report back to the RWQCB by August 2015 with a Work Plan that will result in completed feasibility studies by June 2017.

The City retained Carollo Engineers, Inc. to complete these feasibility studies under the following three work authorizations:

[1] For more information about the feasibility studies, please visit the City of Santa Barbara website at http://www.santabarbaraca.gov/gov/depts/pw/resources/system/sources/desalination.asp.

Work Authorization 1: Work Plans for both studies.
Work Authorization 2: SSI fatal flaw analysis and potable reuse feasibility study.
Work Authorization 3: SSI feasibility study.

The work products for the feasibility studies will be developed to accomplish the following:

- Satisfy the requirements of the City's amended Waste Discharge Requirements for the El Estero Wastewater Treatment Plant.
- Support a future update to the City's Long Term Water Supply Plan to include alternatives considered in the studies.

1.3 Role of the Technical Advisory Panel

In 2015, Carollo Engineers requested that NWRI form and coordinate the activities of a Technical Advisory Panel to provide expert peer review of the technical and scientific aspects of the two feasibility studies. Specifically, the Panel will review the work products (i.e., draft Work Plans, technical memos, reports, etc.) for both feasibility studies and consider public comments on these proposed efforts. The Panel's findings and recommendations will be documented in Panel reports. Background information about the NWRI Panel process can be found in Appendix A. Information is also available at http://www.nwri-usa.org/santa-barbara-panel.htm.

1.4 Panel Members

The Panel is made up of experts in areas related to drinking water management, desalination and wastewater recycling technologies, hydrogeology, water policy and regulations, and other areas relevant to the two feasibility studies. Panel members include:

- Chair: Amy Childress, Ph.D., University of Southern California (Los Angeles, CA)
- Martin B. Feeney, P.G., CHg, Consulting Hydrogeologist (Santa Barbara, CA)
- Heidi R. Luckenbach, P.E., City of Santa Cruz Water Department (Santa Cruz, CA)
- Michael P. Wehner, Orange County Water District (Fountain Valley, CA)
- Eric Zigas, Environmental Science Associates (San Francisco, CA)

It should be noted that Mr. Wehner has replaced former Panel member Heather Collins, P.E., of the Metropolitan Water District of Southern California (Los Angeles, CA). Ms. Collins resigned from the Panel due to a potential conflict of interest with a potable reuse project currently being considered by Metropolitan.

Brief biographies of the Panel members can be found in Appendix B.

2. PANEL MEETING #2

A 2-day meeting of the Panel was held on January 27-28, 2016, in Santa Barbara, California. The first day of the meeting included an open session in which members of the public were invited to attend; it was held at the Santa Barbara City Hall on Anacapa Street. The second day of the meeting was held at the Water Resources Conference Room on Garden Street. This meeting represents the second time the Panel has met to review the *Subsurface Desalination Intake Feasibility Study* and *Potable Reuse Feasibility Study* being undertaken by the City. It is referred to herein as "Panel Meeting #2."

2.1 Background Material

Prior to Panel Meeting #2, the following background material was provided to the Panel:

- Subsurface Desalination Intake Feasibility Study Technical Memoranda:
    - TM-1: Introduction, Background, and Project Alternatives
    - TM-2: Regulatory and Permitting Requirements
    - TM-3: Basis of Design and Initial Screening

- Potable Reuse Feasibility Study Technical Memoranda:
    - TM-1: Introduction, Background, and Project Alternatives
    - TM-2: Regulatory and Permitting Requirements

2.2 Panel Meeting #2 Agenda

Staff from NWRI, the City, and Carollo Engineers collaborated on the development of the agenda for Panel Meeting #2, which is included in Appendix C. The agenda was based on enabling:

- Carollo Engineers to publically present information in the SSI Technical Memoranda on the conceptual design and initial technical screening analysis of SSI options, and (2) preliminary information regarding the potable reuse study.
- Members of the public to have an opportunity to provide comments.
- The Panel to conduct a technical review of the Technical Memoranda and information presented at Meeting #2 regarding both the SSI and potable reuse studies.

Day 1 of Panel Meeting #2 began with a brief closed session in which the Panel, City staff, and Carollo Engineers discussed meeting objectives. After the closed session, a public meeting was held in which a presentation was given by Carollo Engineers that focused mostly on the conceptual design and initial technical screening analysis of SSI options, followed by questions from the Panel. The floor was then open to public comments. Once the public session concluded, the Panel met briefly with City staff and Carollo Engineers for additional clarification

before moving on to a closed Panel session to (1) discuss the information presented and to (2) draft preliminary findings.

Day 2 of Panel Meeting #2 began with a closed discussion with the Panel, City staff, and Carollo Engineers on preliminary information regarding the potable reuse study. The Panel then discussed its preliminary findings regarding the SSI study with City staff and Carollo Engineers. Before adjourning Meeting #2, the Panel met in a closed session to complete a report outline with findings and recommendations, which have been expanded upon in this report.

2.3 Panel Meeting #2 Attendees

All Panel members attended Panel Meeting #2 in person. Other meeting attendees included NWRI staff, City staff, Carollo staff and their sub-consultants, members of the public, and others. A complete list of attendees at Panel Meeting #2 is included in Appendix D.

2.4 Panel Response to Public Comments

Because Panel Meeting #2 included an open public session, all interested persons were invited to attend and comment on the matter. Written comments were also accepted via email for two weeks after the meeting. The Panel's written responses to public comments will be included in a separate document; therefore, public comments will not be addressed in this report.

3. PANEL FINDINGS AND RECOMMENDATIONS

The principal findings and recommendations of the Panel, as derived from the material presented and discussed during Panel Meeting #2, are provided in Sections 3.1 to 3.5. The findings and recommendations are organized under the following section headings:

- General Comments
- Update on Activities since Panel Meeting #1
- Subsurface Desalination Intake Feasibility Study
  - Regulatory Summary for Subsurface Intakes
  - Basis of Design for Subsurface Intakes
  - Summary of Alternatives and Conceptual Design
  - Sediment Transport and Coastal Hazards
  - Hydrogeological Analysis of Subsurface Intake Alternatives
  - Initial Screening
- Potable Reuse Feasibility Study

3.1 General Comments

The following comments pertain to the overall Panel review process as related to the materials, presentations, and discussions resulting from Panel Meeting #2.

3.1.1 Overall

- The Panel appreciates that the pre-meeting materials and presentation provided at Panel Meeting #2 were well-prepared and informative.

- In general, the methodologies and results presented in TM-3 were conducted in a manner to address the needs of the Work Plan that was approved by the RWQCB. In addition, the analyses used are consistent with current industry practices. The panel does provide specific recommendations in this panel report to clarify and/or enhance the methods and analyses.

3.1.2 Subsurface Desalination Intake Feasibility Study

- The conceptual designs in the Subsurface Desalination Intake presentation were useful in portraying the anticipated visual impact of subsurface intake installations on the beaches in Santa Barbara.

- Recognizing that the SSI Technical Memoranda will serve as chapters in the final report, the information should be provided in such a manner that a reasonable reviewer would be able to follow the logic and draw similar conclusions. TM-1 presented the Introduction, Background, and Project Alternatives, and TM-2 presented the Regulatory and Permitting

Requirements; therefore, TM-3 should present the following (which is similar to the flow and logic of the January 27, 2016, presentation):

- Summary of Alternatives and Conceptual Design.
- Sediment Transport and Coastal Hazards.
- Hydrogeological Analysis of Subsurface Intake Alternatives.
- Initial Screening.
- Conclusions and Recommendations.

- Do not comingle the conclusions with background material. For example, the last sentence in the first paragraph of the Sediment Transport Evaluation beginning on page 3-33 of TM-3 states, "Key findings are presented for **each beach site** [emphasis added] considered in the following sections." This section, therefore, should describe the characteristics and physical processes of **each beach site**, and any bullets that draw a conclusion should be reserved for the initial screening discussion section.

- Correct the pagination in TM-3, starting at Table 3.13 (it should be page 3-66, not 3-57).

- The Panel recommends the following information be included to provide better context regarding the SSI study:

  - An explanation as to why the City received the Coastal Development Permit from the California Coastal Commission in 1996 even though the desalination plant had already been operated and put into standby in 1992.

  - Clarification that the Coastal Development Permit was for the existing open ocean intake system.

  - A clear statement as to why the City's desalination facility is exempt from regulatory and permitting requirements in the California Ocean Plan.
    - Include background information provided by Rebecca Bjork, City Public Works Director, about the current permit for the City's desalination facility, which has an open ocean intake.

  - Any consideration given to streamlining the evaluation process since this facility is exempt from the Ocean Plan. For example, costs, land use conflict, or other factors could possibly be included earlier in the assessment.

  - A description of the requirements of the RWQCB amendment to the Waste Discharge Requirements for the El Estero Wastewater Treatment Plant as related to the study.

- Although this facility may be exempt from the California Ocean Plan, the Ocean Plan states that the RWQCB shall require the owner or operator to: "Consider whether the identified need for desalinated water is consistent with an applicable adopted urban water management plan prepared in accordance with Water Code section 10631, or if no urban water management plan is available, other water planning documents such as a county general plan or integrated regional water management plan." (Chapter III.m.2.b.[2]). Based on this requirement, the demand projections in the Long-Term Water Supply Planning process may need to be updated to justify the 10,000 AFY that is stated. To do so, the Panel suggests:

    - Providing a description of the current baseline water use.
    - Providing stacked bar or pie charts showing what comprises the 10,000 AFY of demand; one chart should be for drought conditions and another for non-drought conditions. Clearly document the source of the demand projections.
    - Ensuring the potential use of desalination for drought and non-drought conditions is not lost in the presentation.

3.1.3 Final Report

- The Panel encourages the preparation of an Executive Summary for the final report, as discussed during Panel Meeting #2, and recommends the following:

    - Define the permit deadline driving the project schedule. Is it CCRWQCB Order No. R3-2010-001?

    - Clarify the possible roles of desalination (using subsurface intakes or open ocean intakes) and potable reuse in the Long-Term Water Supply Planning process. Explain the timing of the planning process and how these studies will fit into that process.

3.2 Update on Activities since Panel Meeting #1

The Panel requests that the City and project team provide a written response to the Panel Report for Meeting #2 that includes brief comments on how the Panel's findings and recommendations will be addressed.

3.3 Subsurface Desalination Intake Feasibility Study

The following comments pertain to the Technical Memoranda (TM-1, TM-2, and TM-3) and information presented on the *Subsurface Desalination Intake Feasibility Study.*

3.3.1 Regulatory Summary for Subsurface Intakes

TM-2 does not refer to the California Ocean Plan or the National Environmental Policy Act (NEPA). Reiterate why the California Ocean Plan does not apply to this desalination plant. If

NEPA is not applicable and the City will need to consult with the U.S. Fish and Wildlife Service (USFWS) under the Federal Endangered Species Act (FESA), then please revise the FESA "Section 7" consultation process with the USFWS that is described in Section 2.5.2 of TM-2, to reflect how consultation under the FESA would work (as well as the scheduling implications) without a federal lead agency ("Section 10" consultation).

3.3.2 Basis of the Design for Subsurface Intakes

- Identify how SSI alternatives would work for both drought and non-drought conditions.

- Consider including a sensitivity analysis that would result from releasing some of the design constraints (e.g., property ownership, half-mile boundary).

- On Presentation Slide #14 ("Design, Construction, and Operational Criteria that must be evaluated when implementing a subsurface intake project"), a blend of seawater and groundwater was listed as a design requirement. Clarify what is meant by a "blend of seawater and groundwater."

3.3.3 Summary of Alternatives and Conceptual Design

- In TM-3, Table 3.4 (Feasible Yield and Ocean/Inland Water Contribution Summary) and Table 3.6 (Conceptual Design: Vertical Wells) have similar but inconsistent information. For example:

    - The "capacity, total" for vertical wells is 1,500 gallons per minute (gpm) in Table 3.4 and 1,400 gpm in Table 3.6.
    - The Well Spacing is 560 feet for the low k value in Table 3.4 and 600 feet in Table 3.6.

    Please be consistent.

- TM-3 is inconsistent as to whether the drilling equipment required for slant wells is specialized or not:

    - Page 3-17 states: "Specialized drilling equipment must be employed...."
    - Page 3-20 states: "Although the drilling equipment is the same used for vertical wells...."
    - Page 3-21 refers to "...the custom drilling equipment that is required."

    Please be consistent.

- On Slide #46 ("Construction of a Subsurface Infiltration Gallery is more complex than any subsurface intake alternative"), reference is made to greenhouse gas (GHG) emissions during the construction phase. The Panel feels it is not necessary to discuss GHG emissions for one alternative unless it is discussed for all alternatives.

3.3.4 Sediment Transport and Coastal Hazards

The following comments pertain to the final report titled *Coastal Hazards and Sediment Transport Analysis for the City of Santa Barbara Subsurface Desalination Intake Study*, dated December 29, 2015, and submitted by Scott A. Jenkins, Ph.D., of Michael Baker International. The report was provided as Appendix C in TM-3. An overview of the report was also presented at Panel Meeting #2.

- The Panel felt the study and overview of sediment transport and coastal hazards were informative and useful.

- The Panel would like clarification as to where the City's future shoreline will be located. Please see the "City of Santa Barbara Sea-Level Rise Vulnerability Study" prepared for the California Energy Commission by the University of California, Santa Cruz (July 2012) at http://www.energy.ca.gov/2012publications/CEC-500-2012-039/CEC-500-2012-039.pdf, which includes a discussion of the vulnerability of and previous damage to City beaches and facilities from high tides and winter storms (e.g., impacts to West Cabrillo Boulevard from overtopping waves in 1914 and 1983).

- Please explain the 150-foot setback to protect against erosion and how it was determined.

3.3.5 Hydrogeological Analysis of Subsurface Intake Alternatives

- The hydrogeologic analysis approach and methods of evaluating the yield of the proposed SSI alternatives and then addressing the land requirements within the limitations of the available land are appropriate.

- Analysis of the groundwater-based SSI alternatives (i.e., vertical wells, slant wells, collector wells, and infiltration galleries) was performed with a groundwater model created for this purpose. Although details of the model in the report are limited, it appears that the model uses overly optimistic hydraulic parameters and boundary conditions; therefore, it likely overestimates the hydraulic connection between the nearshore groundwater system and the ocean. This overestimation increases individual SSI yields and reduces inland impacts.

- It is understood that the overly optimistic hydrogeologic assumptions were used to provide a "best case" estimate for the performance of SSI alternatives. This may be appropriate if only one SSI alternative is to be implemented to meet demand; however, the Panel understands that the rejected alternatives may survive to be reevaluated as part of future water supply planning. If the rejected approaches are to survive as possible components of future supply, it is recommended that the SSI alternatives be evaluated with more realistic hydrogeologic parameters.

- The Panel had several concerns with the modeling assumptions:

- The offshore geology is unknown; however, given that seafloor materials were deposited during a transgressive period, it can be assumed that the offshore/seafloor materials are, at least in part, finer grained and certainly significantly more heterogeneous and stratified than the beach deposits. The assumption that offshore hydraulic conductivities are similar to beach hydraulic conductivities is unsupported and may significantly overestimate the volume of seawater that will infiltrate and the amount of water that will move horizontally from the constant head boundary.

- The assumed horizontal/vertical hydraulic conductivity ratio (K_h/K_v) is very low and likely significantly overestimates the amount of water that is moving vertically through the seafloor. The ratio of 5 that is used is much lower than default textbook values, which are typically around 100 for heterogeneous layered systems (Freeze and Cherry, 1979, Anderson and Woessner, 2002). The ratio of 5 is also significantly lower than the values (10 to 100) used by the U.S. Geological Survey (USGS) for the existing model of the Santa Barbara basin. For Huntington Beach SSI analyses, ratios between 10 and 100 were used in sensitivity analyses. In the calibrated groundwater model developed for the Marina slant well analyses, ratios between 34 and 450 were adopted for dune sand and terrace deposit layers, respectively. Given the sensitivity of the results to this ratio, the use of the very low ratio of 5 should be justified. Also, sensitivity analysis should be performed over a greater range for this parameter. If further refinement of the vertical conductivity value is considered important, a series of vibracores should be taken from the seafloor and evaluated for vertical conductivity.

- Equivalent freshwater heads should be used offshore to account for the greater density of seawater.

- The use of a constant-head boundary in the lower layers offshore needs justification. The shallow offshore geology is poorly understood. Whether and where the lower layers outcrop on the seafloor are unknown. It is possible these layers are truncated by offshore faulting. The use of the constant-head boundary condition at this location results in unlimited horizontal flow of water into the model. A general-head boundary condition with a conductance that approximates the geometry of the flow path may be preferred. The conductance could be adjusted to approximate differing assumed geometries.

- Although it is implied that the groundwater-based SSI alternatives derive their offshore flow from vertical leakage through the seafloor, the use of constant-head boundary conditions offshore may result in unlimited horizontal water flow. A detailed narrative is needed to describe and quantify the anticipated horizontal and vertical offshore flows.

- In general, more documentation of the model assumptions and configuration is needed. An appendix that includes the following information would help the reader understand how the analysis was performed:

- A generalized conceptual hydrogeologic model and how it was captured in the grid/layer configuration.
- A map of the model domain that shows boundaries (e.g., constant-head, no flow).
- A cross-section of the model showing the layers, layers thickness, and relationship to seafloor.
- A water budget that details the volume of water derived from leakage through the seafloor vs. the volume of water supplied from the offshore constant-head or general-head boundary. (i.e. constant-head fluxes)
- Particle tracking and presentation of these results to visualize sources and sinks and to help explain to the reader the nature of the flow regime.

- With the exception of the use of equivalent freshwater heads, the adoption of more realistic assumptions (as discussed above) will reduce the hydraulic connection of the subsurface groundwater system with the ocean. It will also reduce estimated yields and increase onshore impacts. Model results, however, will be more realistic and defensible and have residual value to the City.

3.3.6 Initial Screening

- Please number the screening criteria in Table 3.11, in a similar fashion to how they are numbered in Table 3.12.

- There are three screening criteria that seem to use the same logic to draw the same (infeasible) conclusion. In fact, two of the screening criteria listed in Table 3.11 (Initial Screening Criteria) and Table 3.12 (Subsurface Desalination Intake Initial Screening Results) are essentially the same:

    - Hydrogeologic Factors
        - Criterion 4: Insufficient length of beach available for replacing full yield derived from existing open ocean intakes.
    - Design and Construction Constraints
        - Criterion 9: Lack of adequate linear beach front for technical feasibility.

  "Criterion 8: Adequate Capacity" states that "subsurface material lacks adequate transmissivity to meet target yield of at least 15,898 gpm (i.e., build-out intake capacity necessary to produce 10,000 AFY)." While the failure to meet this criterion is stated to be transmissivity, it appears the conclusion is really being drawn because there is insufficient beach (criterion 4) or lack of adequate linear beach front (criterion 9) that causes the lack of adequate capacity, not the transmissivity of the aquifer. Consider how this criterion is used for drought versus non-drought needs, especially since the Ocean Plan states that "design capacity in excess of the need for desalinated water . . . shall not be used by itself to declare subsurface intakes as not feasible."

- The screening table could be misinterpreted. Regardless of what conclusions are reached for meeting current project goals (with 10,000 AFY demand), the conclusions should also include alternatives to meet partial demand.

    - Create another table that addresses the potential feasibility of the SSI alternatives to be components of a long-term future water supply.
    - The unclear terminology in the tables is likely to become clearer once the table is broken up into two tables.
    - The first sentence of TM-3 Section 3.6 states that, "This section presents the basis of design, conceptual design, and initial screening analysis for each of the six SSI alternatives considered in this study." This sentence may be misplaced since the section does not do that.
    - The Panel agrees there are significant risks associated with moving forward with Neodren due to the lack of precedent studies and unproven constructability. One city should not take the risk on an unproven technology. If pursued, the City should seek grant funding and collaborate with Montecito and others to construct a demonstration project.

3.4 Potable Reuse Feasibility Study

The following comments pertain to the *Potable Reuse Feasibility Study*.

3.4.1 General Comments from Panel Report #1

Please address the potable reuse questions and comments in the Panel report from Meeting #1. General comments from the Panel begin on page 4 of the report (and are repeated here):

- "The pursuit of solutions to the City's drought and long-term water supply provides a great opportunity to evaluate the best uses of water. The City of Santa Barbara was an innovator, when it came to developing desalination in the 1990s. Twenty-plus years later, the City has another opportunity to be an innovator in its efforts to find alternative water supply sources. The path forward is currently framed around feasibility and is defined by a series of constraints; another option is to frame the path around opportunities, finding and developing realistic and implementable solutions. For example, based on the State's Recycled Water Policy, the City could explore potable reuse options and meet the balance of need with subsurface intakes. Although the current studies are intended to meet the direction from City Council and RWQCB, a broader view could be taken in exploring alternatives that avoid or minimize environmental impacts associated with open ocean intakes while ensuring the City meets its water supply needs."

- "The objective of the subsurface intake study is to identify subsurface intake alternatives that could replace the open ocean intake volume. The basis of the design criteria should specify if seawater desalination operations would occur under drought conditions or full time (as a base supply). Technical constraints will determine if the intake alternatives

survive the "fatal flaw" analysis. But it is known that potable reuse options will not meet the goal of replacing the permitted intake volume (i.e., <10,000 AFY) because the City does not generate enough wastewater to do so, especially during a drought. The potable reuse options, therefore, could be approached differently, perhaps by looking at realistic potable reuse opportunities, rather than attempting to meet a goal that cannot be achieved in the feasibility study."

- "While the feasibility studies are being prepared in direct response to City Council and RWQCB direction to look at two options (i.e., subsurface desalination intakes and potable reuse), the information gathered for these feasibility studies will have a secondary use: to inform the City's long-term water supply planning efforts. Although an alternative may be flawed in its ability to meet the basis of design criteria for these specific feasibility studies, the same alternative may have utility if the objectives or basis of design criteria are different in future studies; therefore, the Panel recommends the use of another term for "Fatal Flaw," such as "Held from Further Consideration," "Not Carried Forward," or "Does Not Meet Project Objectives."

- "It is the Panel's understanding that the City will undertake the technical feasibility "fatal flaw" evaluation first (rather than evaluate obvious constraints, such as the lack of appropriate real estate and conflicting land uses) because (1) it addresses regulatory requirements set by the RWQCB, and (2) it follows the example set by the evaluation of subsurface intakes for a proposed desalination plant in Huntington Beach, California. Undertaking the technical feasibility evaluation first may be appropriate for the subsurface desalination intake study, but may not be most appropriate for the potable reuse study because the potable reuse study is being performed solely for the City – not for regulatory needs. Although it seems logical to have similar structures for the two Work Plans, it could artificially force upon the potable reuse study significant technical work and costs that might be avoided if the screening criteria were applied differently."

- The City is encouraged to seek further clarification on the basis for the feasibility studies. What are the requirements for the permit issued for the desalination plant by the RWQCB? Based on these requirements, the specific objectives of the feasibility studies need to be clearly stated in the Work Plans. The City and its consultants need to consider adding a narrative to both Work Plans that describes primary and secondary objectives. The primary objective would address fulfilling City Council and RWQCB requirements. The secondary objective would address the development, definition, and exploration of component options that could be considered as part of the City's long-term water supply planning efforts.

- In the current study, full replacement of the screened open ocean intake is listed as the only option. Subsurface desalination intakes and potable reuse are considered as mutually exclusive rather than combined to develop integrated solutions; however, it is likely that the best solution will include combinations of components and complimentary opportunities. The Panel understands this level of review would be conducted at a later time.

3.4.2 Specific Comments from Panel Report #1

Specific comments from the Panel on the Potable Reuse Feasibility Study begin on page 9 of Panel Report #1 (and are repeated here):

Section 1.0: Introduction

- More emphasis appears to be given to IPR for groundwater injection than other options for recycled water usage (e.g., DPR, aquifer storage and recovery, or reservoir augmentation). Are the other options being considered as much as IPR for groundwater injection? For example, the activities to assess and ascertain the feasibility of DPR (e.g., using treated wastewater effluent as desalination feedwater) could present project opportunities for the City.

- Please clarify who owns the wastewater from the El Estero Wastewater Treatment Plant (e.g., is it the City of Santa Barbara?).

- Provide a brief summary of precedent studies.

Section 2.0: Basis of Design

- Why is the discharge of advanced treated wastewater into Lauro Canyon Reservoir considered DPR? Is the DPR assumption based on an inability to meet retention time and blending requirements in Lauro Canyon? Could the retention time requirement in the draft surface water augmentation criteria be met by an alternative treatment process to supplement shorter retention time? This question may not be answerable until after DDW has decided whether to include an alternatives provision in the draft regulations.

- Production Capacity: The average daily flow needs to be augmented with an understanding of diurnal flow.

- Equalization can be used to address diurnal flows.
- Include the storage options for buffering or for equalization, conveyance, treatment, and distribution.

- Water Quality: The City will need an appropriate source control program if potable reuse is to be implemented. Please provide a brief narrative on the present source control program for the El Estero Wastewater Treatment Plant.

- Optimization of the El Estero Wastewater Treatment Plant process operations and water quality should be considered.

- Treatment: As proposed in the Work Plan, full advanced treatment (FAT) will be used to produce recycled water for IPR; however, the FAT treatment train needs to be specified in the Work Plan, including a schematic.

- Groundwater Recharge (Section 2.5): On Page 13, consider including "impact to other wells" as a feasibility screening criteria.

- Groundwater Recharge (Section 2.5.1): On page 14, the Work Plan suggests an assumed injection rate of 75 percent of the extraction rate. What is the basis for the 75-percent injection rate? Experience has shown that injection well performance in finer-grained sediments can be better maintained with injection rates closer to 50 percent of the extraction rate.

- Groundwater Recharge (Section 2.5.2): On page 14, fourth line, should this sentence begin with "This project will *review* available…" and not "This project will *provide* available…"?

- Groundwater Recharge: The existing USGS groundwater model is adequate for the assessment and quantification of the volume of recycled water that might be cyclically stored in a put-and-take operation; however, even though the new USGS model is proposed to have transport capability, the cell size is too large to use the model to simulate flow between wells and defensibly predict residence times. Again, analytical methods might be used as a first cut.

- Groundwater Recharge: Consideration should be given to optimizing the management of the groundwater basin to create storage. Further detail on groundwater contamination and seawater intrusion issues will be necessary.

- Additional Production Wells (Section 2.6, Page 18): The narrative leading up to this section reads as if only IPR (i.e., groundwater injection using treated wastewater) is being considered. This section implies that existing production wells will be used for this concept. The Panel believes it is inconsistent with current regulations to use the same well for injection and production with recycled water.

- Additional Well Sites: The Work Plan should include a preliminary inventory of possible sites for the numerous injection and extraction wells necessary to inject and recover the water.

- Reliability Features (Section 2.8, page 19): The Panel suggests rewriting the paragraph to provide more clarity about project reliability.

Section 3.0: Feasibility Criteria

- The Panel noted that the work authorizations do not include a fatal flaw analysis for potable reuse; however, it is listed in Figure 1.

- The fatal flaw analysis should consider the treatment train and specific requirements of the Groundwater Recharge regulations.

- Please clarify how Oceanographic Factors #8 and #9 in Table 3.1 are relevant to recycled water.

- For Energy Use #13 in Table 3.1, does the City's 2012 Climate Action Plan provide for mitigation/offsets to meet the Plan's thresholds? Consider providing for this as a way to achieve comparable emissions between alternatives.

Additional Recommendations:

- If pursuing potable reuse, the City should begin outreach to the community about recycled water as a water supply option. Water quality and public health concerns raised by some community members will need to be addressed directly in the outreach program.

- The implications of using recycled water for brine dilution should be considered. This should include the environmental implications of discharging the mixed recycled water and brine to the ocean, as well as the reduction in wastewater volume that is available for recycling.

APPENDIX A: PANEL BACKGROUND

About NWRI

For over 20 years, NWRI – a science-based 501c3 nonprofit located in Fountain Valley, California – has sponsored projects and programs to improve water quality, protect public health and the environment, and create safe, new sources of water. NWRI specializes in working with researchers across the country, such as laboratories at universities and water agencies, and are guided by a Research Advisory Board (representing national expertise in water, wastewater, and water reuse) and a six-member Board of Directors (representing water and wastewater agencies in Southern California).

Through NWRI's research program, NWRI supports multi-disciplinary research projects with partners and collaborators that pertain to treatment and monitoring, water quality assessment, knowledge management, and exploratory research. Altogether, NWRI's research program has produced over 300 publications and conference presentations.

NWRI also promotes better science and technology through extensive outreach and educational activities, which includes facilitating workshops and conferences and publishing White Papers, guidance manuals, and other informational material.

More information on NWRI can be found online at www.nwri-usa.org.

About NWRI Panels

NWRI also specializes in facilitating Independent Advisory Panels on behalf of water and wastewater utilities, as well as local, county, and state government agencies, to provide credible, objective review of scientific studies and projects in the water industry. NWRI Panels consist of academics, industry professionals, government representatives, and independent consultants who are experts in their fields.

The NWRI Panel process provides numerous benefits, including:

- Third-party review and evaluation.
- Scientific and technical advice by leading experts.
- Assistance with challenging scientific questions and regulatory requirements.
- Validation of proposed project objectives.
- Increased credibility with stakeholders and the public.
- Support of sound public-policy decisions.

NWRI has extensive experience in developing, coordinating, facilitating, and managing expert Panels. Efforts include:

- Selecting individuals with the appropriate expertise, background, credibility, and level of commitment to serve as Panel members.

- Facilitating hands-on Panel meetings held at the project's site or location.
- Providing written report(s) prepared by the Panel that focus on findings and recommendations of various technical, scientific, and public health aspects of the project or study.

Over the past 5 years, NWRI has coordinated the efforts of over 20 Panels for water and wastewater utilities, city and state agencies, and consulting firms. Many of these Panels have dealt with projects or policies involving groundwater replenishment and potable (indirect and direct) reuse. Specifically, these Panels have provided peer review of a wide range of scientific and technical areas related water quality and monitoring, constituents of emerging concern, treatment technologies and operations, public health, hydrogeology, water reuse criteria and regulatory requirements, and outreach, among others.

More information about the NWRI Independent Advisory Panel Program can be found on the NWRI website at http://nwri-usa.org/Panels.htm.

APPENDIX B: PANEL BIOGRAPHIES

Amy Childress, Ph.D. (Chair)
Professor and Director of Environmental Engineering
University of Southern California (Los Angeles, CA)

Amy Childress has more than 20 years of experience researching membrane processes for water treatment, wastewater reclamation, and desalination. Most recently, she has investigated membrane contactor processes for innovative solutions to contaminant and energy challenges; pressure-driven membrane processes as industry standards for desalination and water reuse; membrane bioreactor technology; and colloidal and interfacial aspects of membrane processes. Dr. Childress has directed research funded by federal, state, and private agencies. Current research projects are funded by US Environmental Protection Agency, the Strategic Environmental Research and Development Program, and California Department of Water Resources. Dr. Childress has received several awards including the Association of Environmental Engineering and Science Professors Outstanding Publication Award and a National Science Foundation CAREER Award, and has served as President of the Association of Environmental Engineering and Science Professors and an editorial board member for several journals. She holds a Ph.D. from the University of California, Los Angeles.

Martin B. Feeney, P.G., C.E.G., C.Hg.
Consulting Hydrogeologist (Santa Barbara, CA)

Martin Feeney has more than 34 years of experience as a hydrogeologist. Since 1997 he has worked as an independent consulting hydrogeologist, providing services to water agencies, private industry, and engineering firms. Previously he worked at several consulting firms including Staal, Gardner, & Dunne, Inc.; Fugro Wes, Inc.; and Balance Hydrologics, Inc., where he provided analysis of groundwater basins, developed groundwater flow and transport models, sited and designed municipal wells, developed injection wells/artificial recharge programs, and performed underground storage tank site assessment and remediation. Mr. Feeney's work in desalination has focused on development of subsurface seawater feedwater intakes, and his projects include: evaluation of subsurface intake feasibility for cities of Oxnard, Ventura, Marina and Monterey; design of the intake and reject disposal systems for the now-operational Sand City desalination facility; and development of feedwater wells on numerous Caribbean islands. He also is a member of the Hydrogeologic Working Group evaluating the proposed slant wells feedwater concept to support a 12 million gallon per day (MGD) desalination facility in the Monterey Bay area and previously sat on the Independent Scientific Technical Advisory Panel that reviewed subsurface feedwater concepts for the proposed 50 MGD desalination facility in Huntington Beach, California, for the Coastal Commission and Poseidon. Mr. Feeney received a BS in Earth Sciences from the University of California, Santa Cruz, and an MS in Environmental Planning from California State University.

Heidi Luckenbach, P.E.
Deputy Director/Engineering Manager
City of Santa Cruz Water Department (Santa Cruz, CA)

Heidi Luckenbach is a civil engineer with more than 20 years of experience in water supply planning, drinking water treatment, and distribution. She has worked for the City of Santa Cruz Water Department for 17 years. As Deputy Director, she manages engineering services for maintenance, operation, and improvement of the water utility, including long-range water supply planning. Ms. Luckenbach previously served as Desalination Program Coordinator for seven years, during which she developed and implemented the work plan for the scwd2 Regional Seawater Desalination Project. Program elements included a seawater desalination pilot study, evaluation of intake alternatives, analysis of brine dilution, comparison of water supply alternatives, and engagement with regulatory agencies. The 2.5-million gallon per day supplemental water supply would serve several communities in North Santa Cruz County. Luckenbach received her BS in Civil Engineering from California State University, Northridge, and an MS in Environmental Engineering from University of California, Los Angeles. She is a Registered Civil Engineer in California, serves as Vice Chair of the Desalination Committee for the California Nevada Section of American Water Works Association, and was recently a board member for the American Membrane Technology Association.

Michael P. Wehner
Assistant General Manager
Orange County Water District (Fountain Valley, CA)

Mike Wehner has almost 40 years of experience in water quality control and water resources management. Initially, he spent 20 years with the Orange County Health Care Agency. Since 1991, he has worked for the Orange County Water District (OCWD), where he currently serves as Assistant General Manager. Among his responsibilities, he directly manages the Water Quality and Technology Group, including Laboratory, Water Quality, Hydrogeology, Research and Development, and Health and Regulatory Affairs Departments. In this capacity, he is involved with numerous aspects with OCWD's Groundwater Replenishment System (the nation's largest IPR project), including providing technical guidance on treatment and quality, as well as managing monitoring programs for the purification facility and receiving groundwater. He was also manager of OCWD's 8-year Santa Ana River Water Quality and Health Study, which evaluated the impact of using effluent-dominated river waters for groundwater recharge. At present, Wehner serves on the Advisory Group on the "Feasibility of Developing Criteria for Direct Potable Reuse" for the California State Water Resources Control Board, as well as expert panels on groundwater replenishment projects for both the Los Angeles Department of Water and Power (California) and Monterey Regional Water Pollution Control Agency (California). He received a Masters of Public Administration from California State University Long Beach and a B.S. in Biological Sciences from the University of California, Irvine

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Eric Zigas
Director, Bay Area Water Group
Environmental Science Associates (San Francisco, CA)

Eric Zigas has more than 35 years of experience in water resources planning and management. Since joining ESA in 2002, he has focused on developing and evaluating water resource projects related to the supply, treatment and distribution of potable water, wastewater, and stormwater. He has worked on Raising Los Vaqueros Dam for Contra Costa Water District, and the development of a water supply solution for the Monterey Peninsula. His work in desalination includes the Coastal Water Project Environmental Impact Report and the Monterey Peninsula Water Supply Project DEIR. Previously Mr. Zigas spent 22 years at EDAW Inc., (now AECOM), a global firm that specializes in urban planning and design, landscape architecture, economics, and cultural and environmental services, where he worked on water policy assignments and long range water supply plans. He holds a degree in Geography from SUNY at Buffalo.

NATIONAL WATER RESEARCH INSTITUTE

Technical Advisory Panel for City of Santa Barbara Subsurface Desalination Intake and Potable Reuse Feasibility Studies

Meeting #2 Agenda

January 27-28, 2016

Meeting Location:

Santa Barbara City Hall
735 Anacapa Street
Santa Barbara, CA 93101

Contacts:

Jeff Mosher, NWRI
(714) 705-3722 (mobile)

Jaime Lumia, NWRI
(714) 378-3278 (NWRI office)

Wednesday, January 27, 2016

CLOSED SESSION begins at 8:30 am in Room 15. Attended by Technical Advisory Panel (TAP), City of Santa Barbara (City), and Carollo Engineers (Carollo).

8:30 am	Welcome and Introductions	Jeff Mosher, NWRI
8:40 am	Review Agenda and Meeting Objectives	Amy Childress, Panel Chair
8:50 am	Discuss the presentations to be delivered by City and Carollo during the Open Session	Moderated by Panel Chair

OPEN SESSION begins at 9:30 am in Council Chambers Room. Attended by TAP, City, Carollo, and members of the public.

9:30 am	Welcome and Introductions	Jeff Mosher, NWRI
9:45 am	Presentation on (a) Conceptual Design and Initial Technical Screening Analysis of Subsurface Desalination Intake Options and (b) Regulatory and Permitting Requirements for Potable Reuse Alternatives	City and Carollo
10:30 am	Questions from Technical Advisory Panel	Moderated by Panel Chair

11:00 am	Public Comments	Moderated by Jeff Mosher
12:00 noon	**ADJOURN OPEN SESSION**	

CLOSED SESSION begins at 12:00 noon in Room 15. Attended by TAP, City, and Carollo.

12:00 noon	**LUNCH with TAP, City, and Carollo**	
12:30 pm	Discussion on Subsurface Desalination Intakes	Moderated by Panel Char
2:00 pm	**BREAK**	
2:15 pm	TAP ONLY. Continue discussion.	Moderated by Panel Char
4:30 PM	**ADJOURN DAY ONE OF MEETING**	

Thursday, January 28, 2016

CLOSED SESSION begins at 8:30 am in the Water Resources Conference Room, 619 Garden Street, Floor 3. Attended by TAP, City, and Carollo.

8:30 am	Discussion on Regulatory and Permitting Requirements for Potable Reuse Alternatives	Moderated by Panel Chair
9:30 am	TAP ONLY. Continue discussion.	Moderated by Panel Chair
12:00 noon	**LUNCH** and debriefing with TAP, City, and Carollo	
1:00 pm	TAP ONLY. Continue discussion.	Moderated by Panel Chair
2:00 pm	**ADJOURN DAY TWO OF MEETING**	

APPENDIX D: PANEL MEETING #2 ATTENDEES

Panel Members:

- Chair: Amy Childress, Ph.D., University of Southern California (Los Angeles, CA)
- Martin B. Feeney, P.G., CHG, Consulting Hydrogeologist (Santa Barbara, CA)
- Heidi R. Luckenbach, P.E., City of Santa Cruz Water Department (Santa Cruz, CA)
- Michael P. Wehner, Orange County Water District (Fountain Valley, CA)
- Eric Zigas, Environmental Science Associates (San Francisco, CA)

National Water Research Institute:

- Susanne Faubl, Water Resources Scientist and Project Manager
- Jeff Mosher, Executive Director
- Gina Vartanian, Outreach and Communications Manager

City of Santa Barbara:

- Rebecca Bjork, Public Works Director
- Joshua Haggmark, Water Resources Manager
- Robert Roebuck, Project Manager II

Carollo Engineers:

- Eric Cherasia
- Tom Seacord

Sub-Consultants:

- Austin Melcher, Dudek
- Joe Monaco, Dudek

Others:

- John Ackerman, Medical Reserve Corp
- Lindsey Baker, League of Women Voters of Santa Barbara
- Jordan Clark, University of California, Santa Barbara
- Rick Frickmann, Santa Barbara Urban Creeks Council
- Diane Gatza, West Basin Municipal Water District
- Garrett Haertel, Monterey Regional Water Pollution Control Agency
- Hillary Hauser, Heal the Ocean
- James Hawkins, Heal the Ocean
- Emily Iskin, Water Systems Consulting, Inc.
- Kathy King, CEC
- Robert Marks, Pueblo Water Resources
- Edward McGowan, Medical Geohydrology
- Charles Newman, Montecito Water District
- Steve Nipper, Sol Wave Water
- Rebecca Nisslay, Water Systems Consulting
- Ken Oplinger, Chamber of Commerce of the Santa Barbara Region

- Corey Radis, Heal the Ocean
- Kira Redmond, Santa Barbara Channelkeeper
- Dick Shaikewitz, Montecito Water District
- Robert Ziegler