



CITY OF SANTA BARBARA

**SUBSURFACE DESALINATION INTAKE AND POTABLE
REUSE FEASIBILITY STUDIES**

**WORKSHOP #3
RESPONSES TO TAP COMMENTS**

FINAL
March 2017



City of Santa Barbara

Subsurface Desalination Intake and Potable Reuse Feasibility Studies

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APPENDIX 1: Draft Final Panel Report

RESPONSES TO TAP COMMENTS

1.0 BACKGROUND

On Wednesday, October 26, 2016, Technical Advisory Panel (TAP) Workshop #3 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 the Draft Final Panel Report for Meeting #3, presented in Appendix 1. The report is divided into three sections and four appendices:

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

Appendix A: Panel Background

Appendix B: Panel Biographies

Appendix C: Panel Meeting #3 Agenda

Appendix D: Panel Meeting #3 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 (Workshop) #3.

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 general comments pertain to the Panel's overall review of the Potable Reuse Feasibility Study.

- The Panel appreciated receiving the background material well in advance of the meeting, which provided sufficient time for review.

CITY RESPONSE: Noted.

- The presentation made by the project team at Meeting #3 was clear and easy to understand inasmuch that the Panel felt the presentation provided a more useful explanation of the basis of design (BOD) than did the written report (i.e., TM-3).

CITY RESPONSE: Noted. The purpose of the presentation was to concisely present material contained in the written report, without diving into as much detail as contained in written report.

- In terms of report formatting, the extensive use of alphas and numerals for in-text citations and footnotes, as well as for table citations and footnotes, makes for a distracting read. In-text citations should be written as (Author, Date), with a separate section for references providing bibliographic details. List footnotes and table notes either alphabetically or numerically (but not both). In addition, either always number or never number the table notes. Please be consistent with formatting throughout the report.

CITY RESPONSE: Noted. TM3 and corresponding final report has been updated to reflect comment.

- The Panel recommends the City consider the feasibility studies from two perspectives: one related to the immediate drought planning, and the second with respect to long-term water planning efforts. It is important to consider these two objectives separately and not co-mingle their goals.

CITY RESPONSE: Noted. With regard to immediate drought planning, the City has a drought plan that has been through public comment and was approved by City Council (i.e., 2010 General Plan EIR and 2011 Long Term Water Supply Plan). The City is following this drought plan to address the current water supply challenges. 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 and PR 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, which can also be informed by future changes in the reliable yield of water from the Cachuma Reservoir.

- If the City would rather not combine drought water supply planning with long-term water supply planning under the *Subsurface Desalination Intake Feasibility Study*, then it also should consider not undertaking infrastructure planning (which is long-term planning) with drought planning under the *Potable Reuse Feasibility Study*. For example, a statement such as "...eliminating the West non-potable reuse (NPR) system poses many advantages for the City's water supply portfolio" alludes to infrastructure planning, or long-term planning that the City is not considering in the current feasibility study. Notably, infrastructure and other long-term planning add pragmatism to the process, which would benefit the two feasibility studies.

CITY RESPONSE: Noted. The report has been updated to include a qualifying statement (end of Section 3.1) indicating that our goal is to evaluate the maximum capacity of potable reuse that is technically feasible, which includes an evaluation of the infrastructure required to convey and use the water (e.g., injection wells, spreading basins, pipelines, etc.). The qualification statement clarifies that the infrastructure concepts presented are not an exhaustive list of alternatives, but are simply shown to demonstrate the water can be used.

Statement cited in Section 3.4 of TM3 was reworded to address comment. Refer to updated TM3.

- The Panel recommends summarizing the information from the three technical memoranda on potable reuse into a concise and easy-to-understand Executive Summary. In this summary, the City’s commitment to using the results of the study in its new long-term water resources plan should be emphasized.

CITY RESPONSE: Noted. An executive summary will be created as the first section of the Potable Reuse Study Final Report summarizing TM1 through TM3, as presented in the Subsurface Intake Final Report. The City’s commitment to using the results of this study to inform future planning efforts will be reiterated.

3.2 Study Scope and Work Plan Objectives

The following comments pertain to the presentation slides (Slides #3 to 6) addressing the background and objectives of the Feasibility Studies.

- The project team demonstrated how the information derived from this effort would inform future studies and long-term planning. The City noted, however, that a Long-Term Water Supply plan will not be developed until the drought runs its course and Cachuma Reservoir begins to spill.

CITY RESPONSE: Noted. This is consistent with study objectives.

- The Panel understands that permit deadlines are driving the project schedule and that the City will present the results of the feasibility studies to the RWQCB in May 2017.

CITY RESPONSE: Noted. This is consistent with study objectives and the Work Plan.

- For the purposes of this effort, the Panel defines “feasible” as “capable of replacing 10,000 AFY.”

CITY RESPONSE: Noted. This is consistent with study objectives and the Work Plan.

3.3 Regulatory Summary

The following comments pertain to Presentation Slide #17 on “Regulatory Status for DPR Continues to Evolve,” which was presented by the project team.

- The absence of current state regulations for DPR does not preclude the development of DPR projects, which the Division of Drinking Water of the State Water Resources Control Board can evaluate on a case-by-case basis.

CITY RESPONSE: Noted. The absence of current state regulations did not negatively influence the study results. Section 2.4 of TM2 states the same information presented in the comment: "...Since the bill has been adopted, DDW has held a series of workshops on this topic and has stated that they are open to review DPR projects on a case by case basis." As stated in the Work Plan and TMs 2-3, the study was based on most recent regulatory activity, including additional requirements from IPR that will likely be incorporated in DPR projects.

- The project team indicated that additional barriers are needed to address trace (i.e., chemical) pollutants; however, additional barriers were not proposed within TM-3.

CITY RESPONSE: Noted. TM2 states that "DDW may opt to require additional treatment barriers for trace pollutants...". The DPR train proposed in TM3 includes additional disinfection steps, which may address trace pollutant concerns. Other additional barriers (i.e., GAC, ozone, etc.) were evaluated during the study (although not presented in text), and can be incorporated into a DPR train using the available footprint. The City will use the information stated in this report during future studies, such as updates to the City's Long Term Water Supply Plan, and if DPR is found to be an alternative that should be carried forward, at this time will the City can refine the DPR treatment train alternatives. It is likely that DPR regulations will be more clearly defined by the time the City begins their Long Term Water Supply Plan update.

- The assumptions related to log removal values and engineered storage for DPR projects (see also Section 3.2.2 in TM-3) are valid for the analysis already conducted; however, the State Water Board needs to revisit these assumptions before the project can move forward.

CITY RESPONSE: Noted. The City continues to track DPR regulatory development. As stated in the TMs, the information presented was based on information available at the time of study. The City and State Water Board will revisit these assumptions before a potential project can move forward.

3.4 Basis of Design

These comments pertain to the Basis of Design (BOD), which was used (as documented in Section 3.2 of TM-3) to identify potable reuse project alternatives and develop conceptual designs.

- Please include additional information on Lauro Canyon Reservoir, which is mentioned briefly in Section 3.2.1 as a potential site for raw water supply augmentation using advanced treated water produced by DPR.

CITY RESPONSE: Noted. A footnote was added to Section 3.2.1 to provide additional information on Lauro Reservoir, including capacity.

- The Panel requests that the City clarify the level of uncertainty regarding required future releases from Cachuma Reservoir (as discussed in Section 3.2.1 and Appendix A: Work Plan). It appears to the Panel that this uncertainty is contributing to the City's reluctance to assume production volumes less than 10,000 AFY.

CITY RESPONSE: The Panel's interpretation of the City's reluctance to assume less than 10,000 AFY is correct, however, this project was designed based upon direction from both City Council and the RWQCB. Refer to the Work Plan Section 1.3 (Scope) and TM1, Section 1.2 (Scope) for additional background.

With regard to the uncertainty of the future safe yield from Cahcuma, as stated in Section 1.5 (Goal of Study) in the Work Plan and TM1 Section 1.4 (Goal of Study): "...the City's primary water source is Cachuma Reservoir, which provides over 50 percent of the City's water supply during a normal (non-drought) year. The City's water supply allocation from Cachuma could be reduced in the future due to pending federal environmental decisions on a revised Biological Opinion for the Cachuma Project, reduced operational yield due to siltation in the reservoir, and reduced drought yield as a result of the current historic drought. The City's supply planning will need to be updated to address shortages caused by such reductions to the City's existing Cachuma supply. Options for replacing a reduced Cachuma supply may include desalination and potable reuse.

Because the amount of the reduction from the City's Cachuma supply is unknown at this time, it is premature for the City to evaluate exact desalination and potable reuse capacity options that may or may not meet the City's needs. The timing for this analysis would be more appropriate following the final federal environmental decisions and operational yield analyses that determine the future Cachuma allocations."

The 10,000 AFY screening factor stated in the Work Plan, and was therefore selected based upon direction from the City Council and the RWQCB as well as the uncertainty of the long-term safe yield from Cachuma. This approach was further approved by the RWQCB in a letter dated October 20, 2015.

- Clarify the importance of adhering to the City’s production capacity goal of 10,000 AFY rather than upholding a threshold of 1,400 AFY (delivered) for the production of non-potable recycled water. As discussed in Section 3.2.3, the City emphasizes the need to retain the 1,400 AFY of non-potable recycled water, making 11,400 AFY the goal of the *Potable Reuse Feasibility Study*. Yet the City suggests in Alternative 1A abandoning half the recycled water customers to address future infrastructure issues. As a result, is the priority 10,000 AFY or 11,400 AFY?

CITY RESPONSE: As described in the Work Plan and Section 3.2.3 of TM3, the target yield for each potable reuse alternative was 10,000 AFY, which is required to replace the City's desalination plant capacity. Since the City currently relies on 1,400 AFY of NPR water as part of its overall water supply, any potable reuse alternatives that would eliminate or reduce the water available for NPR must replace (up to) this 1,400 AFY capacity in addition to replacing the capacity of the City's desalination plant. Therefore: 1,400 AFY (NPR) + 10,000 AFY (PR) = 11,400 AFY.

Response to comment regarding Alternative 1A: As defined in the Work Plan and TM3, the summation of NPR and PR capacities must equal 11,400 AFY to maintain the overall capacity of the City's existing water supply portfolio. Thus, if half of the NPR system was abandoned, the summation of the remaining NPR capacity and the PR capacity must equal 11,400 AFY, to pass the initial screening criteria under the current project objectives.

Response to priority question: As stated above and in project documents, the priority is to maintain the overall capacity of the City's existing water supply portfolio, which includes 1,400 AFY of NPR and up to 10,000 AFY of desalination.

- The Panel requests clarification regarding the annual production capacity demands for potable and non-potable water, as follows:
 - If 10,000 AFY is needed for potable reuse and 1,400 AFY is needed for non-potable reuse, how much water must come into the wastewater treatment plant and under what climate conditions?

CITY RESPONSE: The City's Long Term Water Supply Plan identifies a typical range in water production from various sources during both normal years and during drought conditions. 1,400 AFY is consistent year to year and can be viewed as independent of drought conditions. Permitted to a capacity of 10,000 AFY, the Desalination Plant is currently a tool in the City's water supply portfolio. After the present drought ends, when the long-term reliable yield for Cachuma is determined, and the City has a chance to review their drought plan, the City can assess what options are available to meet the reduced capacity from Cachuma and also, update their drought plan based upon this current record setting drought, lengthening both the duration (years of drought) and the availability of various supply alternatives.

As shown in the City's Long-Term Water Supply Plan, the City's long-term average water demands are projected to go down over time, despite modest population growth. Therefore, the City does not expect that future wastewater flows will provide 11,400 AFY in the future unless the City expands its wastewater service area. There are opportunities for the City to expand its wastewater service area.

- How much potable water needs to be served to result in 10,000 AFY of recoverable wastewater flow.

CITY RESPONSE: The City's average annual supply demand is 14,000 AFY during non-drought years. With a 10% safety factor that accounts for changes in supply availability, the City's Long Term Water Supply plan states that the supply target is 15,400 AFY. The approved drought plan includes 15% conservation, reducing demand to 13,090 AFY. However, the City has exceeded this goal during the present drought cycle.

As shown in the City's Long-Term Water Supply Plan, the City's long-term average water demands are projected to go down over time, despite modest population growth. Therefore, the City does not expect that future wastewater flows will provide 11,400 AFY in the future unless the City expands its wastewater service area. There are opportunities for the City to expand its wastewater service area.

- Based on the percentages listed in the City's supply portfolio, the Panel estimated that 14,000 AFY would be the annual production capacity demand for potable and non-potable water. Is this a reasonable estimate? Does this capacity reflect a normal year or a drought year?

CITY RESPONSE: Refer to prior response, above.

- The Panel recommends that the City project future daily effluent flows from the El Estero Wastewater Treatment Plant, which could differ significantly from the historical daily effluent flows shown in Figures 3.3 and 3.4 of Section 3.2.3. In addition, consider the changes to wastewater flows that will occur once the desalination facility is operational.

CITY RESPONSE: Noted. As stated in the Work Plan and in TM3, the capacity of wastewater available from the City's El Estero WWTP was characterized based upon historical data, taking into account drought conditions and diurnal flows. The following flows were characterized for the design basis: 1). Average, minimum, and maximum annual flow; 2). Average, minimum, and maximum day flow; 3). Minimum and maximum hour flows. The data analyzed and presented in this study includes drought and non-drought conditions. Conservation and water efficiency have increased in the recent years, and more conservation programs are planned for the future. As stated in the TM and presentation, if potable reuse is to be further considered for the City, additional studies will be required. At this time, it will be critical to project future daily

effluent flows and understand changes to available wastewater flows, accounting for impacts related to drought, growth and increased conservation.

3.5 Surface and Hydrogeologic Properties

The following comments pertain to Section 3.3 of TM-3, titled "Hydrogeologic Analysis of Groundwater Replenishment (IPR) Alternatives."

- Clarify in the report that the numerical groundwater flow and transport model of the Storage Unit 1 and Foothill basins, as discussed in Section 3.3, was used only to inform the analysis of the IPR Implementation Approach (and not DPR).

CITY RESPONSE: Noted. The title and header of Section 3.3 state "IPR" for clarity. However, additional text has been added to Section 3.3 to emphasize this modeling applies to IPR alternatives only. Refer to updated TM3.

- The Panel agrees with the overall conclusions of the hydrogeologic analysis of the alternatives for IPR. The City reached a reasonable conclusion that the negative effects and limited yield make surface application of recycled water infeasible for this project, even though it was not determined using the model. Given the limited capacity of the groundwater basin, it has been established that the basin cannot accept significant volumes of water and/or serve as an environmental buffer. That said, the Panel has concerns regarding the appropriateness of the groundwater model used.

CITY RESPONSE: Noted. Specific concerns are addressed where raised in subsequent comments.

- The Panel understands that the analysis of the hydrogeologic feasibility of the IPR alternatives relied partially on the groundwater model of the Santa Barbara groundwater basin developed by the U.S. Geological Survey (USGS). The model is an (in-progress) update of the model originally developed in 1984 and subsequently revised and expanded, sequentially, in 1986, 1989, and 1998. Although documentation of the current version of the model is not available, based on the limited information available, the newest version appears to apply a finer discretization to the 1998 model. This re-discretization is assumed necessary to provide numerical stability when the flow model is coupled with the solute transport module.

CITY RESPONSE: Noted. This is generally consistent with the City's understanding.

- The Panel understands that the revised model uses a conceptual hydrogeologic model similar to previous versions of the model. Notably:
 - The groundwater system is characterized as two confined water-bearing units separated by a finer-grained unit.

- There is no layer representing the surficial deposits that extend from the top of the upper confined zone to the ground surface.
- There is no active layer underlying the ocean.
- The boundary condition with the ocean for both water-bearing units is represented solely as a leaky offshore fault.

CITY RESPONSE: Noted. This is generally consistent with the City's understanding.

- The Panel acknowledges that the numeric model developed from the adopted conceptual hydrogeologic model is appropriate for assessing generalized water budget changes in response to climatic cycles and changes in water levels associated with varying pumping stresses; however, consider the following:
 - Using particle tracking, the numerical model can provide estimates of travel times.
 - The numerical model as currently configured cannot appropriately simulate important processes or assess the impacts of some considerations associated with the proposed IPR alternatives.

CITY RESPONSE: Noted. Consideration No. 1: Particle tracking was utilized to provide estimates of travel times, as described in Section 3.3.1 and Tables 3.6 and 3.7 of TM3. Consideration No. 2: The chief limitation of the model as related to the IPR alternatives is the lack of a layer representing the surficial deposits above Upper Producing Zone. Therefore, travel times for surface application of tertiary treated recycled water could not fully assessed, however, as described in Section 3.3.3, this was not a limiting factor in the evaluation.

- The Panel notes that the IPR analysis considered the effects of increased water levels near areas where advanced treated water would be infiltrated, namely conditions associated with shallow water levels, such as habitat creation, impacts to vegetation, geohazards, and contaminant mobilization. Clarify that these analyses were informed by professional judgment and not by the model; the model used cannot simulate the shallow zone of the aquifer system.

CITY RESPONSE: Noted. The Panel's description is accurate. The model results for the producing zones were interpreted using professional judgment to infer and assess conditions associated with shallow water levels, such as habitat creation, impacts to vegetation, geohazards, and contaminant mobilization.

- The Panel notes that the project team, as part of the subsurface intake analysis, acknowledged the USGS model (in its existing form at the time, and still, as now updated) had limitations in its ability to simulate the infiltration and movement of seawater into the basin from the ocean. As a result, the project team developed a different groundwater model with a shallow layer that interfaces with the ocean floor

for the analysis. The new model demonstrated that seawater could be induced to move vertically through the seafloor into the upper producing zone if gradients were adequate. Clarify why this other model was not used to assess the effectiveness of the IPR seawater intrusion barrier, as it more appropriately simulates coastal boundary conditions.

CITY RESPONSE: Noted. The local scale model developed for the subsurface intake analysis cannot be used to evaluate the effectiveness of IPR Implementation Approach No. 2 (referred to by the Panel as the “IPR seawater intrusion barrier”) because it does not simulate groundwater flow in the upper and lower producing zones, which are the barrier target zones. Furthermore, the local scale model does not extend inland to the IPR study area. As described in the Appendix B of the Subsurface Desalination Intake Feasibility Study, the local scale model developed for the subsurface intake analysis only simulates the interaction between the ocean and the shallow zone, which is located above the upper producing zone and separated from the upper producing zone by several aquitards. Thus, the Panel’s conclusion that the new model demonstrated that seawater could be induced to move vertically through the seafloor into the upper producing zone is not accurate.

- The Panel cautions that the USGS model, which is purported to establish the sensitivity of the basin to seawater intrusion in response to basin pumping, continues to use an undocumented, unsupported, and partially discredited offshore fault as the boundary condition. Evidence for the fault never was strong, and recent offshore geophysical work undertaken by both the offshore divisions of the USGS and Montecito Water District has raised significant questions as to the existence of this fault.

CITY RESPONSE: Noted. The nature of the fault is not considered a critical parameter in the evaluation of the IPR implementation approaches because target areas are primarily located in the inland portion of the basin and are, therefore, not sensitive to the offshore boundary condition. It is noted that IPR Implementation Approach No. 2 (referred to by the Panel as the “IPR seawater intrusion barrier”) is located near the shoreline; however, this approach is not technically feasible because of the low permeability of the producing zones near the barrier alignment, which greatly limits potential injections rates. The offshore boundary condition does not affect the aquifer permeability near the barrier alignment and, therefore, was not a critical factor in assessing the feasibility of the barrier.

- As an aside, the Panel questions whether the current USGS model can be defensibly used for its purported purpose given the following: (1) uncertainty in the location or existence of the offshore fault; and (2) absence of a shallow seafloor layer.

CITY RESPONSE: Noted. Comment Part 1: Please see the City’s detailed response to the prior comment, which explains why the offshore fault is not considered a critical

parameter in the evaluation of the IPR implementation approaches. Comment Part 2: The IPR implementation approaches evaluated do not target the shallow seafloor sediments and those sediments are separated from the targeted producing zones by several aquitards. Therefore, the absence of a shallow seafloor model layer is not a limitation with respect to the evaluation of the IPR implementation approaches described in TM3.

3.6 Potable Reuse Alternatives

The following comments pertain to Section 3.4 of TM-3, titled “Summary of Potable Reuse Alternatives.”

- Eliminate Figures 3.17A and B (Initial Summary of Potable Reuse Alternatives) and Figure 3.18 (Initial Alternatives Numbering Characteristics Matrix), which are confusing. The document should focus on Figures 3.19 and 3.20, and the explanation as to why Alternative 4 was eliminated from consideration should be provided earlier in the report, as discussed below in Section 3.8 on “Initial Screening Analysis.”

CITY RESPONSE: Noted. Figures have been presented in TM3 to provide logic and reasoning that went into selecting alternatives. It is important to consider the entire range of alternatives, that were then refined as the study proceeded. The executive summary has been created to provide a clear and concise summary, to address this comment and others. Refer to executive summary of final report.

- The Panel recognizes the importance of the equalization basins to normalize diurnal variation for available flow volume, as discussed in Sections 3.4.2 and 3.4.3. Notably, from an operational standpoint, the equalization basins also may help stabilize water quality.

CITY RESPONSE: Noted. The project team and City agree that equalization basins also may help stabilize water quality. Text stating this point was added to Sections 3.4.2 and 3.4.3. Refer to updated TM3.

- The annual flow rates presented in the report are based on MGD assumptions that are too high. It is too optimistic to assume the reuse plant will be online 100 percent of the time. A more conservative estimate would be 95 percent or less.

CITY RESPONSE: Noted. As presented in Figure 3.4, the daily secondary effluent flow rate ranges from 6.5 to 8.93 mgd (i.e., 10% and 95% not exceeded). The annual average flow is 7.73 mgd, which is the basis for sizing the treatment facility. Certainly 7.73 mgd cannot be produced without using some redundant equipment. Therefore, the difference between the 7.73 mgd annual average flow available for treatment is the "nameplate capacity" versus "reliable production capacity". Redundancy (e.g., n+1 for pumps and treatment trains) was added to make the "nameplate capacity" equal to the "reliable production capacity" across a year. Redundancy for pumps and

treatment process equipment is stated in the conceptual design criteria tables located in Appendix C. Refer to Appendix C for detailed information.

If a potable reuse alternative were to be carried forward in the future, preliminary design level analyses will be conducted. Redundancy can be incorporated to provide adequate treatment capacity so that the annual average flow rate can be produced. Based upon the redundancy and the known distribution of flow rate variations, the on-line factor (e.g., 95 percent) can be determined.

A note has been added to the updated TM3 in section 3.5 for clarification. Refer to updated TM3.

- The Panel recommends that the project team thoroughly vet the option for diluting seawater with wastewater before advanced treatment. The Panel does not disagree with the conclusion, but the rationale should be clear and quantified.

CITY RESPONSE: Noted. Raw wastewater cannot be combined with seawater and sent to the desalination plant, due to source water regulations. The alternative considered in this study was treating the wastewater at the AWTF, and then using the AWTF effluent as a source water (combined with seawater) for re-treatment at the desalination plant. However, as stated in the beginning of Section 3.4, the intake water salinity is not reduced enough to affect the recovery rate of the plant. Thus, 55 percent of the AWTF product water is lost to the desalination plant's brine stream; alternatives considered in this study use a low pressure membrane filtration process after AWTF treatment, which does not lose any water to brine.

Section 3.4 has been updated for clarification. Refer to updated TM3.

- DPR could include an option where the AWTF and DWTF are the same facility.

CITY RESPONSE: Noted. As stated in the project goals and in the Work Plan and TMs, the purpose of this study was to provide an understanding of the maximum capacity of SSI and PR alternatives. Various options of IPR and DPR were presented in this study, but they were not an exhaustive list of all alternatives. Based upon the recently released DPR guidelines, the City may consider permitting the AWTF as a DWTF. Such an alternative can be considered as part of future studies.

- Other options could be considered for the treatment train configuration. For example, ozone/BAC in advance of microfiltration can be used to control chemicals.

CITY RESPONSE: Noted. As stated in the project goals and in the Work Plan and TMs, the purpose of this study was to provide an understanding of the maximum capacity of SSI and PR alternatives. Various options of treatment trains were evaluated during this study, but this study was not intended to be an exhaustive list of all treatment train alternatives.

While the quality of effluent (e.g., TDS) from El Estero warrants RO treatment, the City agrees that many additional treatment process options - that still include RO treatment to address TDS - can be developed, including ozone/BAC, etc. As stated in

the project documents, if potable reuse is to be further considered for the City, additional studies will be required, and may be identified when the City updates 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. At this time, it will be important to consider a full range of process alternatives, including various treatment alternatives, layouts, and technologies.

3.7 Conceptual Design Study

The following comments pertain to Section 3.5 of TM-3, titled "Conceptual Design Summary."

- Clarify whether the City is willing to examine changing from purple pipe (i.e., tertiary treated) recycled water to the distribution of advanced treated (DPR) water for non-potable purposes, as well as to augment raw water supplies for drinking water treatment .

CITY RESPONSE: Several alternatives presented in TM3 include the reuse of all or a portion of the City's purple pipe for distribution of AWTF water. The purpose of this study was to provide an understanding of the maximum capacity PR alternatives. However, it is also necessary to understand the scope and feasibility of the additional infrastructure required to utilize this water supply, and as a result, various treatment and infrastructure options of IPR and DPR were presented in this study. The City recognizes that these options are not an exhaustive list of all alternatives. As stated in the TM3, if potable reuse is to be further considered as a water supply for the City, additional studies will be required, including an update to the City's Long Term Water Supply Plan. Future studies can include further analysis of changing from purple pipe recycled water to the distribution of advanced treated (DPR) water for non-potable purposes.

- The A and B series alternatives do not need to be mutually exclusive. For example, they could be phases of the same alternatives (1A and 1B) rather than separate alternatives.

CITY RESPONSE: Noted. The City acknowledges the comment and agrees that the A and B series alternative do not need to be mutually exclusive. The evaluation of phased alternatives (i.e., as stated in the comment) is beyond the scope and goals of the present study. As stated in the project documents, if potable reuse is to be further considered for the City, additional studies will be required. 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), and, the TAPs comments which will be included as an appendix to this study's final report, can be used to inform

these future supply alternatives evaluations. The City acknowledges that it will be important to consider a full range of project alternatives, including phased implementation of alternatives during these future studies.

- In Section 3.5.3, the table that summarizes the potential maximum yields for the alternatives for non-potable reuse, potable reuse, and desalination (e.g., Table 3-19) is more useful than Figures 17 through 20 in describing the maximum yields of each alternative.

CITY RESPONSE: Noted. The purpose of Figures 17 through 20 was to describe the methodology of the selection, and to provide a detailed flow diagram of the water from WWTP effluent to the various sources, accounting for losses during treatment - there by presenting a flow balance of water for the various alternatives. This information will be useful for future studies. The purpose of Table 3-19 is summarized the potential maximum yields for alternatives.

- Regarding the impact of the future expansion of the desalination facility on the viability of the potable reuse alternatives:
 - DPR Alternatives 2A and 2B were found to be infeasible because they would take up space in the desalination facility. This finding is not clear and needs to be explained in the report.

CITY RESPONSE: We would like to correct what appears to be a misunderstanding - the impact on the desalination facility was not one of the initial screening criteria. As stated in Table 3.22, Alternatives 2A and 2B were found to be "Potentially Feasible, but does not meet current study goals" based on initial screening criteria 7a and 7b (Adequate Capacity).

- Should there be an additional initial screening criterion: "enough space must be retained at the desalination facility to expand to 10,000 AFY"?

CITY RESPONSE: Refer to the above response. Retention of adequate space to expand the desalination facility to 10,000 AFY was not an initial screening criteria used to evaluate the technical feasibility of the various alternatives.

- If the desalination facility were to be replaced, that space will be available for DPR.

CITY RESPONSE: Noted. The City acknowledges this comment. As stated in the project documents, if potable reuse is to be further considered for the City, additional studies will be required. 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), and, the TAPs comments which will be included as an appendix to this study's final report, can be used to inform these future supply alternatives evaluations.

- It may be possible, with some ingenuity, to design the new AWTF so that it complements (rather than displaces) the opportunity for future expansion of desalination to 10,000 AFY. The City should maintain a planning approach that includes innovative designs to ensure that alternatives are not ruled out prematurely.

CITY RESPONSE: Noted. The City acknowledges the comment and agrees that additional designs can be evaluated. As stated in the project documents, if potable reuse is to be further considered for the City, additional studies will be required. 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) , and, the TAPs comments which will be included as an appendix to this study's final report, can be used to inform these future supply alternatives evaluations. The City will maintain a planning approach that includes innovative designs and ensures alternatives are screened appropriately.

- Would the City realistically consider not building out the desalination plant so it produces less than 10,000 AFY of water?

CITY RESPONSE: The analysis of considering whether the City builds out its desalination plant to produce 10,000 AFY of water or less is outside the scope of this study. The City will address this question, among others, in future studies, such as an update to its Long Term Water Supply Plan.

- Financially, it makes more sense to pay for desalination if the water will be used more than once (i.e., coupled with potable reuse).

CITY RESPONSE: Noted. Financial analysis of water supply alternatives will be included as part of a future study.

– Regarding the flow equalization tanks:

- Clarify why the flow equalization tanks need to be located on the same property as the desalination plant. The City should consider innovative alternative designs.

CITY RESPONSE: Flow equalization tanks do not need to be located on the same property as the desalination plant (525 E. Yanonali). As shown in Figure 3.31 and Figure 3.32, equalization tanks and engineered storage tanks are located on the AWTF site, location at the City's Corporation Yard (401 E. Yanonali). When referring to Figures 3.33 and 3.34, the new WTP is located adjacent to the desalination plant, but no tanks are included here. As stated in previous comment responses, innovative alternative designs may be considered in future studies.

- Clarify why a second (i.e., redundant) flow equalization tank is required. Perhaps it is possible to design a more compact flow equalization system.

CITY RESPONSE: Refer to Appendix C for in-depth equalization tank sizing information. As stated in TM3, equalization tanks were sized based on the diurnal fluctuation of flows experienced at El Estero WWTP. To provide operational flexibility, redundant 1.5 million gallon tanks were shown on the conceptual site model. This is not a requirement and was done to show that full redundancy can be provided on the available land, which is useful information for future studies. Design criteria and reliability goals (i.e., tank redundancy) can be refined during future studies based on the bigger picture of the City's water supply portfolio and how potable reuse fits in. Additional text has been added as a footnote for clarification in Section 3.5.2. Refer to updated TM3.

3.8 Initial Screening Analysis

The following comments pertain to Section 3.6 of TM-3, titled "Initial Screening Analysis," which included a discussion of the results from the initial screening analysis performed to evaluate the technical feasibility of potable reuse alternatives.

- The Panel found the discussion of the technical feasibility of the alternatives for IPR and DPR to be confusing. Alternatives that do not meet the project objective or are not viable should be discussed and rejected earlier in the report. Explain early in the document that: (1) there is not enough wastewater to meet the target yield; (2) there is not enough storage in the groundwater basin; (3) Cachuma Reservoir is too far away; and (4) the seawater intrusion barrier is not required, effective, or necessary (and why). Then describe the reasonable range of alternatives and their rankings against the criteria.

CITY RESPONSE: Responses discussing each of the numbered items are listed below and number as in the original comment as follows:

General: The evaluation process follows the process established by the Work Plan. Initial screening criteria for project alternatives were identified. We cannot screen the potable reuse alternative until it has been developed far enough to consider it against the initial screening criteria. Using the information developed in this report, the City can better refine project alternatives for further consideration in future studies.

1). The amount of wastewater available is discussed in TM3, Section 3.2.3. At the end of this section, the average flow available is stated to be 8,660 AFY, which is below the target yield. Like with the SSI study, we could simply stop the evaluation of all alternatives, here, however, the City's study seeks to understand the technical feasibility of using the maximum capacity available. Thereby the alternatives were "potentially feasible but don't meet the study goals".

2). The capacity of the groundwater basin to store AWTF effluent water was evaluated during the hydrogeological modeling, results are presented in Section

3.3.2. Refer to Tables 3.8 through 3.11, which indicate capacity of the basins. Like with the SSI study, the objective of this study was to understand the maximum capacity of potable reuse that is technically feasible. In this case, the potable reuse application is groundwater recharge (IPR). The evaluation of the maximum recharge (storage) capacity needs to be established in order to evaluate this application against the initial screening alternatives presented in the Work Plan. In this case, this study has established a maximum capacity of groundwater recharge which can inform future studies.

3). Section 3.2.1, "Potable Reuse Application", discusses the types of potable reuse to be considered in the analysis. A footnote at the end of this section discusses surface augmentation of the nearest water body (i.e., Cachuma) is approximately 23 miles away and would require significant pumping conveyance. While the City can still consider this alternative further in future studies, reasons for excluding this alternative from consideration during this study are stated at the end of Section 3.2.1.

4). Results of the analysis for IPR Implementation Approach No. 2 (i.e., seawater intrusion barrier) were discussed during the hydrogeological modeling, presented in Section 3.3.2. This section presents discussion as to "why" the seawater intrusion barrier is not required as follows:

" For IPR Implementation Approach No. 2, the groundwater modeling results indicate that the capacity of the Storage Unit I producing zones to accept, store, and transmit recycled water, is very limited in the coastal portion of the basin. The modeling results indicate that even with increased pumping inland of the barrier, only approximately 740 AFY year of recycled water can be injected to form a partial seawater intrusion barrier before excessive head buildup occurs at the injection sites. Additionally, the model results indicate that the barrier would not completely prevent seawater intrusion even with twenty-four simulated barrier wells. Although it may be possible to create an effective seawater intrusion barrier with even more wells, the IPR yield would not increase materially. The modeling results indicate that the IPR Alternative No. 2 is not technically feasible and this implementation approach will not be carried forward to initial screening analysis."

This section also refers to Appendix B, which contains additional details regarding the hydrogeological analysis. Refer to Appendix B for additional information.

Please also refer to the executive summary, which has been created to summarize the results of TM1, TM2 and TM3. This comment has been used as one of the guidelines to draft the executive summary, which should address confusion about alternatives.

- Regarding Table 3.22 in Section 3.6, titled "Potable Reuse Alternatives Initial Screening Results," the row labeled "Regulations Exist in CA?" is misleading. Rewrite it for clarification.

CITY RESPONSE: Noted. The subsection titled "Direct Potable Reuse" under Section 3.2.2 of TM3 states that although regulations do not yet exist in the state of California, DDW will review projects on a "case by case" basis.

A new footnote (7) was added to Table 3.22 for clarification. Refer to updated TM3.

3.9 TM-3 Conclusions and Recommendations

The following comments pertain to Section 3.7 of TM-3, titled "Conclusions and Recommendations."

- Notably, in Section 3.7, a discussion was included of the alternatives considered and discounted, but no actual recommendations were provided. The project team is encouraged to include recommendations related to long-term water supply planning.

CITY RESPONSE: Noted. The final paragraph states that the City will use the information developed in this report to inform future studies, such as updates to the City's Long Term Water Supply Plan. It is beyond the scope of this study to provide recommendations related to long-term water supply planning.

- In particular, the Panel suggests discussing the alternatives categorized as PF*, or "potentially feasible, but did not meet study goals," within the recommendation section.

CITY RESPONSE: Noted. As stated in the previous comment responses, it is beyond the scope of this study to provide recommendations within the memo related to long-term water supply planning. However, the City will use the information developed in this report to inform future studies, such as updates to the City's Long Term Water Supply Plan.

- During the meeting, the project team verbally indicated a preference among the alternatives, which should be formalized in the Executive Summary of the final report.

CITY RESPONSE: Noted. The executive summary will be created to summarize the study (TM1 through TM3). The TAP Comments will be included as an appendix which can also be used to inform future studies. However, it is beyond the scope of this study to indicate a preference among alternatives in this study. The City may further evaluate potable reuse alternatives (and may consider additional alternatives to those presented in this study) during later studies.

APPENDIX 1 – DRAFT FINAL PANEL REPORT

NATIONAL WATER RESEARCH INSTITUTE

Draft Panel Report for Meeting #3:

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

Based on a Technical Advisory Panel (TAP) Meeting
Held on October 26-27, 2016 (Panel Meeting #3)

Prepared by:

Technical Advisory Panel (TAP)

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

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Submitted:

January 3, 2017

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

DISCLAIMER

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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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ACRONYMS

AFY	Acre feet per year
ASR	Aquifer storage and recovery
AWTP	Advanced water treatment plant
BAC	Biological activated carbon
CEQA	California Environmental Quality Act
DPR	Direct potable reuse
DWTP	Drinking water treatment plant
FAT	Full advanced treatment
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
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* 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 Background¹

In the late 1980s, the City of Santa Barbara 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. The plant was operated between March and June of 1992, and then placed on long-term standby mode due to sufficient supply.

In 1991, City voters elected to make desalination a permanent part of the City's water supply portfolio. With the approval of the Long Term Water Supply Program in 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.

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 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 City Council directed the Public Works Department to evaluate the feasibility of (1) replacing the open ocean intake with a subsurface intake 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 in which the City would report 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:

Work Authorization 1: Work Plans for both studies.

Work Authorization 2: Subsurface intake fatal flaw analysis and potable reuse feasibility study.

Work Authorization 3: Subsurface intake feasibility study.

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

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 the alternatives considered in these studies.

1.3 Role of the Technical Advisory Panel

Carollo Engineers requested 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 (e.g., draft Work Plans, technical memoranda, and reports) for both feasibility studies and will consider public comments on these proposed efforts. Findings and recommendations will be documented in Panel reports. Background information about the NWRI Panel process can be found in **Appendix A**. Information specific to the Panel can be found at www.nwri-usa.org/santa-barbara-panel.htm.

1.4 Panel Members

The Panel includes experts in areas related to drinking water management, desalination and wastewater reclamation technology, 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., CEG, 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)

Refer to **Appendix B** for brief biographies of the Panel members.

2. PANEL MEETING #3

A 2-day meeting of the Panel was held October 26-27, 2016, in Santa Barbara, California. The first day 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 was held at the Water Resources Conference Room on Garden Street. This meeting represents the third time the Panel has met to review the *Subsurface Desalination Intake Feasibility Study* and *Potable Reuse Feasibility Study* undertaken by the City of Santa Barbara.

2.1 Background Material

Prior to Meeting #3, the following background material was provided to the Panel:

- *Potable Reuse Feasibility Study Technical Memoranda (TM)*, which include:
 - TM-1: Introduction, Background, and Project Alternatives
 - TM-2: Regulatory and Permitting Requirements
 - TM-3: Basis of Design and Initial Screening: Potable Reuse

- *Subsurface Desalination Intake Feasibility Study (FINAL)*

2.2 Meeting #3 Agenda

Staff from NWRI, the City, and Carollo Engineers, as well as the Panel Chair, collaborated on the development of the agenda for Panel Meeting #3, which is included in **Appendix C**. The agenda was based on meeting the following specific objectives:

- Carollo Engineers will present information from Technical Memorandum #3 (TM-3) on the conceptual design and initial technical screening analysis of potable reuse options.
- Members of the public will have an opportunity to provide comments.
- The Panel will conduct a technical review of TM-3 and other information presented at the meeting.

Day 1 of the meeting began with a brief closed session in which the Panel, City staff, and Carollo Engineers and their sub-consultants discussed meeting objectives. After the closed session, a public meeting was held in which Carollo Engineers gave a presentation that focused on the conceptual design and initial technical screening analysis of potable reuse options, followed by questions from the Panel. The floor was then open to public comments. Once the public session adjourned, the Panel met in a closed session to discuss the information presented and prepare preliminary findings for this report.

On Day 2, the Panel met in a closed session to discuss their preliminary findings regarding the initial basis of design for potable reuse options. During the discussion, the Panel developed a report outline, which has been expanded upon in this report.

2.3 Meeting #3 Attendees

All Panel members attended Meeting #3. Other attendees included NWRI staff, City staff, Carollo staff and their sub-consultants, members of the public, and others. A list of meeting attendees is included in **Appendix D**.

3. FINDINGS AND RECOMMENDATIONS

The principal findings and recommendations have been derived from the material presented and discussed during Meeting #3, specifically Technical Memorandum #3 (TM-3) and the slide presentation on the *Potable Reuse Feasibility Study*. The findings and recommendations are organized under the following categories:

- General Comments
- Study Scope and Work Plan Objectives
- Regulatory Summary
- Basis of Design
- Surface and Hydrogeologic Properties
- Potable Reuse Alternatives
- Conceptual Design Study
- Initial Screening Analysis
- TM-3 Conclusions and Recommendations

3.1 General Comments

The following general comments pertain to the Panel's overall review of the *Potable Reuse Feasibility Study*.

- The Panel appreciated receiving the background material well in advance of the meeting, which provided sufficient time for review.
- The presentation made by the project team at Meeting #3 was clear and easy to understand insomuch that the Panel felt the presentation provided a more useful explanation of the basis of design (BOD) than did the written report (i.e., TM-3).
- In terms of report formatting, the extensive use of alphas and numerals for in-text citations and footnotes, as well as for table citations and footnotes, makes for a distracting read. In-text citations should be written as (Author, Date), with a separate section for references providing bibliographic details. List footnotes and table notes either alphabetically or numerically (but not both). In addition, either always number or never number the table notes. Please be consistent with formatting throughout the report.
- The Panel recommends the City consider the feasibility studies from two perspectives: one related to the immediate drought planning, and the second with respect to long-term water planning efforts. It is important to consider these two objectives separately and not co-mingle their goals.
- If the City would rather not combine drought water supply planning with long-term water supply planning under the *Subsurface Desalination Intake Feasibility Study*, then it also should consider not undertaking infrastructure planning (which is long-term planning) with drought planning

under the *Potable Reuse Feasibility Study*. For example, a statement such as “...eliminating the West non-potable reuse (NPR) system poses many advantages for the City’s water supply portfolio” alludes to infrastructure planning, or long-term planning that the City is not considering in the current feasibility study. Notably, infrastructure and other long-term planning add pragmatism to the process, which would benefit the two feasibility studies.

- The Panel recommends summarizing the information from the three technical memoranda on potable reuse into a concise and easy-to-understand Executive Summary. In this summary, the City’s commitment to using the results of the study in its new long-term water resources plan should be emphasized.

3.2 Study Scope and Work Plan Objectives

The following comments pertain to the presentation slides (Slides #3 to 6) addressing the background and objectives of the Feasibility Studies.

- The project team demonstrated how the information derived from this effort would inform future studies and long-term planning. The City noted, however, that a Long-Term Water Supply plan will not be developed until the drought runs its course and Cachuma Reservoir begins to spill.
- The Panel understands that permit deadlines are driving the project schedule and that the City will present the results of the feasibility studies to the RWQCB in May 2017.
- For the purposes of this effort, the Panel defines “feasible” as “capable of replacing 10,000 AFY.”

3.3 Regulatory Summary

The following comments pertain to Presentation Slide #17 on “Regulatory Status for DPR Continues to Evolve,” which was presented by the project team.

- The absence of current state regulations for DPR does not preclude the development of DPR projects, which the Division of Drinking Water of the State Water Resources Control Board can evaluate on a case-by-case basis.
- The project team indicated that additional barriers are needed to address trace (i.e., chemical) pollutants; however, additional barriers were not proposed within TM-3.
- The assumptions related to log removal values and engineered storage for DPR projects (see also Section 3.2.2 in TM-3) are valid for the analysis already conducted; however, the State Water Board needs to revisit these assumptions before the project can move forward.

3.4 Basis of Design

These comments pertain to the Basis of Design (BOD), which was used (as documented in Section 3.2 of TM-3) to identify potable reuse project alternatives and develop conceptual designs.

- Please include additional information on Lauro Canyon Reservoir, which is mentioned briefly in Section 3.2.1 as a potential site for raw water supply augmentation using advanced treated water produced by DPR.
- The Panel requests that the City clarify the level of uncertainty regarding required future releases from Cachuma Reservoir (as discussed in Section 3.2.1 and Appendix A: Work Plan). It appears to the Panel that this uncertainty is contributing to the City’s reluctance to assume production volumes less than 10,000 AFY.
- Clarify the importance of adhering to the City’s production capacity goal of 10,000 AFY rather than upholding a threshold of 1,400 AFY (delivered) for the production of non-potable recycled water. As discussed in Section 3.2.3, the City emphasizes the need to retain the 1,400 AFY of non-potable recycled water, making 11,400 AFY the goal of the *Potable Reuse Feasibility Study*. Yet the City suggests in Alternative 1A abandoning half the recycled water customers to address future infrastructure issues. As a result, is the priority 10,000 AFY or 11,400 AFY?
- The Panel requests clarification regarding the annual production capacity demands for potable and non-potable water, as follows:
 - If 10,000 AFY is needed for potable reuse and 1,400 AFY is needed for non-potable reuse, how much water must come into the wastewater treatment plant and under what climate conditions?
 - How much potable water needs to be served to result in 10,000 AFY of recoverable wastewater flow.
 - Based on the percentages listed in the City’s supply portfolio, the Panel estimated that 14,000 AFY would be the annual production capacity demand for potable and non-potable water. Is this a reasonable estimate? Does this capacity reflect a normal year or a drought year?
- The Panel recommends that the City project future daily effluent flows from the El Estero Wastewater Treatment Plant, which could differ significantly from the historical daily effluent flows shown in Figures 3.3 and 3.4 of Section 3.2.3. In addition, consider the changes to wastewater flows that will occur once the desalination facility is operational.

3.5 Surface and Hydrogeologic Properties

The following comments pertain to Section 3.3 of TM-3, titled “Hydrogeologic Analysis of Groundwater Replenishment (IPR) Alternatives.”

- Clarify in the report that the numerical groundwater flow and transport model of the Storage Unit 1 and Foothill basins, as discussed in Section 3.3, was used only to inform the analysis of the IPR Implementation Approach (and not DPR).
- The Panel agrees with the overall conclusions of the hydrogeologic analysis of the alternatives for IPR. The City reached a reasonable conclusion that the negative effects and limited yield

make surface application of recycled water infeasible for this project, even though it was not determined using the model. Given the limited capacity of the groundwater basin, it has been established that the basin cannot accept significant volumes of water and/or serve as an environmental buffer. That said, the Panel has concerns regarding the appropriateness of the groundwater model used.

- The Panel understands that the analysis of the hydrogeologic feasibility of the IPR alternatives relied partially on the groundwater model of the Santa Barbara groundwater basin developed by the U.S. Geological Survey (USGS). The model is an (in-progress) update of the model originally developed in 1984 and subsequently revised and expanded, sequentially, in 1986, 1989, and 1998. Although documentation of the current version of the model is not available, based on the limited information available, the newest version appears to apply a finer discretization to the 1998 model. This re-discretization is assumed necessary to provide numerical stability when the flow model is coupled with the solute transport module.
- The Panel understands that the revised model uses a conceptual hydrogeologic model similar to previous versions of the model. Notably:
 - The groundwater system is characterized as two confined water-bearing units separated by a finer-grained unit.
 - There is no layer representing the surficial deposits that extend from the top of the upper confined zone to the ground surface.
 - There is no active layer underlying the ocean.
 - The boundary condition with the ocean for both water-bearing units is represented solely as a leaky offshore fault.
- The Panel acknowledges that the numeric model developed from the adopted conceptual hydrogeologic model is appropriate for assessing generalized water budget changes in response to climatic cycles and changes in water levels associated with varying pumping stresses; however, consider the following:
 - Using particle tracking, the numerical model can provide estimates of travel times.
 - The numerical model as currently configured cannot appropriately simulate important processes or assess the impacts of some considerations associated with the proposed IPR alternatives.
- The Panel notes that the IPR analysis considered the effects of increased water levels near areas where advanced treated water would be infiltrated, namely conditions associated with shallow water levels, such as habitat creation, impacts to vegetation, geohazards, and contaminant mobilization. Clarify that these analyses were informed by professional judgement and not by the model; the model used cannot simulate the shallow zone of the aquifer system.
- The Panel notes that the project team, as part of the subsurface intake analysis, acknowledged the USGS model (in its existing form at the time, and still, as now updated) had limitations in its

ability to simulate the infiltration and movement of seawater into the basin from the ocean. As a result, the project team developed a different groundwater model with a shallow layer that interfaces with the ocean floor for the analysis. The new model demonstrated that seawater could be induced to move vertically through the seafloor into the upper producing zone if gradients were adequate. Clarify why this other model was not used to assess the effectiveness of the IPR seawater intrusion barrier, as it more appropriately simulates coastal boundary conditions.

- The Panel cautions that the USGS model, which is purported to establish the sensitivity of the basin to seawater intrusion in response to basin pumping, continues to use an undocumented, unsupported, and partially discredited offshore fault as the boundary condition. Evidence for the fault never was strong, and recent offshore geophysical work undertaken by both the offshore divisions of the USGS and Montecito Water District has raised significant questions as to the existence of this fault.
- As an aside, the Panel questions whether the current USGS model can be defensibly used for its purported purpose given the following: (1) uncertainty in the location or existence of the offshore fault; and (2) absence of a shallow seafloor layer.

3.6 Potable Reuse Alternatives

The following comments pertain to Section 3.4 of TM-3, titled “Summary of Potable Reuse Alternatives.”

- Eliminate Figures 3.17A and B (Initial Summary of Potable Reuse Alternatives) and Figure 3.18 (Initial Alternatives Numbering Characteristics Matrix), which are confusing. The document should focus on Figures 3.19 and 3.20, and the explanation as to why Alternative 4 was eliminated from consideration should be provided earlier in the report, as discussed below in Section 3.8 on “Initial Screening Analysis.”
- The Panel recognizes the importance of the equalization basins to normalize diurnal variation for available flow volume, as discussed in Sections 3.4.2 and 3.4.3. Notably, from an operational standpoint, the equalization basins also may help stabilize water quality.
- The annual flow rates presented in the report are based on MGD assumptions that are too high. It is too optimistic to assume the reuse plant will be online 100 percent of the time. A more conservative estimate would be 95 percent or less.
- The Panel recommends that the project team thoroughly vet the option for diluting seawater with wastewater before advanced treatment. The Panel does not disagree with the conclusion, but the rationale should be clear and quantified.
- DPR could include an option where the AWTF and DWTF are the same facility.
- Other options could be considered for the treatment train configuration. For example, ozone/BAC in advance of microfiltration can be used to control chemicals.

3.7 Conceptual Design Study

The following comments pertain to Section 3.5 of TM-3, titled “Conceptual Design Summary.”

- Clarify whether the City is willing to examine changing from purple pipe (i.e., tertiary treated) recycled water to the distribution of advanced treated (DPR) water for non-potable purposes, as well as to augment raw water supplies for drinking water treatment .
- The A and B series alternatives do not need to be mutually exclusive. For example, they could be phases of the same alternatives (1A and 1B) rather than separate alternatives.
- In Section 3.5.3, the table that summarizes the potential maximum yields for the alternatives for non-potable reuse, potable reuse, and desalination (e.g., Table 3-19) is more useful than Figures 17 through 20 in describing the maximum yields of each alternative.
- Regarding the impact of the future expansion of the desalination facility on the viability of the potable reuse alternatives:
 - DPR Alternatives 2A and 2B were found to be infeasible because they would take up space in the desalination facility. This finding is not clear and needs to be explained in the report.
 - Should there be an additional initial screening criterion: “enough space must be retained at the desalination facility to expand to 10,000 AFY”?
 - If the desalination facility were to be replaced, that space will be available for DPR.
 - It may be possible, with some ingenuity, to design the new AWTF so that it complements (rather than displaces) the opportunity for future expansion of desalination to 10,000 AFY. The City should maintain a planning approach that includes innovative designs to ensure that alternatives are not ruled out prematurely.
 - Would the City realistically consider not building out the desalination plant so it produces less than 10,000 AFY of water?
 - Financially, it makes more sense to pay for desalination if the water will be used more than once (i.e., coupled with potable reuse).
- Regarding the flow equalization tanks:
 - Clarify why the flow equalization tanks need to be located on the same property as the desalination plant. The City should consider innovative alternative designs.
 - Clarify why a second (i.e., redundant) flow equalization tank is required. Perhaps it is possible to design a more compact flow equalization system.

3.8 Initial Screening Analysis

The following comments pertain to Section 3.6 of TM-3, titled “Initial Screening Analysis,” which included a discussion of the results from the initial screening analysis performed to evaluate the technical feasibility of potable reuse alternatives.

- The Panel found the discussion of the technical feasibility of the alternatives for IPR and DPR to be confusing. Alternatives that do not meet the project objective or are not viable should be discussed and rejected earlier in the report. Explain early in the document that: (1) there is not enough wastewater to meet the target yield; (2) there is not enough storage in the groundwater basin; (3) Cachuma Reservoir is too far away; and (4) the seawater intrusion barrier is not required, effective, or necessary (and why). Then describe the reasonable range of alternatives and their rankings against the criteria.
- Regarding Table 3.22 in Section 3.6, titled “Potable Reuse Alternatives Initial Screening Results,” the row labeled “Regulations Exist in CA?” is misleading. Rewrite it for clarification.

3.9 TM-3 Conclusions and Recommendations

The following comments pertain to Section 3.7 of TM-3, titled “Conclusions and Recommendations.”

- Notably, in Section 3.7, a discussion was included of the alternatives considered and discounted, but no actual recommendations were provided. The project team is encouraged to include recommendations related to long-term water supply planning.
- In particular, the Panel suggests discussing the alternatives categorized as PF*, or “potentially feasible, but did not meet study goals,” within the recommendation section.
- During the meeting, the project team verbally indicated a preference among the alternatives, which should be formalized in the Executive Summary of the final report.

APPENDIX A: PANEL BACKGROUND

About NWRI

For more than 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. Childress has directed research funded by federal, state, and private agencies. Current research projects are funded by U.S. Environmental Protection Agency, the Strategic Environmental Research and Development Program, and California Department of Water Resources. 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., CEG, CHg

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. 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 over 40 years of experience in water quality control and water resources management. He spent 20 years with the Orange County Health Care Agency in Water Quality Control. 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, Research and Development, Hydrogeology, and Health and Regulatory Affairs Departments. He provides technical guidance on treatment and quality for OCWD's Groundwater Replenishment System (the nation's largest IPR project), as well as manages monitoring programs for the purification facility and groundwater basin. He managed 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. Wehner served 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 potable reuse projects for the Los Angeles Department of Water and Power, the City of San Diego and Monterey Regional Water Pollution Control Agency. 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

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 (EIR), the Monterey Peninsula Water Supply Project (MPWSP) Draft EIR, and the current MPWSP Draft EIR/EIS. 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 received a degree in Geography from the State University of New York at Buffalo.

NATIONAL WATER RESEARCH INSTITUTE

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

Meeting #3 Agenda

October 26-27, 2016

Meeting Location:

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

Contacts:

Suzanne Faubl, NWRI
(714) 378-3278 (NWRI office)
(949) 258-2093 (mobile)

Wednesday, October 26, 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.

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 the City and Carollo Engineers during the Open Session	Moderated by Panel Chair

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

9:30 am	Welcome and Introductions	Jeff Mosher, NWRI
9:45 am	Presentation on Conceptual Basis of Design and Initial Screening Analysis of Potable Reuse Alternatives	City and Carollo Engineers
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 Engineers.

12:00 noon LUNCH with TAP, City, and Carollo Engineers.

12:30 pm Discussion on Potable Reuse Alternatives Moderated by Panel Chair

2:00 pm BREAK

2:15 pm TAP ONLY. Continue discussion. Moderated by Panel Chair

4:30 PM ADJOURN DAY ONE OF MEETING

Thursday, October 27, 2016

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

8:30 am Discussion Conceptual Basis of Design and Initial Screening Analysis of Potable Reuse Alternatives Moderated by Panel Chair

12:00 noon WORKING LUNCH

1:00 pm Debriefing with TAP, City, and Carollo Engineers Moderated by Panel Chair

2:00 pm ADJOURN DAY TWO OF MEETING

APPENDIX D: MEETING #3 ATTENDEES

Panel Members:

- Chair: Amy Childress, Ph.D., University of Southern California (Los Angeles, CA)
- Martin B. Feeney, P.G., CEG, 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:

- Suzanne Faubl, Water Resources Scientist and Project Manager
- Jeff Mosher, Executive Director

City of Santa Barbara:

- Joshua Haggmark, Water Resources Manager
- Robert Roebuck, Project Manager II
- Cathy Taylor, Water System Manager

Carollo Engineers:

- Eric Cherasia
- Tom Seacord

Sub-Consultants:

- Austin Melcher, Dudek
- Joe Monaco, Dudek
- Jeff Barry, GSI
- Tim Thompson, GSI

Others:

- Lindsey Baker, League of Women Voters of Santa Barbara
- Alex Bennett, Heal the Ocean
- Jordan Clark, University of California, Santa Barbara
- Hillary Hauser, Heal the Ocean
- Kira Redmond, Santa Barbara Channelkeeper