NATIONAL WATER RESEARCH INSTITUTE

Volume I

Final Panel Meeting Report #4: Surface Water Augmentation – IPR Criteria Review

Based on an Expert Panel Meeting Held March 11-12, 2015
(Expert Panel Meeting #4)

Prepared By:
Expert Panel on the Development of Water Recycling Criteria
for Indirect Potable Reuse (IPR) through Surface Water Augmentation and the
Feasibility of Developing Criteria for Direct Potable Reuse (DPR)

Prepared For:
State Water Resources Control Board Division of Drinking Water
(Agreement No. 13-21041)

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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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The Drinking Water Program was officially transferred from CDPH to the State Water Resources Control Board (State Board) and renamed as the Division of Drinking Water (DDW) on July 1, 2014. Financial support for the Panel is being provided by DDW through Agreement No. 13-21041.

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In addition, the Panel thanks the National Water Research Institute for administering and organizing the Panel's efforts. The Panel would also like to recognize the State Board's Direct Potable Reuse (DPR) Advisory Committee for participating in the fourth Panel Meeting.

DISCLAIMER

This report was prepared by an NWRI Expert Panel (Panel), which is administered by the National Water Research Institute (NWRI). Any opinions, findings, conclusions, or recommendations expressed in this report were prepared by the Panel. This report was published for informational purposes.

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- *Draft Final Panel Meeting Report: Surface Water Augmentation Regulation Concept Review – Volume I (Panel Meeting #3: December 11-12, 2014),* prepared Draft February 18, 2015, by the Expert Panel on the Development of Water Recycling Criteria for Indirect Potable Reuse through Surface Water Augmentation and the Feasibility of Developing Criteria for Direct Potable Reuse.
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ACRONYMS

AF	Acre foot
AWT	Advanced water treatment
CDPH	California Department of Public Health
CFSTR	Continuous Flow Stirred Tank Reactor
$CHCl_3$	Chloroform
CWA	Clean Water Act
CWC	California Water Code
DDW	State Water Resources Control Board Division of Drinking Water
DPR	Direct potable reuse
EPA	U.S. Environmental Protection Agency
IPR	Indirect potable reuse
LRV	Log reduction value
MCL	Maximum contaminant level
MGD	Million gallons per day
NL	Notification level
NPDES	National Pollutant Discharge Elimination System
NWRI	National Water Research Institute
POTW	Publicly owned treatment works
RO	Reverse osmosis
RWQCB	Regional Water Quality Control Board
SDWA	Safe Drinking Water Act
State Board	State Water Resources Control Board
SWA	Surface water augmentation
SWSAP	Surface water source augmentation project
TOC	Total organic carbon

1. PURPOSE OF THE REPORT

The purpose of this report is to provide the State Water Resources Control Board (State Board) with the Expert Panel's recommendations from their March 11-12, 2015, meeting on information provided by State Board staff regarding the initial draft document titled "Surface Water Augmentation IPR Preliminary California Regulation Concept" prepared by the State Board and dated July 2014.

2. PURPOSE AND HISTORY OF THE PANEL

In 2013, the National Water Research Institute (NWRI) of Fountain Valley, California, a 501c3 nonprofit, appointed state and national water industry experts to an independent, third-party Expert Panel to provide advice to the State of California on developing Water Recycling Criteria for indirect potable reuse (IPR) through surface water augmentation (SWA) and determining the feasibility of developing criteria for direct potable reuse (DPR).

The Panel was originally formed on behalf of the Drinking Water Program of the California Department of Public Health (CDPH). As of July 1, 2014, the Drinking Water Program was officially transferred from CDPH to the State Board and renamed as the Division of Drinking Water (DDW); therefore, hereafter, CDPH will be referred to as the State Board in this report. The Panel for the State Board is being administered by NWRI.

2.1 Panel Charge

The specific purpose of the Panel is provided in Chapter 7.3 – entitled "Direct and Indirect Potable Reuse" – of the California Water Code[1]. The exact wording is as follows:

> 13565. (a) (1) On or before February 15, 2014, the department shall convene and administer an expert panel for purposes of advising the department on public health issues and scientific and technical matters regarding development of uniform water recycling criteria for indirect potable reuse through surface water augmentation and investigation of the feasibility of developing uniform water recycling criteria for direct potable reuse. The expert panel shall assess what, if any, additional areas of research are needed to be able to establish uniform regulatory criteria for direct potable reuse. The expert panel shall then recommend an approach for accomplishing any additional needed research regarding uniform criteria for direct potable reuse in a timely manner.

With respect to SWA, the Panel's charge – as stated in Section 13562 of the California Water Code – is as follows:

> (B) Prior to adopting uniform water recycling criteria for surface water augmentation, the department shall submit the proposed criteria to the expert panel convened pursuant to subdivision (a) of Section 13565. The expert panel shall review the proposed criteria and shall adopt a finding as to whether, in its expert opinion, the proposed criteria would adequately protect public health.

[1] Appendix A contains a copy of Chapter 7.3 of the California Water Code, effective January 1, 2014. http://www.leginfo.ca.gov/cgi-bin/displaycode?section=wat&group=13001-14000&file=13560-13569 (last accessed October 6, 2014).

Please refer to Chapter 7.3 of the California Water Code (Appendix A) for a description of State Board and Panel activities as pertaining to this effort.

2.2 Panel Members

The Panel is made up of 12 individuals who meet the California Water Code Section 13565 requirement that the Panel "shall be comprised, at a minimum, of a toxicologist, an engineer licensed in the state with at least three years' experience in wastewater treatment, an engineer licensed in the state with at least three years' experience in treatment of drinking water supplies and knowledge of drinking water standards, an epidemiologist, a limnologist, a microbiologist, and a chemist."

Panel members include:

- *Panel Co-Chair:* Adam Olivieri, Dr.P.H., P.E., EOA, Inc. (Oakland, CA)
- *Panel Co-Chair:* James Crook, Ph.D., P.E., Environmental Engineering Consultant (Boston, MA)
- Michael Anderson, Ph.D., University of California, Riverside (Riverside, CA)
- Richard Bull, Ph.D., MoBull Consulting (Richland, WA)
- Dr.-Ing. Jörg E. Drewes, Technische Universität München (Munich, Germany)
- Charles Haas, Ph.D., Drexel University (Philadelphia, PA)
- Walter Jakubowski, M.S.., WaltJay Consulting (Spokane, Washington)
- Perry McCarty, Sc.D., Stanford University (Stanford, CA)
- Kara Nelson, Ph.D., University of California, Berkeley (Berkeley, CA)
- Joan B. Rose, Ph.D., Michigan State University (East Lansing, MI)
- David Sedlak, Ph.D., University of California, Berkeley (Berkeley, CA)
- Tim Wade, Ph.D., United States Environmental Protection Agency (Durham, NC)

Background information about the NWRI Panel process can be found in Appendix B, and brief biographies of the Panel members can be found in Appendix C. Further information about the Panel can also be found on the NWRI website at www.nwri-usa.org/ca-panel.htm.

3. PANEL MEETING

A two-day meeting of the Panel was held on March 11-12, 2015, at the San Francisco Estuary Institute (SFEI) in Richmond, California. The specific focus of the meeting was to continue to review the State Board's draft IPR-SWA Criteria, finalize Panel reports from the last two Panel meetings, and receive an update on DPR research efforts and activities to date.

3.1 Background Material

Prior to the meeting, the following background material was provided to the Panel:

- *Draft Final Panel Meeting Report: Panel's Initial Discussions on the Draft Surface Water Augmentation IPR Preliminary California Regulation Concept (Dated July 2014) – Volume I (Panel Meeting #2: July 24-25, 2014)*, prepared October 6, 2014, revised February 18, 2015, by the Expert Panel on the Development of Water Recycling Criteria for Indirect Potable Reuse through Surface Water Augmentation and the Feasibility of Developing Criteria for Direct Potable Reuse.

- *Draft Final Panel Meeting Report: Surface Water Augmentation Regulation Concept Review – Volume I (Panel Meeting #3: December 11-12, 2014)*, Draft February 18, 2015, by the Expert Panel on the Development of Water Recycling Criteria for Indirect Potable Reuse through Surface Water Augmentation and the Feasibility of Developing Criteria for Direct Potable Reuse.

- *Supplemental Material for the March 11-12, 2015, Expert Panel Meeting (Meeting #4) on Potential Topics (Table 1) and Additional Information to Be Provided by the State Board (Table 2) on Surface Water Augmentation (SWA) Criteria (From the Panel Report on Meeting #2)*, Draft February 19, 2015.

These background materials are also provided in Volume II of this report.

3.2 Meeting Agenda and Logistics

Staff from NWRI, the co-chairs of the Panel, and the State Board collaborated on the development of an agenda for the Panel meeting, which is included in Appendix D. The agenda was based on meeting the following specific objectives:

1. Continue to review the State Board's draft criteria for SWA.
2. Review and finalize the draft Panel report on Reservoir Criteria from Meeting #3.
3. Receive input on the draft National DPR Framework document.
4. Finalize the Panel Report from Meeting #2.

The Panel met in a closed session on the first day to discuss and finalize the Panel Report from Meeting #3, focusing mostly on the Panel's edits to Chapter 17 (reservoir criteria). Panel member Dr. Michael Anderson presented an explanation of the basis for the proposed comments

(see Section 5.1 of Panel Report #3) on the draft Reservoir Criteria. The Panel also addressed State Board's comments to finalize Panel Report #2, which are provided in Tables 1 and 2 of the Supplemental Material. Following this session, the Panel met with State Board staff to review and discuss the Panel's proposed edits to Panel Report #3; these edits are contained in Panel Report #4 (based on the March 11-12, 2015, Panel meeting). In addition, the Panel provided final input on responses to Tables 1 and 2, thus finalizing Panel Reports #2 and #3.

The second day included an open session providing an update on the State Board's DPR Advisory Committee by Committee member Marsi Steirer of the City of San Diego, as well as a presentation by Dr. George Tchobanoglous of the University of California Davis on a collaborative effort by other agencies (i.e., WateReuse Association, American Water Works Association, and Water Environment Foundation) to develop a national DPR Framework document.

Specifically, presentations included:

- Summary of Meeting # 4 of the DDW DPR Advisory Committee
- Developing a Direct Potable Reuse Framework Document for the WateReuse Association

The slide presentations are provided in Volume III of this report. Time was allowed for questions and discussion between State Board staff, presenters, and Panel members following each presentation. Attendees then engaged in an open discussion on the differences between IPR and DPR, before the meeting was closed to Panel Members and State Board staff to discuss the Panel's final thoughts on SWA using IPR.

3.3 Meeting Attendees

All Panel members participated at the meeting with the exception of Dr. Kara Nelson (who is on sabbatical). Panel Members Mr. Walter Jakubowski and Dr. Jörg Drewes were unable to attend in person; therefore, they participated via web-enabled conference call. Other attendees included NWRI staff, State Board staff, water reuse research representatives, and utility representatives. A complete list of Panel meeting attendees is included in Appendix E.

4. SUMMARY OF PANEL KEY COMMENTS AND RECOMMENDATIONS

A key focus of this Panel meeting was to continue to review the initial draft *Surface Water Augmentation IPR Preliminary California Regulation Concept* (dated July 2014) and better understand the intent and technical basis of the SWA draft reservoir criteria. Based on Panel discussions, the Panel organized comments and recommendations under the following topics:

- General Comments.
- Review and Respond as Needed to State Board's Response (Dated November 26, 2014) to the Draft Final Panel Meeting Report Covering the July 24-15, 2014, Panel Meeting #2, draft October 6, 2014, revised February 18, 2015.
- Review and Comment on the State Board's Draft Proposed Reservoir Criteria – Final Panel Report #3.
- Recommendations on Proposed SWA Criteria.

4.1 General Comments

The comments in this section focus on the overarching concepts and understandings that will guide and govern the Panel's approach to conducting the review of IPR criteria for SWA (and, eventually, DPR) as required by the California Water Code.

- The Panel commends the effort by the State of California, specifically the State Board's DDW, to develop SWA regulations for IPR, which could help communities throughout California supplement existing drinking water sources, improve the reliability of existing water supplies, and facilitate additional potable reuse in communities throughout California and the remaining United States.

- As per California Water Code Section 13560-13569, the Panel recognizes that the State Board has been mandated to "develop and adopt uniform water recycling criteria for surface water augmentation" on or before December 31, 2016. Further, the Panel understands that it is charged to "review the proposed criteria and shall adopt a finding as to whether, in its expert opinion, the proposed criteria would adequately protect public health" before the criteria are adopted.

4.1.1 Background on the Basis for State Board Development and Approval of IPR–SWA Criteria

Following the initial approval of the San Diego IPR proposal to augment a surface water reservoir, CDPH (now referred to as the State Board) and the Department of Water Resources convened the California Potable Reuse Committee to identify conditions necessary for safe SWA throughout California. In 1996, the California Potable Reuse Committee produced the document, "A Proposed Framework for Regulating the Indirect Potable Reuse of Advanced Treated Reclaimed Water by Surface Water Augmentation" (Framework). Subsequently, the California Recycled Water Task Force was created by statute in 2001 and was tasked, in part, to evaluate the need to reconvene the California

Potable Reuse Committee to update their findings in the Framework. In the report *Water Recycling 2030 – Recommendations of California's Recycled Water Task Force, State of California, 2003*, the Task Force concluded in Recommendation 6.3 that it was not necessary to revisit the Framework and that the State should be able to make determinations regarding IPR based on the following publications:

- "Report of the Scientific Advisory Panel on Groundwater recharge with Reclaimed Water," State of California (1987).
- "Issues in Potable Reuse," National Research Council (1998).
- "A Proposed Framework for Regulating the Indirect Potable Reuse of Advanced Treated Reclaimed Water by Surface Water Augmentation," State of California (1996).[2]
- State Board draft groundwater recharge regulations (August 5, 2008)[3].

4.1.2 Proposed 1996 Framework for Regulating Indirect Potable Reuse by Surface Water Augmentation

The California Potable Reuse Committee examined the feasibility and safety of potable reuse of recycled water following advanced treatment. In the 1996 Proposed Framework document, committee members concluded that planned IPR of advanced treated recycled water using surface water reservoirs is feasible under the following six specific criteria:

1. Application of Best Available Technology in advanced wastewater treatment with the treatment plants meeting operating criteria.
2. Maintenance of appropriate retention times based on reservoir dynamics.
3. Maintenance of advanced wastewater treatment plant reliability to consistently meet primary microbiological, chemical, and physical drinking water standards.
4. SWA projects using advanced treated recycled water must comply with applicable State of California criteria for groundwater recharge for direct injection with recycled water.
5. Maintenance of reservoir quality.
6. Provision for an effective source control program.

Other project approval considerations identified in the Framework include:

a. Independent Monitoring Oversight Authority. This authority would be appointed by

[2] California Potable Reuse Committee (1996). A Proposed Framework for Regulating the Indirect Potable Reuse of Advanced Treated Reclaimed Water by Surface Water Augmentation in California. Prepared for the California Department of Health Services and California Department of Water Resources. Published by the California Department of Water Resources.

[3] California State Water Resources Control Board (2014) *Water Recycling Criteria*. Title 22, Division 4, Chapter 3, California Code of Regulations, Sacramento, CA. http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/lawbook/RWregulations_20140618.pdf

CDPH (now the State Board) and Regional Water Quality Control Board (RWQCB) to provide a third-party review of operational, regulatory, and environmental issues associated with the project.

b. Coordination. Coordination between water reclamation agencies, regulatory agencies, and agencies responsible for public water systems should be instituted in both formal and informal channels.

c. Operator Training and Certification. Operator training and certification programs must ensure reliable operation of advanced treatment facilities.

d. Source Aesthetic Quality. Use of advanced treated recycled water should not negatively impact the aesthetics (taste, odor, and appearance) or consumer acceptance of the public drinking water supply.

4.2 Review and Respond as Needed to State Board's Comments (Dated November 26, 2014) on the Draft Final Panel Meeting Report Covering the July 24-15, 2014, Panel Meeting #2 (draft October 6, 2014, Revised February 18, 2105)

The Panel appreciates the comments provided by State Board staff (November 26, 2014) on the *Draft Final Panel Meeting Report: Panel's Initial Discussions on the Draft Surface Water Augmentation IPR Preliminary California Regulation Concept (Panel Meeting #2: July 24-25, 2014), Volume I,* draft October 6, 2014, revised Draft February 18, 2015. The comments helped clarify many issues. The following subjects are addressed in this section:

- Final Review of Panel Report #2 (Panel Meeting July 24-25, 2014) – The Panel briefly discussed and revised the Draft Final Report dated February 18, 2015, at the March meeting. A few minor edits and/or clarifications were received from the Panel. The report is final as of March 12, 2015.

- Final Review of Supplemental Information derived from Panel Report #2 – The material package for Panel Meeting #4 contained two tables of supplemental information:

    - Table 1 contains a summary of additional comments and/or questions from State Board staff that was not completely addressed as part of Panel Report #2 and potentially required some review and input from the Panel. The Panel completed the review of Table 1 and provided input and clarification (see the edited version of Table 1 in Appendix F).

    - Table 2 contains a summary of additional input and clarification that State Board staff intends to provide to the Panel as part of the revised draft IPR-SWA criteria for Panel review and discussion at the next Panel meeting (Appendix F and a further discussion in Panel Report #4, Section 5, regarding Next Steps).

4.3 Review and Comments on the State Board's Draft Proposed Reservoir Criteria – Draft Final Panel Report #3

Included in Panel Report #3 (Section 4.3) is a summary of:

- The State Board staff's four independent (and not necessarily equivalent) proposed options for reservoir criteria.
- The Panel's understanding of the assumptions provided by State Board staff.
- The Panel's additional understandings of the proposed SWA criteria as they may relate to current State groundwater recharge regulations for IPR projects.
- Panel observations regarding SWA criteria based on the above and discussions at Panel Meeting #3.

Panel Report #3 also contains 18 specific comments (see Section 5.1) on the draft proposed reservoir criteria in addition to the Panel's draft modifications (see Section 5.2) to the SWA criteria. Based on Panel discussions at Meeting #4 and further deliberation by the Panel Co-Chairs regarding the best approach to document and provide Panel Meeting #4 input to State Board staff, the Co-Chairs (with the assistance of Panel member Dr. Michael Anderson) determined that preparing a separate Panel Report for Meeting #4 was the best option. Therefore, Panel Report #3 is considered complete as of March 12, 2015.

4.3.1 Recommendations on the Proposed SWA Criteria

The Panel – after lengthy discussion and deliberation of draft recommendations contained in Panel Report #3 based on Meeting #3 – provides the following comments and recommendations regarding the proposed SWA-IPR criteria.

4.4.1 Recommended Modifications to Draft Surface Water Treatment Criteria for proposed Sections 64601, 64602, 64603, and 64604 (Title 22, Div. 4, Chapter 17)

The additional recommended modifications, together with the recommendations contained in Panel Report #3 and discussed with State Board staff, are shown below in strike-out and yellow highlighted added text. The Panel understands the Section numbers may further change (please note that the Section numbers shown do not correspond to those in the original State Board draft criteria), but found that using the format noted below is an easier way to provide the Panel recommendations.

> **Title 22, CALIFORNIA CODE OF REGULATIONS DIVISION 4. ENVIRONMENTAL HEALTH CHAPTER 17. SURFACE WATER TREATMENT,**
>
> **Article ?. Surface Water Reservoirs Augmented with Recycled Water**
>
> **§64601. General Criteria for Determining the Suitability of a Reservoir Used as a Source of Domestic Water for Augmentation with Recycled Water.**
>
> (a) Reservoirs receiving ~~a discharge of~~ recycled water as part of a SWSAP must have been in operation as an approved surface water (§ 64651.10) for a sufficient period of time to establish a baseline record of reservoir raw water quality and treated drinking water quality. In no case shall the reservoir have been operating as an approved surface water for less than five years prior to ~~the discharge of~~ augmentation with recycled water.

(b) The public water system using the reservoir as a domestic water source must have sufficient control over the operation of the reservoir to assure their ability to comply with the requirements of this Article.

§64602. Retention and Mixing of Recycled Water in the Reservoir[4].

Implementation of SWA in a source drinking water reservoir requires that several criteria be met:

(a) The reservoir must have a theoretical retention time of at least 6 months. The theoretical retention time shall be determined monthly by taking the volume of the impounded water at the end of the month and the total outflow from the reservoir during the month, including overflow and withdrawals for water use. The average time that recycled municipal wastewater is retained in the reservoir shall thus be at least six months prior to withdrawal for use as a drinking water supply.

(b) The SWSAP sponsor must be able to demonstrate through tracer studies and hydrodynamic modeling that:

(i) the volume of water withdrawn from the reservoir on any given day contains no more than 1 percent by volume of recycled water added to the reservoir on any single previous day, or

(ii) the volume of water withdrawn from the reservoir on any given day contains no more than 10 percent by volume of recycled water added to the reservoir on any single previous day and in addition is subjected to an independent treatment process producing a 1-$\log_{10}$ pathogen reduction[5].

(c) Reservoir water suitable for receipt of recycled water must be from reservoir watershed runoff, imported water that has been approved as a surface water source, or recycled water meeting the requirements of §60321 (d). Recycled water may only be delivered to ~~discharged into~~ the reservoir when less than one percent of the reservoir water is recycled water that did not meet the requirements of §60321.

(d) To verify that the dilution requirement in subsection (b) is being met, prior to the end of the sixth month of operation under hydraulic conditions representative of normal SWSAP operations the SWSAP shall initiate a tracer study utilizing an added tracer. The Division of Drinking Water must approve the tracer test protocol. The Division of Drinking Water must also be notified of significant changes in SWA and reservoir operation beyond those in the project permit; the DDW may require a SWSAP's project sponsor to demonstrate that the reservoir hydraulic characterization used to comply with this section remains valid.

§64603. Public Hearings.

(a) Three public hearings for a SWSAP shall be held by public water systems using the SWSAP as a source of supply prior to the Division of Drinking Water's submittal of recommendations regarding the SWSAP to the RWQCB or SWRCB, or approving the SWSAP as an approved source in a public water system permit. The SWSAP water-recycling agency shall participate in the hearings for the purpose of presenting information on the recycled water source, treatment,

[4] Based on Panel discussions and deliberation at Meeting #4, this section was further revised from the recommended text in the Panel Report for Meeting #3 to specify volumetric dilution rather than dilution in concentration to eliminate confusion regarding the concentration of specific constituent(s). In addition, text was added to specify that the proposed volumetric dilutions referred to are demonstrated as noted "*through tracer studies and hydrodynamic modeling*" to ensure that a sufficiently detailed analysis be conducted to support meeting the dilution criteria.

[5] For enteric virus reduction, *Giardia* cyst reduction, and *Cryptosporidium* oocyst reduction.

monitoring, and anticipated SWRCB or RWQCB permit provisions. Prior to a public hearing, the public water system(s) and SWSAP water-recycling agency shall provide the Division of Drinking Water, for review and approval, the information the public water system(s) and SWSAP water-recycling agency intends to present at the hearing and on the Internet. Following the Division of Drinking Water's approval of the information, the SWSAP water recycling agency shall place the information on the Internet and in a repository that provides at least thirty days of public access to the information prior to the public hearings.

(b) Prior to placing the information required pursuant to subsection (a) in a repository (TERM NEEDS FURTHER DEFINITION/CLARIFICATION), the SWSAP shall:

(1) Notify the public of the following;

(A) the location and hours of operation of the repository,
(B) the Internet address where the information may be viewed,
(C) the purpose of the repository and public hearing,
(D) the manner in which the public can provide comments, and
(E) the date, time, and location of the public hearing.

(2) Notify all public water systems that can receive water, directly or indirectly, including through emergency connections, from the SWSAP.

(c) Unless directed otherwise by the Division of Drinking Water, the public notification made pursuant to subsection (b)(2) shall be by direct mail and the notification made pursuant to (b)(1) shall be by one or more of the following methods delivered in a manner to reach persons whose source of drinking water may be impacted by the SWSAP:

(1) Local newspaper(s) publication;
(2) Mailed or direct delivery of a newsletter;
(3) Conspicuously placed statement in water bills; or
(4) Television and/or radio.

NOTE: Authority cited: §116551 H&S Code

§64604. Alternative Source of Supply

Prior to operation of a new SWSAP, or during the first year of operation after [*insert effective date*] for an existing SWSAP, the public water system(s) using the augmented reservoir as a source shall have a Division of Drinking Water approved plan that provides an alternative source of domestic water supply, or a Division of Drinking Water approved treatment mechanism in the event that the water withdrawn from the augmented reservoir meets the following:~~, as a result of the SWSAP:~~

(1) Is not being treated to meet California drinking water standards,
(2) Has been degraded to the degree that it is no longer a safe source of drinking water, or
(3) Receives water that fails to meet subsection 60320.010(c).

4.4.2 Recommend Deletion of Reservoir LRVs from Draft Surface Water Treatment Criteria for Surface Water Reservoirs Augmented with Recycled Water (Old Section 64603 in Proposed Title 22, Div. 4, Chapter 17)

As noted above in Section 4.4.1, the reservoir log reduction values (LRVs) were removed as a compliance pathway in the draft recommendations proposed by the Panel as part of Panel Report #3. The basis for this recommendation was, in part, the challenge of developing LRVs for a reservoir that could approach the rigor with which they are assigned to engineered treatment processes.

Moreover, the initial definition that credits 1-$\log_{10}$ virus reduction for each month the recycled

water is retained in the reservoir is ambiguous. For example, how exactly is retention time defined in this context? It is recognized that some water from a pulse of off-spec water will have a very short residence time within the reservoir, while a portion will also spend a very long time in the reservoir. The discussion below was developed by Dr. Anderson (Panel Member) and discussed by the Panel at Panel Meeting #4.

The challenge in defining an appropriate retention time can be seen from some simple calculations. Reservoir augmentation with advanced water treatment (AWT) water during the winter well-mixed period can, as a useful approximation, be represented as a continuous flow stirred-tank reactor (CFSTR) which, for a reactive contaminant subject to a first-order loss process, is given the differential equation:

$$\frac{dC}{dt} = \frac{Q(C_{in}-C)}{V} - kC \qquad (1)$$

In this expression, C is the concentration in the reservoir and outflow (since well-mixed), C_{in} is the concentration of contaminant delivered to the reservoir, Q is the flow through the reservoir (assumed here to represent both AWT inflow and reservoir outflow due to the assumption of constant reservoir volume), k is the first-order rate constant, V is the reservoir volume, and t is time. A simple analytical solution to this differential equation for an instantaneous pulse input of mass m equivalent to $Q*C_{in}*\Delta t$ is (Chapra, 1997):

$$C_t = \frac{QC_{in}\Delta t}{V} e^{-\left(\frac{Q}{V}+k\right)t} \qquad (2)$$

As an example, consider a reservoir with a volume of 15,100 acre feet (AF) that receives a flow of 27 million gallons per day (MGD) with a 1-day pulse of off-spec water contaminated with a conservative substance (tracer), chloroform ($CHCl_3$), and virus each at concentrations of 100 (arbitrary units). The tracer is conservative, so it has a k-value of 0 d^{-1}, while $CHCl_3$ is lost from the water column through volatilization with a rate constant of 0.0086 d^{-1} assuming 1 m s^{-1} windspeed and mean reservoir depth of 30 meters (m), and the virus is inactivated with a rate constant of 0.0768 d^{-1} (1-log per month). At this volume and flow rate, the reservoir has an average hydraulic retention time of 6 months.

In response to a pulse of off-spec AWT water at a concentration of 100 (arbitrary units), mixing within the reservoir will lower concentrations of the tracer, virus, and $CHCl_3$ to 0.55 (a dilution of 1:182) (Figure 1a). The concentration of the conservative tracer within the reservoir and its outflow then decreases as a result of flushing out of the reservoir with continued (in-spec) flows into the reservoir (Figure 1a, red line). It is important to note that the time required for the 1-day pulse of tracer to be flushed from the reservoir substantially exceeds the average hydraulic retention time; in fact, some small amount of tracer was still present after more than four times the average retention time (>2 years) (Figure 1a, red line).

Concentrations of virus and $CHCl_3$ in the reservoir decrease more rapidly than the tracer as a result of both flushing and loss via inactivation or volatilization (Figure 1a). Volatilization lowered the concentration of $CHCl_3$ such that it was effectively absent after about 400 days

(Figure 1a, green line). Viruses were relatively rapidly inactivated, with essentially all lost within 100 days (Figure 1a, blue line).

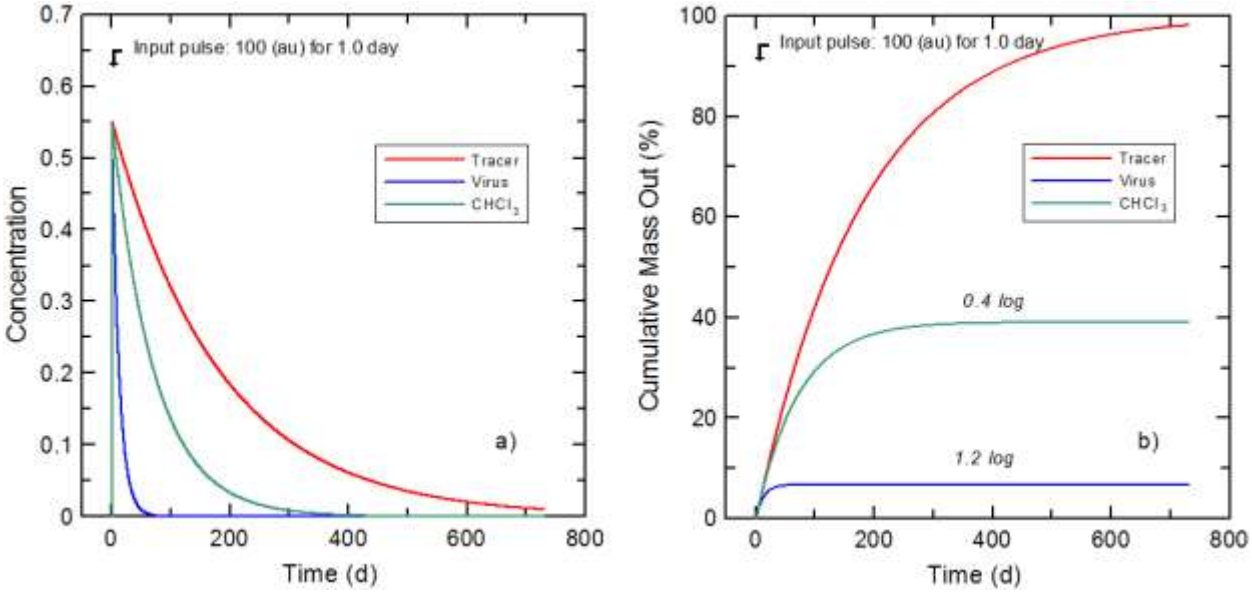

Figure 1. Solution to Equation 2 for a 15,100-AF reservoir modeled as a CFSTR with an average hydraulic residence time of 6 months receiving a 1-day pulse of off-spec AWT water at concentration of 100 (arbitrary units): (a) concentrations of a conservative tracer, virus, and $CHCl_3$ over time, and (b) cumulative mass exported from reservoir over time.

The amount of contaminant exported from the reservoir and delivered to the downstream drinking water treatment plant varied between the three contaminants (Figure 1b). By definition, a conservative substance or tracer is not subject to *in situ* loss processes, so the full amount of tracer that was inputted with the 1-day pulse of off-spec water is eventually exported from the reservoir. As noted, this process takes more than 2 years for the scenario modeled here. The mass of $CHCl_3$ exported from the reservoir reached only 39-percent of that discharged to the reservoir, so the difference is a result of loss due to volatilization (Figure 1b, green line). In this case, volatilization served as a type of *in situ* treatment that removed 61 percent of the $CHCl_3$. Inactivation quickly lowered virus concentration in the reservoir, although some viruses were flushed from the reservoir as a result of inflows; under the assumptions here, almost 7 percent were exported downstream, while 93 percent were removed, achieving the equivalent of 1.2 log of *in situ* treatment. Thus, the reservoir serves not only as an environmental buffer reducing the concentration and providing time to respond to treatment plant excursions, but also as a barrier to transport of reactive contaminants downstream by providing *in situ* treatment. If one uses the 6-month average retention time with the 1-log per month proposed in initial draft criteria, the level of removal is dramatically higher than that calculated when including the dynamic response as a result of flushing and inactivation described above (see Figure 1).

Moreover, the amount of removal varies in a complex way with hydraulic conditions even when a constant inactivation rate is assumed (e.g., Figure 2). A 50,000-AF reservoir with AWT flows of 15 MGD would have an average hydraulic residence of 3 years (1,086 days). Delivery of a 1-day pulse of off-spec AWT water at a virus concentration of 100 (arbitrary units) during winter well-mixed conditions would achieve a dilution of that water to 0.092 (arbitrary units) (Figure

2a, red line). As a result of flushing from the reservoir and inactivation, virus concentrations in the reservoir and at the intake to the drinking water treatment plant would decline to negligible levels within 60 to 80 days. The reservoir under these conditions would achieve 1.9-log virus removal (Figure 2b, red line).

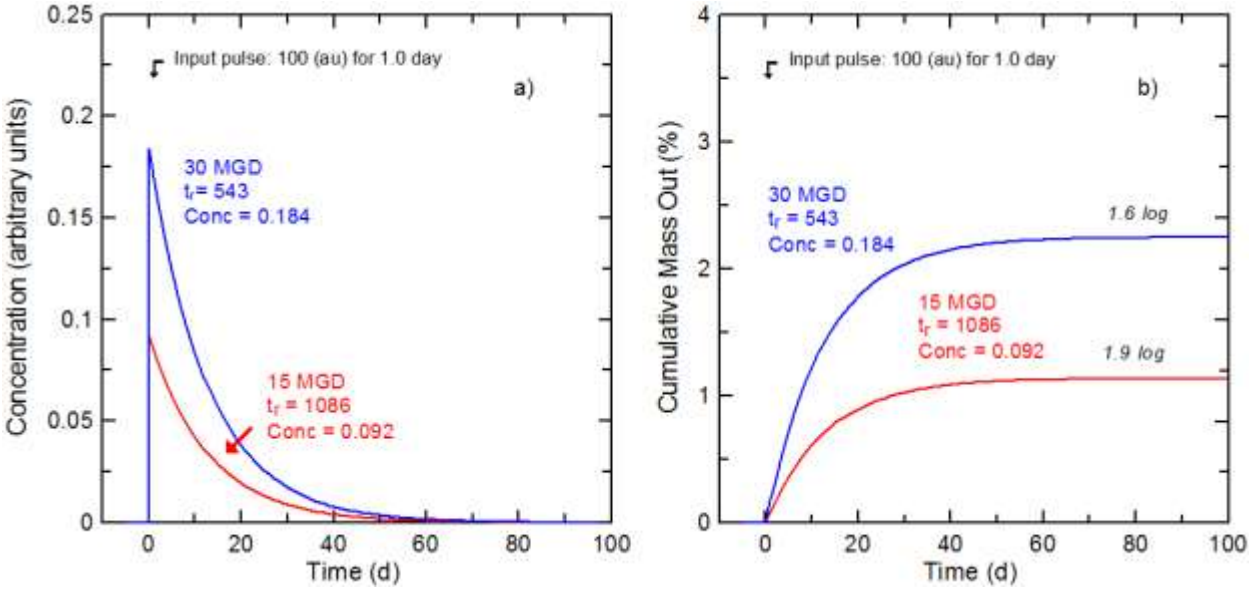

Figure 2. Solution to Equation 2 for a 50,000-AF reservoir modeled as a CFSTR receiving a 1-day pulse of off-spec AWT water at concentration of 100 (arbitrary units): (a) concentrations of a conservative tracer, virus, and $CHCl_3$ over time, and (b) cumulative mass exported from reservoir over time.

Increasing flow through the reservoir to 30 MGD doubles the virus concentration upon mixing (Figure 2a, blue line) and reduces the amount of *in situ* treatment to 1.6 log virus removal (Figure 2b, blue line). Such *in situ* removal would be even more highly varied if one included not only hydraulic and operational factors, but also the effects of water temperature, turbidity, and other environmental and water quality conditions.

4.4.3 Recommended Modifications to Draft Surface Water Augmentation - Recycling Criteria for proposed Sections 60301.xxx through 60321.009 (Title 22, Div. 4, Chapter 3)

The Panel's recommended modifications are shown below in strike-out and yellow highlighted added text. Comments and additional notes are shown in red text.

Title 22, CALIFORNIA CODE OF REGULATIONS
DIVISION 4. ENVIRONMENTAL HEALTH
CHAPTER 3. RECYCLING CRITERIA

ARTICLE 1. Definitions

Note – the Water Code definition of surface water augmentation (§13561) is “the planned placement of recycled water into a surface water reservoir used as a source of domestic drinking water supply.”

Section 60301.xxx. Surface Water Source Augmentation Project (SWSAP)

“Surface Water Source Augmentation Project (SWSAP)” means a project that implements surface water augmentation at a specific reservoir.

Section 60301.xxx. SWSAP Water Recycling Agency.

"SWSAP water recycling agency" means any agency that receives water-recycling requirements for a SWSAP from a RWQCB and is, in whole or part, responsible for the SWSAP meeting the requirements of this Chapter.

Section 60301.xxx. Augmented Reservoir.

"Augmented Reservoir" means a reservoir used as a domestic water source that receives ~~discharge of~~ recycled water as part of a SWSAP.

ARTICLE 5.x. Surface Water Augmentation

Surface water reservoirs used as source supplies for drinking water should be of sufficient water quality to protect public health and minimize aesthetic and treatment problems. At the same time, such reservoirs often provide a number of additional beneficial uses. Thus, consistent with the Porter-Cologne Water Quality Control Act, Cal. Water Code, Division 7, § 13000, surface water augmentation shall not impair a reservoir’s beneficial use as a source drinking water supply, nor impair its other designated beneficial uses

Section 60321. General Requirements.

(a) Recycled municipal wastewater used for a SWSAP shall be from a wastewater management agency that:

(1) administers an industrial pretreatment and pollutant source control program;

(2) implements and maintains a source control program that includes at a minimum:

(A) an assessment of the fate of Division of Drinking Water ~~Quality~~-specified contaminants through the wastewater and recycled municipal wastewater treatment systems,

(B) contaminant source investigations and contaminant monitoring that focus on Division of Drinking Water ~~Quality~~-specified contaminants,

(C) an outreach program to industrial, commercial, and residential communities within the sewage collection agency's service area for the purpose of managing and minimizing the discharge of contaminants of concern at the source, and

(D) an up-to-date inventory of contaminants discharged into the wastewater collection system so that new contaminants of concern can be readily identified and evaluated.

(3) is compliant with the effluent limits established in the RWQCB or SWRCB permit for the SWSAP.

(b) Prior to operation, a SWSAP water recycling agency shall have an Operations Plan submitted to and approved by the Division of Drinking Water ~~Quality~~. An Operations Plan shall describe the operations, maintenance, and monitoring necessary for the SWSAP to meet the requirements of this chapter. The SWSAP water recycling agency shall be responsible for ensuring that the Operations Plan is, at all times, representative of the current operations, maintenance, and monitoring of the SWSAP.

(c) Prior to operating a SWSAP, a project sponsor shall demonstrate to the Division of Drinking Water ~~Quality~~ and Regional Board that a project sponsor possesses adequate managerial and technical capability to assure compliance with this Article.

(d) Prior to augmentation of a reservoir with recycled municipal wastewater, a SWSAP's water recycling agency shall demonstrate that all treatment processes have been installed and can be operated by the water recycling agency to achieve their intended function. A protocol describing the actions to be taken to meet this subsection shall be included in the engineering report submitted pursuant to section ??.

Note: The Panel has not received any text for "Section ??" above.

(e) If a water recycling agency fails to complete compliance monitoring required pursuant to this Article, the Regional Board may determine water quality-related compliance based on available data.

(f) A water recycling agency shall ensure that the recycled municipal wastewater used for a SWSAP shall be from a wastewater management agency that is not in violation of the effluent limits pertaining to surface water augmentation pursuant to this Article, as established in the wastewater management agency's Regional Board permit.

(g) If a water recycling agency has been directed by the Division of Drinking Water ~~Quality~~ or Regional Board to suspend surface water augmentation ~~application~~ pursuant to this Article, surface water augmentation shall not resume until the project sponsor has obtained Division of Drinking Water ~~Quality~~ and Regional Board approval.

Section 60321.001 Alternatives.

(a) A project sponsor may use an alternative to a requirement in this Article if the SWSAP's water recycling agency:

(1) demonstrates to the Division of Drinking Water ~~Quality~~ that the proposed alternative provides an equivalent level of performance with respect to the reliability and removal of contaminants of concern and assures at least the same level of protection to public health;

(2) receives written approval from the Division of Drinking Water ~~Quality~~ prior to implementation of the alternative; and

(3) if required by the Division of Drinking Water ~~Quality~~ or Regional Board, conducts a public hearing on the proposed alternative, disseminates information to the public, and receives public comments, pursuant to sections 60320.202(b) and (c).

(b) Unless specified otherwise by the Division of Drinking Water ~~Quality~~, the demonstration in subsection (a)(1) shall include the results of a review of the proposed alternative by an independent scientific advisory panel that includes a toxicologist, a limnologist, an engineer licensed in California with at least three years of experience in wastewater treatment and public drinking water supply, a microbiologist, and a chemist.

Section 60321.002 Laboratory Analyses.

(a) Analyses for contaminants having primary or secondary MCLs shall be performed by laboratories approved to perform such analyses by the Division of Drinking Water ~~Quality~~ utilizing Division of Drinking Water ~~Quality~~-approved drinking water methods.

(b) Analyses for chemicals other than those having primary or secondary MCLs shall be described in the SWSAP's Operation Optimization Plan prepared pursuant to section 60320.122.

Section 60321.003. Control of Pathogenic Microorganisms.

(a) A SWSAP water recycling agency shall design and operate wastewater treatment such that the recycled ~~municipal waste~~water delivered ~~discharged~~ to an augmented reservoir for a SWSAP receives treatment that reliably achieves at least 8-log enteric virus reduction, 7-log *Giardia* cyst reduction, and 8-log *Cryptosporidium* oocyst reduction ~~minus the organism log reductions reliably provided in the reservoir by the SWSAP project sponsor and required in their PWS permit as determined pursuant to …(reference the reservoir criteria for the SWSAP).~~ The treatment train shall consist of at least two separate treatment processes for each pathogen (i.e., enteric virus, *Giardia* cysts, or *Cryptosporidium* oocysts), a separate treatment process may be credited with no more than 6-log reduction, with at least two processes each being credited with no less than 1.0-log reduction.

(b) The SWSAP water recycling agency shall validate each of the treatment processes used to meet the requirements in subsection (a) for their log reduction by submitting a report for the Division of Drinking Water ~~Quality's~~ review and approval, or by using a challenge test approved by the Division of Drinking Water ~~Quality~~, that provides evidence of the treatment process's ability to reliably and consistently achieve the log reduction. The report and/or challenge test shall be prepared by engineer licensed in California with at least five years of experience, as a licensed engineer, in wastewater treatment and public water supply, including the evaluation of treatment processes for pathogen control. The project sponsor shall propose and include in its Operations Plan prepared pursuant to section 60320.xxx, on-going monitoring using the pathogenic microorganism of concern or a microbial, chemical, or physical surrogate parameter(s) that verifies the performance of each treatment process's ability to achieve its credited log reduction.

(c) If the pathogen reduction in subsection (a) is not met based on the on-going monitoring required pursuant to subsection (b), within 24 hours of being aware the SWSAP water recycling agency shall immediately investigate the cause and initiate corrective actions. For failing to meet the pathogen reduction criteria longer than 4 consecutive hours or more than a total of 8 hours during any 7-day period, the Division of Drinking Water ~~Quality~~ and RWQCB shall be immediately notified. Failures of shorter duration shall be reported to the RWQCB no later than 10 days after the month in which the failure occurred.

If the effectiveness of the treatment train used by the recycling agency ~~a treatment train's ability~~ to reduce enteric virus is less than 6-logs, or Giardia cysts is less than 5-logs, or Cryptosporidium oocysts reduction is less than 6-logs, the SWSAP water recycling agency shall immediately notify the Division of Drinking Water ~~Quality~~ and RWQCB, and discontinue delivery ~~application~~ of recycled municipal wastewater at the SWSAP, unless directed otherwise by the Division of Drinking Water ~~Quality~~ or the RWQCB.

Section 60321.004. Control of Regulated Chemicals and Physical Characteristics.

Note: The Panel has not received any text of Section 60321.004 to review.

Section 60321.005. Advanced Treatment Criteria.

Full advanced treatment is the treatment of an oxidized wastewater, as defined in section 60301.650, using a reverse osmosis and an oxidation treatment process that, at a minimum, meets the criteria of this section.

(a) A project sponsor shall select for use a reverse osmosis membrane such that:

(1) each membrane element used in the project has achieved a minimum rejection of sodium chloride of no less than 99.0 percent (99.0%) and an average (nominal) rejection of sodium chloride of no less than 99.2 percent (99.2%), as DPH-14-003E GW Replenishment Using RW May 30, 2014 demonstrated through Method A of ASTM International's method D4194-03 (2008) using the following substitute test conditions:

(A) tests are operated at a recovery of no less than 15 percent (15%) (CLARIFY MEANING);

(B) sodium chloride rejection is based on three or more successive measurements, after flushing and following at least 30 minutes of operation having demonstrated that rejection has stabilized;

(C) an influent pH no less than 6.5 and no greater than 8.0; and

(D) an influent sodium chloride concentration of no greater than 2,000 mg/L, to be verified prior to the start of testing; and

(2) during the first twenty weeks of full-scale operation the membrane produces a permeate with no more than five percent (5%) of the sample results having TOC concentrations greater than 0.25 mg/L (or other similar performance surrogate approved by the Division of Drinking Water) , as verified through monitoring no less frequent than weekly.

(b) For the reverse osmosis treatment process, a project sponsor shall propose, for Division of Drinking Water ~~Quality~~ review and approval, on-going performance monitoring (e.g., conductivity, ~~or~~ TOC) that indicates when the integrity of the process has been compromised. The proposal shall include at least one form of continuous monitoring, as well as the associated surrogate and/or operational parameter limits and alarm settings that indicate when the integrity has been compromised.

(Changes to this section are recommended based on adopting the concept of using performance indicator chemicals for oxidation processes as reported by Dickenson et al. (2009), *Environmental Science & Technology,* 43(16): 6,242-6,247.)

(c) To demonstrate a sufficient oxidation process has been designed for implementation, a project sponsor shall:

(1) Propose an ongoing performance monitoring program using suitable indicator chemicals, for Division of Drinking Water review and approval, that can demonstrate proper operation of the oxidation process. Suitable indicator chemicals are defined as chemicals representing functional groups that are well amendable to chemical oxidation reactions. The occurrence of these indicator chemicals in recycled water may be site specific and shall be verified by an occurrence study on the project's municipal wastewater effluent feeding the full advanced treatment process.

(2) Perform an occurrence study on the project's municipal wastewater to effluent identify indicator compounds and select a total of three ~~at least nine~~ indicator compounds representing any~~, with at least one from each of the~~ functional group~~s~~ as specified in subparagraphs (A) through (~~I~~ G) below. A project sponsor shall submit an occurrence study protocol, as well as the subsequent results and chosen indicator compounds, to the Division of Drinking Water ~~Quality~~ for review and approval.

(A) Hydroxy Aromatic

(B) Amino/Acylamino Aromatic

(C) Nonaromatic with carbon double bonds

(D) Deprotonated Amine

(E) Alkoxy Polyaromatic

(F) Alkoxy Aromatic

(G) Alkyl Aromatic

~~(H) Saturated Aliphatic~~

~~(I) Nitro Aromatic~~

(~~2~~3) Utilize an oxidation process that achieves proper ~~optimal~~ removal of the indicator compounds selected in paragraph (~~1~~ 2) such that removal is no less than~~; (A)~~ 0.5-log (69 percent) for any ~~each~~ indicator compound. ~~representing the functional groups in paragraphs (1)(A) through (1)(G), and (B) 0.3-log (50 percent) for each indicator compound representing the functional groups in paragraphs (1)(H) and (1)(I).~~

(~~3~~ 4) Establish at least one surrogate or operational parameter that reflects the removal of at least one ~~five~~ of the three ~~nine~~ indicator compounds selected pursuant to paragraph (~~1~~ 2) such that;

~~(A) at least one of the five indicator compounds represents at least one functional group in paragraphs (1)(A) through (1)(G),~~

~~(B) at least one of the five indicator compounds represents at least one functional group in paragraphs (1)(H) or (1)(I),~~

(~~C~~A) at least one surrogate or operational parameter is capable of being monitored continuously, recorded, and have associated alarms, and

(~~D~~ B) ~~a surrogate or operational parameter, including the parameter in subparagraph (C), is identified that~~ indicates when the process may no longer meet the criteria established in paragraph (~~2~~ 3).

(~~4~~ 5) Conduct testing that includes confirmation of the findings of the occurrence study in paragraph (1) and provides evidence that the requirements of paragraphs (~~2~~ 3) and (~~3~~ 4) can be met with a full-scale oxidation process. The testing shall include challenge or spiking tests conducted to determine the removal differential under normal operating conditions utilizing, at minimum, the three ~~nine~~ indicator compounds identified in paragraph (~~1~~ 2). A project sponsor shall submit a testing protocol, as well as the subsequent results, to the Division of Drinking Water ~~Quality~~ for review and approval.

(d) In lieu of demonstrating that a sufficient oxidation process has been designed for implementation pursuant to subsection (c), a project sponsor may conduct testing demonstrating that the oxidation process will provide no less than 0.5-log (69 percent) reduction of 1,4-dioxane.

(1) A project sponsor shall submit a testing protocol, as well as the subsequent results, to the Division of Drinking Water ~~Quality~~ for review and approval. The testing shall include challenge or spiking tests, using 1,4-dioxane, to demonstrate the proposed oxidation process will achieve the minimum 0.5-log reduction under the proposed oxidation process's normal full-scale operating conditions.

(2) A project sponsor shall establish surrogate and/or operational parameters that reflect whether the minimum 0.5-log 1,4-dioxane reduction design criterion~~a~~ is being met. At least one surrogate or operational parameter shall be capable of being monitored continuously, recorded, and have associated alarms that indicate when the process is not

operating as designed.

(e) During the full-scale operation of the oxidation process designed pursuant to subsection (c) or (d), a project sponsor shall continuously monitor the surrogate and/or operational parameters established pursuant to subsection (c)(~~3~~ 4)(~~C~~ B) or (d)(2), as applicable. A project sponsor shall implement, in full-scale operation, the oxidation process as designed pursuant to subsection (c) or (d).

(f) Within 60 days after completing the initial 12-months of monitoring pursuant to subsection (e), a project sponsor shall submit a report to the Division of Drinking Water ~~Quality~~ and Regional Board that includes:

(1) the results of the monitoring performed in subsection (e); (2) the removal differential of the indicator compounds; (3) a description of the efficacy of the surrogate and/or operational parameters to reflect the removal differential of the indicator compounds; and (4) a description of actions taken, or to be taken, if the indicator compound removal did not meet the associated design criteria in subsection (c) or (d), the continuous surrogate and/or operational parameter monitoring in subsection (c)(~~3~~ 4)(~~C~~ B) or (d)(2) fails to correspond to the differential indicator compound removal, or the surrogate and/or operational parameter established in subsection (c)(~~3~~ 4)(~~D~~ ~~B~~) or (d)(2) is not met.

(g) Within 60 days after completing the initial 12 months of operation of the reverse osmosis process (or equivalent process per Section 60321.001) a project sponsor shall submit a report to the Division of Drinking Water ~~Quality~~ and Regional Board describing the effectiveness of the treatment, process failures, and actions taken in the event the on-going monitoring in subsection (b) indicated that process integrity was compromised.

(h) Each quarter, a project sponsor shall calculate what percent of results of the quarter's monitoring, conducted pursuant to subsections (b) and (e), did not meet the surrogate and/or operational parameter limits established to assure proper on-going performance of the reverse osmosis and oxidation processes. If the percent is greater than ten, within 45 days after the end of the quarter a project sponsor shall:

(1) submit a report to the Division of Drinking Water ~~Quality~~ and Regional Board that identifies the reason(s) for such failure, if known, and describes the corrective actions planned or taken to reduce the percent to ten percent (10%) or less; and

(2) consult with the Division of Drinking Water ~~Quality~~ and, if required, comply with an alternative monitoring plan approved by the Division of Drinking Water ~~Quality.~~

(i) Each month a project sponsor shall collect samples (e.g. grab or composite) that are statistically representative of the effluent of the advanced treatment process and have the samples analyzed for contaminants having MCLs and notification levels (NLs). After 12 consecutive months with no results exceeding an MCL or NL, a project sponsor may apply for a reduced monitoring frequency. The reduced monitoring frequency shall be no less than quarterly. Monitoring conducted pursuant to this subsection may be used in lieu of the monitoring (for the same contaminants) required pursuant to sections 60320.212 and 60320.220. The effluent of the advanced treatment process shall not exceed an MCL.

Section 60321.006. Additional Chemical and Constituent Monitoring

(a) Each quarter, the SWSAP's water recycling agency shall sample and analyze the recycled municipal wastewater and the reservoir (from the reservoir monitoring locations established pursuant to section ??) for the following:

(1) Priority Toxic Pollutants (chemicals listed in 40 CFR section 131.38, "Establishment of numeric criteria for priority toxic pollutants for the State of California", as the foregoing may be amended) specified by the Division of Drinking Water ~~Quality~~, based on the Division of Drinking Water ~~Quality's~~ review of the SWSAP's engineering report; and

(2) Chemicals that the Division of Drinking Water ~~Quality~~ has specified, based on a review of the SWSAP's engineering report, the affected reservoir and the results of the assessment performed pursuant to section ?? .

Note: The Panel has not received any text for Section ?? above.

(b) Each quarter, the SWSAP's project sponsor shall sample and analyze the recycled municipal wastewater for Division of Drinking Water ~~Quality~~-specified chemicals having notification levels (NLs). Recharge water may be monitored in lieu of recycled municipal wastewater if the fraction of recycled municipal wastewater in the recharge water is equal to or greater than the average fraction of recycled municipal wastewater in the recharge water applied over the quarter. If the fraction of recycled municipal wastewater in the recharge water being monitored is less than the average fraction of recycled municipal wastewater in the recharge water applied over the quarter, the reported value shall be adjusted to exclude the effects of dilution. If a result exceeds a NL, within 72 hours of notification of the result a project sponsor shall collect another sample and have it analyzed for the contaminant as confirmation. If the average of the initial and confirmation sample exceeds the contaminant's NL, or a confirmation sample is not collected and analyzed pursuant to this subsection, the SWSAP shall initiate weekly monitoring for the contaminant until the running four-week average no longer exceeds the NL.

(1) If the running four-week average exceeds the contaminant's NL, a project sponsor shall describe the reason(s) for the exceedance and provide a schedule for completion of corrective actions in a report submitted to the Regional Board no later than 45 days following the quarter in which the exceedance occurred, with a copy concurrently provided to the Division of Drinking Water ~~Quality~~.

(2) If the running four-week average exceeds the contaminant's NL for sixteen consecutive weeks, a project sponsor shall notify the Division of Drinking Water ~~Quality~~ and Regional Board within 48 hours of knowledge of the exceedance.

(c) A project sponsor may reduce monitoring for the chemicals in this section to once each year following Division of Drinking Water ~~Quality~~ approval based on the Division of Drinking Water ~~Quality's~~ review of the most recent two years of results of the monitoring performed pursuant to this section.

(d) Annually, a project sponsor shall monitor the recycled municipal wastewater for indicator compounds specified by the Division of Drinking Water ~~Quality~~ and Regional Board based on the following:

. (1) a review of the SWSAP's engineering report;

. (2) the inventory developed pursuant to section ??;

. **Note: DDW need to fill in Section ?? above.**

.

. (3) the affected surface water reservoir and watershed;

. (4) an indicator compound's ability to characterize the presence of pharmaceuticals, endocrine disrupting chemicals, personal care products, and other indicators of the

presence of municipal wastewater; and

(5) the availability of a test method for a chemical.

(e) A chemical or contaminant detected as a result of monitoring conducted pursuant to this section shall be reported to the Division of Drinking Water ~~Quality~~ and Regional Board no later than the quarter following the quarter in which the results are received by the SWSAP's project sponsor.

Section 60321.007. Operation Optimization and Plan.

(a) Prior to operation of a SWSAP, a project sponsor shall submit an Operation Optimization Plan to the Division of Drinking Water ~~Quality~~ and Regional Board for review and approval. At a minimum, the Operation Optimization Plan shall identify and describe the operations, maintenance, analytical methods, monitoring necessary for the SWSAP to meet the requirements of this Article, and the reporting of monitoring results to the Division of Drinking Water ~~Quality~~ and Regional Board. A project sponsor shall be responsible for ensuring that the Operation Optimization Plan is, at all times, representative of the current operations, maintenance, and monitoring of the SWSAP. A SWSAP's project sponsor shall make the Operation Optimization Plan available to the Division of Drinking Water ~~Quality~~ or Regional Board for review upon request.

(b) During the first year of operation of a SWSAP and at all times thereafter, all treatment processes shall be operated in a manner providing optimal reduction of all chemicals and contaminants including:

(1) microbial contaminants;

(2) regulated contaminants identified in section 60320.212 and the nitrogen compounds required pursuant to section 60320.210; and

(3) chemicals and contaminants required pursuant to section 60320.220.

(c) Within six months of optimizing treatment processes pursuant to subsection (b) and anytime thereafter operations are optimized that result in a change in operation, a project sponsor shall update the SWSAP's Operation Optimization Plan to include such changes in operational procedures and submit the operations plan to the Division of Drinking Water ~~Quality~~ for review.

Section 60321.008. Monitoring Between a SWSAP Recycled Water Discharge and Domestic Water Supply Withdrawal Point.

(a) Prior to operating a SWSAP, each SWSAP shall identify monitoring sites (in the Engineering report) throughout the volume of the reservoir that represent:
(1) Different water quality conditions over the horizontal extent of the reservoir,
(2) Levels in the reservoir that correspond to depths at which water may be withdrawn, and from the epilimnion and hypolimnion.

(b) Monitoring shall be conducted by the water recycling agency as follows:

(1) Quarterly for two years prior to SWSAP operation at each monitoring point. The samples shall be analyzed for the constituents and characteristics in sections 60320.020, 60320.030, 60320.045 and 60320.47.

(2) Quarterly for two years prior to SWSAP operation and at least one sample each quarter thereafter, shall be collected at each monitoring point. Each sample shall be

analyzed for TOC, total nitrogen, nitrate, nitrite, the constituents in tables 64449-A and B of section 64449, total coliform bacteria, temperature, dissolved oxygen, chlorophyll a, total and dissolved phosphorus, and any other water quality constituents specified by the Division of Drinking Water and Regional Water Quality Control Board based on the results of the recycled municipal wastewater monitoring conducted pursuant to this chapter; and

(c) Analytical results of monitoring performed pursuant to paragraph (b)(2) shall be reported to the Division of Drinking Water ~~Quality~~ and the RWQCB by the SWSAP, as follows:

(1) For all chemical analyses completed in a calendar month, the SWSAP shall ensure the laboratory submits results no later than the end of the following month using the Electronic Deliverable Format as defined in the Electronic Deliverable Format (EDF) Version 1.2i Guidelines & Restrictions dated April 2001 and Data Dictionary dated April 2001.

(2) For any results exceeding an MCL ~~or at anytime coliform bacteria are present,~~ within 48 hours of receiving the results.

Section 60321.009. Annual and Five-Year Reporting.

Note: The Panel has not received any text of Section 60321.009 to review.

5. Panel Preliminary Conclusions and Next Steps on IPR-SWA Draft Criteria

The Panel discussions to date have built on the 1996 Framework document developed by the California Potable Reuse Committee to look into the feasibility and safety of potable reuse of recycled water following advanced treatment. The California Potable Reuse Committee members concluded that planned IPR of advanced treated recycled water using surface water reservoirs is feasible following six specific criteria, as previously discussed in Section 4.1.2. While the Panel agrees with these six specific criteria, new research and advances in treatment technologies and monitoring techniques over approximately the past 20 years have advanced the science and understanding of IPR projects. Further, an additional 20 years of experience with IPR through groundwater recharge has added significant knowledge and confidence to the operation and management of IPR projects.

The Panel's review and discussions of the IPR-groundwater recharge regulations as they relate to IPR-SWA criteria and the Panel review and discussions of the first draft DDW SWA criteria has resulted in a number of recommendations and needed clarifications on the draft SWA criteria. The Panel looks forward to receiving a complete revised draft of all sections of the State Board's proposed SWA criteria that addresses the Panel's comments and recommendations. It is the Panel's understanding that the State Board intends to provide a complete revised draft of the SWA criteria to the Panel at least three (3) weeks (i.e., by May 13, 2015) prior to the next Panel meeting, which is scheduled for the first week of June 2015.

The intent of the Panel at the June 2015 meeting (Meeting #5) is to: a) review the revised draft SWA criteria, b) provide any additional comments and/or questions to State Board staff, and c) if appropriate, provide a "preliminary" conceptual approval of the revised draft SWA criteria. The Panel notes that it will consider and appropriately address the full charge of the Panel stated in Sections 13562 (B) and (C) of the California Water Code as part of review of the State Board's final SWA criteria during the formal State Board adoption process. The schedule for conducting

the Panel's formal review and approval per the California Water Code statute will need to be determined in consultation with State Board staff as part of the State Board's formal review and adoption process.

CALIFORNIA WATER CODE
CHAPTER 7.3 DIRECT AND INDIRECT POTABLE REUSE
SECTION 13560-13569

13560. The Legislature finds and declares the following:

(a) In February 2009, the state board unanimously adopted, as Resolution No. 2009-0011, an updated water recycling policy, which includes the goal of increasing the use of recycled water in the state over 2002 levels by at least 1,000,000 acre-feet per year by 2020 and by at least 2,000,000 acre-feet per year by 2030.

(b) Section 13521 requires the department to establish uniform statewide recycling criteria for each varying type of use of recycled water where the use involves the protection of public health.

(c) The use of recycled water for indirect potable reuse is critical to achieving the state board's goals for increased use of recycled water in the state. If direct potable reuse can be demonstrated to be safe and feasible, implementing direct potable reuse would further aid in achieving the state board's recycling goals.

(d) Although there has been much scientific research on public health issues associated with indirect potable reuse through groundwater recharge, there are a number of significant unanswered questions regarding indirect potable reuse through surface water augmentation and direct potable reuse.

(e) Achievement of the state's goals depends on the timely development of uniform statewide recycling criteria for indirect and direct potable water reuse.

(f) This chapter is not intended to delay, invalidate, or reverse any study or project, or development of regulations by the department, the state board, or the regional boards regarding the use of recycled water for indirect potable reuse for groundwater recharge, surface water augmentation, or direct potable reuse.

(g) This chapter shall not be construed to delay, invalidate, or reverse the department's ongoing review of projects consistent with Section 116551 of the Health and Safety Code.

13561. For purposes of this chapter, the following terms have the following meanings:

(a) "Department" means the State Department of Public Health.

(b) "Direct potable reuse" means the planned introduction of recycled water either directly into a public water system, as defined in Section 116275 of the Health and Safety Code, or into a raw water supply immediately upstream of a water treatment plant.

(c) "Indirect potable reuse for groundwater recharge" means the planned use of recycled water for replenishment of a groundwater basin or an aquifer that has been designated as a source of water supply for a public water system, as defined in Section 116275 of the Health and Safety Code.

(d) "Surface water augmentation" means the planned placement of recycled water into a surface water reservoir used as a source of domestic drinking water supply.

(e) "Uniform water recycling criteria" has the same meaning as in Section 13521.

13561.5. The state board shall enter into an agreement with the department to assist in implementing this chapter.

13562. (a) (1) On or before December 31, 2013, the department shall adopt uniform water recycling criteria for indirect potable reuse for groundwater recharge.

(2) (A) Except as provided in subparagraph (C), on or before December 31, 2016, the department shall develop and adopt uniform water recycling criteria for surface water augmentation.

(B) Prior to adopting uniform water recycling criteria for surface water augmentation, the department shall submit the proposed criteria to the expert panel convened pursuant to subdivision (a) of Section 13565. The expert panel shall review the proposed criteria and shall adopt a finding as to whether, in its expert opinion, the proposed criteria would adequately protect public health.

(C) The department shall not adopt uniform water recycling criteria for surface water augmentation pursuant to subparagraph (A), unless and until the expert panel adopts a finding that the proposed criteria would adequately protect public health.

(b) Adoption of uniform water recycling criteria by the department is subject to the requirements of Chapter 3.5 (commencing with Section 11340) of Part 1 of Division 3 of Title 2 of the Government Code.

13562.5. Notwithstanding any other law, no later than June 30, 2014, the department shall adopt, by emergency regulations in accordance with Chapter 3.5 (commencing with Section 11340) of Part 1 of Division 3 of Title 2 of the Government Code, requirements for groundwater replenishment using recycled water. The adoption of these regulations is an emergency and shall be considered by the Office of Administrative Law as necessary for the immediate preservation of the public peace, health, safety, and general welfare. Notwithstanding Chapter 3.5 (commencing with Section 11340) of Part 1 of Division 3 of Title 2 of the Government Code, emergency regulations adopted by the department pursuant to this section shall not be subject to review by the Office of Administrative Law and shall remain in effect until revised by the department.

13563. (a) (1) On or before December 31, 2016, the department, in consultation with the state board, shall investigate and report to the Legislature on the feasibility of developing uniform water recycling criteria for direct potable reuse.

(2) The department shall complete a public review draft of its report by September 1, 2016. The department shall provide the public not less than 45 days to review and comment on the public review draft.

(3) The department shall provide a final report to the Legislature

by December 31, 2016. The department shall make the final report available to the public.

(b) In conducting the investigation pursuant to subdivision (a), the department shall examine all of the following:

(1) The availability and reliability of recycled water treatment technologies necessary to ensure the protection of public health.

(2) Multiple barriers and sequential treatment processes that may be appropriate at wastewater and water treatment facilities.

(3) Available information on health effects.

(4) Mechanisms that should be employed to protect public health if problems are found in recycled water that is being served to the public as a potable water supply, including, but not limited to, the failure of treatment systems at the recycled water treatment facility.

(5) Monitoring needed to ensure protection of public health, including, but not limited to, the identification of appropriate indicator and surrogate constituents.

(6) Any other scientific or technical issues that may be necessary, including, but not limited to, the need for additional research.

(c) (1) Notwithstanding Section 10231.5 of the Government Code, the requirement for submitting a report imposed under paragraph (3) of subdivision (a) is inoperative on December 31, 2020.

(2) A report to be submitted pursuant to paragraph (3) of subdivision (a) shall be submitted in compliance with Section 9795 of the Government Code.

13563.5. (a) The department, in consultation with the state board, shall report to the Legislature as part of the annual budget process, in each year from 2011 to 2016, inclusive, on the progress towards developing and adopting uniform water recycling criteria for surface water augmentation and its investigation of the feasibility of developing uniform water recycling criteria for direct potable reuse.

(b) (1) A written report submitted pursuant to subdivision (a) shall be submitted in compliance with Section 9795 of the Government Code.

(2) Pursuant to Section 10231.5 of the Government Code, this section is repealed on January 1, 2017.

13564. In developing uniform water recycling criteria for surface water augmentation, the department shall consider all of the following:

(a) The final report from the National Water Research Institute Independent Advisory Panel for the City of San Diego Indirect Potable Reuse/Reservoir Augmentation (IPR/RA) Demonstration Project.

(b) Monitoring results of research and studies regarding surface water augmentation.

(c) Results of demonstration studies conducted for purposes of approval of projects using surface water augmentation.

(d) Epidemiological studies and risk assessments associated with projects using surface water augmentation.

(e) Applicability of the advanced treatment technologies required for recycled water projects, including, but not limited to, indirect potable reuse for groundwater recharge projects.

(f) Water quality, limnology, and health risk assessments

associated with existing potable water supplies subject to discharges from municipal wastewater, stormwater, and agricultural runoff.

(g) Recommendations of the State of California Constituents of Emerging Concern Recycled Water Policy Science Advisory Panel.

(h) State funded research pursuant to Section 79144 and subdivision (b) of Section 79145.

(i) Research and recommendations from the United States Environmental Protection Agency Guidelines for Water Reuse.

(j) The National Research Council of the National Academies' report titled "Water Reuse: Potential for Expanding the Nation's Water Supply Through Reuse of Municipal Wastewater."

(k) Other relevant research and studies regarding indirect potable reuse of recycled water.

13565. (a) (1) On or before February 15, 2014, the department shall convene and administer an expert panel for purposes of advising the department on public health issues and scientific and technical matters regarding development of uniform water recycling criteria for indirect potable reuse through surface water augmentation and investigation of the feasibility of developing uniform water recycling criteria for direct potable reuse. The expert panel shall assess what, if any, additional areas of research are needed to be able to establish uniform regulatory criteria for direct potable reuse. The expert panel shall then recommend an approach for accomplishing any additional needed research regarding uniform criteria for direct potable reuse in a timely manner.

(2) The expert panel shall be comprised, at a minimum, of a toxicologist, an engineer licensed in the state with at least three years' experience in wastewater treatment, an engineer licensed in the state with at least three years' experience in treatment of drinking water supplies and knowledge of drinking water standards, an epidemiologist, a limnologist, a microbiologist, and a chemist. The department, in consultation with the advisory group and the state board, shall select the expert panel members.

(3) Members of the expert panel may be reimbursed for reasonable and necessary travel expenses.

(b) (1) On or before January 15, 2014, the department shall convene an advisory group, task force, or other group, comprised of no fewer than nine representatives of water and wastewater agencies, local public health officers, environmental organizations, environmental justice organizations, public health nongovernmental organizations, the department, the state board, the United States Environmental Protection Agency, ratepayer or taxpayer advocate organizations, and the business community, to advise the expert panel regarding the development of uniform water recycling criteria for direct potable reuse and the draft report required by Section 13563. The department, in consultation with the state board, shall select the advisory group members.

(2) Environmental, environmental justice, and public health nongovernmental organization representative members of the advisory group, task force, or other group may be reimbursed for reasonable and necessary travel expenses.

(3) In order to ensure public transparency, the advisory group established pursuant to paragraph (1) shall be subject to the Bagley-Keene Open Meeting Act (Article 9 (commencing with Section 11120) of Chapter 1 of Part 1 of Division 3 of Title 2 of the

Government Code).

(c) On or before June 30, 2016, the department shall prepare a draft report summarizing the recommendations of the expert panel.

(d) The department may contract with a public university or other research institution with experience in convening expert panels on water quality or potable reuse to meet all or part of the requirements of this section should the department find that the research institution is better able to fulfill the requirements of this section by the required date.

13566. In performing its investigation of the feasibility of developing the uniform water recycling criteria for direct potable reuse, the department shall consider all of the following:

(a) Recommendations from the expert panel appointed pursuant to subdivision (a) of Section 13565.

(b) Recommendations from an advisory group, task force, or other group appointed by the department pursuant to subdivision (b) of Section 13565.

(c) Regulations and guidelines for these activities from jurisdictions in other states, the federal government, or other countries.

(d) Research by the state board regarding unregulated pollutants, as developed pursuant to Section 10 of the recycled water policy adopted by state board Resolution No. 2009-0011.

(e) Results of investigations pursuant to Section 13563.

(f) Water quality and health risk assessments associated with existing potable water supplies subject to discharges from municipal wastewater, stormwater, and agricultural runoff.

13567. An action authorized pursuant to this chapter shall be consistent, to the extent applicable, with the federal Clean Water Act (33 U.S.C. Sec. 1251 et seq.), the federal Safe Drinking Water Act (42 U.S.C. Sec. 300f et seq.), this division, and the California Safe Drinking Water Act (Chapter 4 (commencing with Section 116270) of Part 12 of Division 104 of the Health and Safety Code).

13569. The department may accept funds from nonstate sources and may expend these funds, upon appropriation by the Legislature, for the purposes of this chapter.

APPENDIX B: 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 comments 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.

Examples of recent NWRI Panels include:

- **Development of Water Recycling Criteria for Indirect Potable Reuse through Surface Water Augmentation and the Feasibility of Developing Criteria for Direct Potable Reuse** for the State Water Resources control Board Division of Drinking Water (CA)
- **Evaluating Water Quality Testing at the Silicon Valley Advanced Water Purification Center for Future Potable Reuse Applications** for the Santa Clara Valley Water District (CA)
- **Developing Proposed Direct Potable Reuse Operational Procedures and Guidelines for New Mexico** for the New Mexico Environment Department (NM)
- **Monterey Peninsula Groundwater Replenishment Project** for the Monterey Regional Water Pollution Control Agency (CA)
- **Groundwater Recharge Scientific Study** for the LOTT Clean Water Alliance (WA)
- **Groundwater Replenishment System Program Review** for the Orange County Water District (CA)
- **Examining the Criteria for Direct Potable Reuse** for Trussell Technologies (CA) and WateReuse Research Foundation (VA)
- **Evaluating Potable Reuse** for the Santa Clara Valley Water District (CA)
- **Indirect Potable Reuse/Reservoir Augmentation Project Review** for the City of San Diego (CA)
- **BDOC as a Surrogate for Organics Removal in Groundwater Recharge** for the California Department of Public Health (CA)
- **Recycled Water Master Plan** for Tucson Water (AZ)
- **Groundwater Replenishment Project Review** for the Los Angeles Department of Water and Power (CA)

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

APPENDIX C: Panel Member Biographies

Adam Olivieri, Dr.PH, P.E. (Panel Co-Chair)
Vice President
EOA Inc. (Oakland, CA)

Adam Olivieri has 35 years of experience in the technical and regulatory aspects of water recycling, groundwater contamination by hazardous materials, water quality and public health risk assessments, water quality planning, wastewater facility planning, urban runoff management, and on-site waste treatment systems. He has gained this experience through working as a staff engineer with the California Regional Water Quality Control Board (San Francisco Bay Region), as staff specialist (and Post-doc fellow) with the School of Public Health at the University of California, Berkeley, project manager/researcher for the Public Health Institute, and as a consulting engineer. He is currently the Vice president of EOA, Inc., where he manages a variety of projects, including serving as Santa Clara County Urban Runoff Program's Manager since 1998. Olivieri is also the author or co-author of numerous technical publications and project reports. He received a B.S. in Civil Engineering from the University of Connecticut, an M.S. in Civil and Sanitary Engineering from the University of Connecticut, and both an MPH and Dr.PH in Environmental Health Sciences from University of California, Berkeley.

James Crook, Ph.D., P.E. (Panel Co-Chair)
Water Reuse and Environmental Engineering Consultant (Boston, MA)

Jim Crook is an environmental engineer with more than 40 years of experience in state government and consulting engineering arenas, serving public and private sectors in the U.S. and abroad. He has authored more than 100 publications and is an internationally recognized expert in water reclamation and reuse. He has been involved in numerous projects and research activities involving public health, regulations and permitting, water quality, risk assessment, treatment technology, and all facets of water reuse. Crook spent 15 years directing the California Department of Health Services' water reuse program, during which time he developed California's first comprehensive water reuse criteria. He also spent 15 years with consulting firms overseeing water reuse activities and is now an independent consultant specializing in water reuse. He currently serves on several advisory panels and committees sponsored by NWRI and others. Among his honors, he was selected as the American Academy of Environmental Engineers' 2002 Kappe Lecturer and the WateReuse Association's 2005 Person of the Year. Crook received a B.S. in Civil Engineering from the University of Massachusetts and both an M.S. and Ph.D. in Environmental Engineering from the University of Cincinnati.

Michael Anderson, Ph.D.
Professor of Applied Limnology and Environmental Chemistry and Chair
Department of Environmental Sciences

University of California, Riverside (Riverside, CA)

Michael Anderson, a Professor of Applied Limnology and Environmental Chemistry, has taught courses at the University of California, Riverside, since 1990. His research focus includes water and soil sciences, with particular emphasis in applied limnology and lake/reservoir management; surface water quality and modeling; fate of contaminants in waters, soils, and sediments; and environmental chemistry. Current research projects include laboratory, field, and modeling studies in support of the development of species conservation habitat at the Salton Sea, sponsored by the California DWR and DFG, and a survey of organochlorine pesticides and Polychlorinated Biphenyls (PCBs) in McGrath Lake that is funded by the Los Angeles Regional Water Quality Control Board. He and his students also recently completed studies quantifying the abundance and distribution of quagga mussel veligers in the reservoirs of the Colorado River Aqueduct, as well as assessing the ecological and biological conditions at Lake Elsinore. In addition, he has served on various panels and workgroups, including as member of the California Department of Water Resource's Salton Sea Hydrologic Technical Workgroup (2007-2008). Anderson received a B.S. in Biology from Illinois Benedictine College, M.S. in Environmental Studies from Bemidji State University, and Ph.D. in Environmental Chemistry from Virginia Tech.

Richard Bull, Ph.D.
Consulting Toxicologist
MoBull Consulting (Richland, WA)

Since 2000, Richard Bull has been a Consulting Toxicologist with MoBull Consulting, where he conducts studies on the chemical problems encountered in water for water utilities, as well as federal, state, and local governments. Bull is a Professor Emeritus at Washington State University, where he maintains Adjunct Professor appointments in the College of Pharmacy and the Department of Environmental Science. Formerly, he served as a senior staff scientist at DOE's Pacific Northwest National Laboratory, Professor of Pharmacology/Toxicology at Washington State University, and Director of the Toxicology and Microbiology Division in the Cincinnati Laboratories for the U.S. Environmental Protection Agency. Bull has published extensively on research on central nervous system effects of heavy metals, the carcinogenic and toxicological effects of disinfectants and disinfection by-products, halogenated solvents, acrylamide, and other contaminants of drinking water. He has also served on many international scientific committees convened by the National Academy of Sciences, World Health Organization, and International Agency for Research on Cancer regarding various contaminants of drinking water. Bull received a B.S. in Pharmacy from the University of Washington and a Ph.D. in Pharmacology from the University of California, San Francisco.

Dr.-Ing. Jörg E. Drewes
Chair Professor, Chair of Urban Water Systems Engineering
Technische Universität München (Munich, Germany)

Jörg Drewes joined the Technische Universität München in 2013. Prior, he was a professor in the Department of Civil and Environmental Engineering at Colorado School of Mines (CSM), where he taught from 2001 to 2013. While at CSM, he served as the Director of Research for the National Science Foundation's Engineering Research Center *ReNUWIt* (which included Stanford University, University of California Berkeley, New Mexico State University, and CSM). He also served as Co-Director of CSM's Advanced Water Technology Center (AQWATEC). Drewes is actively involved in research in the areas of energy efficient water treatment and non-potable and potable water reuse. Current research interests include treatment technologies leading to potable reuse and the fate and transport of persistent organic compounds in these systems. He has published more than 250 journal papers, book contributions, and conference proceedings, and served on National Research Council Committees on *Water Reuse as an Approach for Meeting Future Water Supply Needs* and *Onsite Reuse of Graywater and Stormwater*. He also currently serves as Chair of the International Water Association (IWA) Water Reuse Specialist Group. Drewes received a Cand. Ing. (B.S.), Dipl. Ing. (M.S.), and Doctorate (Dr.-Ing.) in Environmental Engineering from the Technical University of Berlin, Germany.

Charles Haas, Ph.D.
Department Head, L.D. Betz Professor of Environmental Engineering
Drexel University (Philadelphia, PA)

Charles Haas is the Department Head of the Civil, Architectural, and Environmental Engineering at Drexel University since 1991. He is also the L.D. Betz Professor of Environmental Engineering and Director of the Drexel Engineering Cities Initiative. Prior to joining Drexel, he served on the faculties of Rensselaer Polytechnic Institute and the Illinois Institute of Technology. Haas specializes in water treatment, risk assessment, environmental modeling and statistics, microbiology, and environmental health. He received a B.S. in Biology and M.S. in Environmental Engineering, both from the Illinois Institute of Technology. He also received a Ph.D. in Environmental Engineering from the University of Illinois at Urbana-Champaign.

Walter Jakubowski, M.S.
Consultant
WaltJay Consulting (Spokane, WA)

Walter Jakubowski has degrees in Pharmacy from Brooklyn College of Pharmacy, Long Island University; in microbiology from Oregon State University, and graduate training in epidemiology from the University of Minnesota. He has research publications on hospital pharmacy; on microorganisms in oysters and clams under the federal Shellfish Sanitation Program, and more than 40 peer-reviewed publications on determining the health effects and public health significance of pathogens, especially intestinal protozoa and viruses, in drinking water, waste water and municipal sewage sludge. He has served as a consultant to the World

Health Organization on pathogenic intestinal protozoa (for development of the International Drinking Water Guidelines), and to the Pan-American Health Organization on environmental virus methods. He was instrumental in conducting the first international symposium on *Legionella* and Legionnaire's Disease at the Centers for Disease Control. He has more than 48 years of experience working with waterborne pathogens, especially enteric viruses, *Giardia* and *Cryptosporidium.* He initiated landmark studies on the human infectious dose of *Cryptosporidium* and chaired the Joint Task Group on Pathogenic Intestinal Protozoa for *Standard Methods for the Examination of Water and Waste Water* from 1978 to 2005. He was a charter member of U.S. EPA's Pathogen Equivalency Committee and served on that committee until his retirement from the U.S. Public Health Service/Environmental Protection Agency in 1997. Since then, he has been practicing as a private consultant while serving on various professional committees, panels, and boards.

Perry McCarty, Sc.D.
Silas H. Palmer Professor of Civil and Environmental Engr. Emeritus
Stanford University (Stanford, CA)

Perry McCarty is the Silas H. Palmer Professor of Civil and Environmental Engineering Emeritus at Stanford University. McCarty received the Clarke Prize Award in 1997 for his significant contributions to the areas of water treatment, reclamation, groundwater recharge, and water chemistry and microbiology. He is universally recognized for his research on understanding contaminant behavior in groundwater aquifers and sediments. McCarty has received numerous honors, including being elected to the National Academy of Engineering and American Academy of Arts and Sciences, as well as receiving an honorary doctorate from the Colorado School of Mines. He was also awarded the John and Alice Tyler Prize for Environmental Achievement in 1992 and the Stockholm Water Prize in 2007. McCarty received his B.S. from Wayne State University, and both his M.S. and Sc.D. from Massachusetts Institute of Technology.

Kara Nelson, Ph.D.
Professor
University of California, Berkeley (Berkeley, CA)

Kara Nelson is a Professor in Civil and Environmental Engineering at the University of California, Berkeley. She received her B.A. degree in biophysics from U.C. Berkeley, her M.S.E. degree in environmental engineering from the University of Washington, and her Ph.D. in environmental engineering from U.C. Davis. Her research program addresses critical issues at the intersection of public health and the environment, with a focus on reducing the threat posed by waterborne pathogens by improving our engineering infrastructure to make it more effective, affordable, as well as maximize its environmental benefits. Specific research areas include mechanisms of pathogen inactivation, molecular techniques for pathogen detection, optimizing treatment processes, water reuse, and challenges with providing safe drinking water and

sanitation in the developing world. Dr. Nelson has published over 50 articles in peer-reviewed journals, including two invited reviews, and one book chapter. She is the Director of Graduate Education at the National Science Foundation Engineering Research Center for Reinventing our Nation's Urban Water Infrastructure (ReNUWIt), the faculty leader of the Research Thrust Area on Safe Water and Sanitation at Berkeley Water Center. Dr. Nelson was awarded the Presidential Early Career Award for Scientists and Engineers (PECASE) at a ceremony in the White House in 2004. This award is the nation's highest honor for scientists in the early stages of their career.

Joan B. Rose, Ph.D.
Homer Nowlin Endowed Chair for Water Research
Michigan State University (East Lansing, MI)

Joan Rose, a professor at Michigan State University, has made groundbreaking advances in understanding water quality and protecting public health for more than 20 years and has published over 300 articles. She is widely regarded as the world's foremost authority on the microorganism *Cryptosporidium* and was the first person to present a method for detecting this pathogen in water supplies. She examines full-scale water treatment systems for the removal of pathogens. In 2001, she received the Athalie Richardson Irvine Clarke Prize from NWRI for her advances in microbial water-quality issues. She served as the Chair of the Science Advisory Board for the U.S. Environmental Protection Agency's Drinking Water Committee for 4 years, and currently serves on the Science Advisory Board for the Great Lakes. In addition, she is Co-Director of the Center for Water Sciences (which includes work with the Great Lakes and Human Health Center of the National Oceanic & Atmospheric Administration) at Michigan State University, where she is also Director of the Center for Advancing Microbial Risk Assessment. Rose received a B.S. in Microbiology from the University of Arizona, an M.S. in Microbiology from the University of Wyoming, and a Ph.D. in Microbiology from the University of Arizona.

David Sedlak, Ph.D.
Malozemoff Professor, Department of Civil and Environmental Engineering
University of California, Berkeley (Berkeley, CA)

David Sedlak is a Professor of Civil and Environmental Engineering at the University of California, Berkeley. He is also Co-Director of the Berkeley Water Center and Deputy Director of the National Science Foundation's Engineering Research Center for Reinventing the Nation's Urban Water Infrastructure (ReNUWIt). His research focus is on the fate of chemical contaminants, with the long-term goal of developing cost-effective, safe, and sustainable systems to manage water resources. Sedlak's previous experience includes Staff Scientist at ENVIRON Corporation and membership on the National Research Council's Committee on Water Reuse. He has individually or co-authored over 70 peer-reviewed publications, among many other publications and presentations. Sedlak published a book in 2014 called "Water 4.0: The Past, Present, and Future of The World's Most Vital Resource," where he points out that most of the

population gives little thought to the hidden systems that bring us water and take it away and how these marvels of engineering face challenges that cannot be solved without a fundamental change to our relationship with water. Sedlak received a B.S. in Environmental Science from Cornell University and a Ph.D. in Water Chemistry from the University of Wisconsin.

Tim Wade, Ph.D.
Epidemiology Branch Chief
United States Environmental Protection Agency (Durham, NC)

Tim Wade is the Epidemiology Branch Chief at the United States Environmental Protection Agency (U.S. EPA) and Assistant Professor of Epidemiology at the University of North Carolina, Chapel Hill. Wade has been working with the U.S. EPA since 2005, conducting a series of epidemiologic studies to evaluate the health effects of arsenic exposure in well water in Inner Mongolia. As Branch Chief, Wade determines research priorities, directs staff and post-doctoral students, and manages an annual budget of over $1 million annually. In 2011, Wade received the EPA Office of Water Bronze Medal for his exceptional service to the Office of Water in the development of recreational water quality criteria. He received a B.A. in Biological Science from California Polytechnic at Pomona, a B.A. in Psychobiology from Claremont McKenna College, and both an MPH and Ph.D. in Epidemiology from the University of California at Berkeley.

APPENDIX D: Meeting Agenda

NATIONAL WATER RESEARCH INSTITUTE

Expert Panel

SWRCB's Division of Drinking Water (DDW)
Development of Water Recycling Criteria for
Indirect Potable Reuse through Surface Water Augmentation and the
Feasibility of Developing Criteria for Direct Potable Reuse

Meeting #4 Agenda
March 11-12, 2015

LOCATION
San Francisco Estuary Institute
4911 Central Avenue
Richmond, CA 94804

CONTACTS
Jeff Mosher (Cell)
714-705-3722
Brandi Caskey (NWRI Office)
(714) 378-3278

Meeting Objectives:

- Continue to review the State Board's draft criteria for surface water augmentation.
- Review and finalize the draft Panel report on Reservoir Criteria from Meeting #3.
- Receive input on the draft National DPR Framework document funded by the WateReuse Association.
- Finalize the Panel Report from Meeting #2.

Wednesday, March 11, 2015

Closed Session Starts 8:30 am

8:30 am	Welcome and Introductions	Jeff Mosher, NWRI
8:45 am	Review Agenda and Meeting Objectives	Adam Olivieri and Jim Crook, Panel Co-Chairs
9:00 am	Presentation on Draft Panel Report from Meeting #3	Michael Anderson, Panel Member
10:30 am	**Break**	
10:45 am	Panel Discussion, Conclusions, and Edits to Report #3	Co-Chairs

12:00 pm	**Lunch**	
12:45 pm	Wrap-Up Panel Discussion on Report #3	Co-Chairs
Open Session Starts 1:30 pm		
1:30 pm	Panel Follow-Up Questions/Discussion on Reservoir Criteria with State Board staff	Co-Chairs
2:30 pm	**Break**	
4:00 pm	Wrap up	Co-Chairs
4:30 pm	**ADJOURN**	

Thursday, March 12, 2015

Open Session Starts 8:30 am

8:30 am	Welcome and Introductions	Co-Chairs
8:45 am	DPR Advisory Committee Update	Marsi Steirer, Advisory Committee Representative
9:15 am	Presentation on National DPR Framework	George Tchobanoglous, U.C. Davis
10:00 am	Discussion on the DPR Framework	Co-Chairs
10:30 am	**Break**	
10:45 am	Continue DPR Framework Discussion	Co-Chairs
12:00 pm	**Lunch**	

Closed Session Starts 1:00 pm (with State Board staff)

1:00 pm	Panel Review and Finalization of Meeting Report #2	Co-Chairs
2:30 pm	**Break**	
2:45 pm	Panel Review and Finalization of Meeting Report #2	Co-Chairs
3:30 pm	Wrap up and Next Steps (Meeting Calendar)	Co-Chairs
4:00 pm	**ADJOURN**	

APPENDIX E: Meeting Attendees

Panel Members:

- *Panel Co-Chair:* Adam Olivieri, Dr.P.H., P.E., EOA, Inc. (Oakland, CA)
- *Panel Co-Chair:* James Crook, Ph.D., P.E., Water Reuse and Environmental Engineering Consultant (Boston, MA)
- Michael Anderson, Ph.D., University of California, Riverside (Riverside, CA)
- Richard Bull, Ph.D., MoBull Consulting (Richland, WA)
- Dr.-Ing. Jörg E. Drewes, Technische Universität München (Munich, Germany) (on phone)
- Charles Haas, Ph.D., Drexel University (Philadelphia, PA)
- Walter Jakubowski, M.S., WaltJay Consulting (Spokane, Washington) (on phone)
- Perry McCarty, Sc.D., Stanford University (Stanford, CA)
- Joan B. Rose, Ph.D., Michigan State University (East Lansing, MI)
- Tim Wade, Ph.D., United States Environmental Protection Agency (Durham, NC)

National Water Research Institute:

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

State Water Resources Control Board, Division of Drinking Water:

- Randy Barnard, P.E.
- Mark Bartson, P.E.
- Brian Bernados, P.E.
- Stefan Cajina, P.E.
- Jing-Tying Chao, P.E.
- Cindy Forbes, P.E.
- Bob Hultquist, P.E.
- Karen Larsen
- Mike McKibben, P.E.
- Sherly Rosilela (on phone)
- Kurt Souza, P.E. (on phone)

Utility Representatives:

- Jim Fielder, P.E., D.WRE, Chief Operating Officer, Santa Clara Valley Water District
- Albert Lau, P.E., Director of Engineering and Planning, Padre Dam Municipal Water District
- Jeff Pasek, Watershed Manager, City of San Diego
- Marsi Steirer, Deputy Director, City of San Diego
- Toby Roy, Water Resources Manager, San Diego County Water Authority

Others:

- Sasha Harris-Lovett, University of California Berkeley

- Nancy King, California Department of Water Resources (on phone)
- Bruce Macler, Ph.D., U.S. Environmental Protection Agency
- Brian Pecson, Trussell Technologies, Inc.
- Tom Pezzetti, California Department of Water Resources
- Michael Ross, California Department of Water Resources (on phone)
- George Tchobanoglous, Ph.D., P.E., NAE, University of California, Davis
- Jennifer West, WateReuse California

APPENDIX F: Final Review of Supplemental Information Derived from Panel Report #2

TABLE 1
POTENTIAL TOPICS -
ADDITIONAL INPUT FROM PANEL ON SWA DRAFT CRITERA (IN RESPONSE TO DDW COMMENTS ON PANEL REPORT #2)

BASED ON PANEL DISCUSSIONS – PANEL MEETING #4

Pretreatment/Source Control Program Comments (60321 [a]).

- The overall objective of this section needs to focus on the requirement for a source control program aimed at the protection of public health. The Panel understands that existing regulations (both Federal and State) and permits (i.e., publicly owned treatment works [POTW] and drinking water plants) require some form of source control and/or pretreatment program. For example, National Pollutant Discharge Elimination System (NPDES) permits issued to POTWs typically require a pretreatment program that generally is focused on the protection of POTW operations. Over time, in some cases, this requirement shifted to include source control efforts as part of POTW permit compliance with water-quality based receiving water objectives. As part of regulating safe drinking water, watershed protection and source control focuses on protecting the source waters for public consumption. Thus, the pretreatment/source control program needs to be a credible barrier for the entire reclaimed water project. An additional level of scrutiny is needed as part of developing clear regulations that requires considering potential risks to the public through the drinking water supply and which contaminants are of concern today and which could be of concern tomorrow.

- Further clarification and focus is necessary for potential recycled water projects that receive a significant (as defined by the State Board) contribution of wastewater from industrial sources. Questions may arise about contaminants from, for example, the biotechnology industry, nano-manufacturing, and wastewater mostly comprised of commercial and industrial operations.

  PANEL INPUT: In addition to the above comments/concerns, the Panel firmly believes that both the POTW source control program and the SDWA source water protection program are fundamental to the success of IPR-SWA projects and the protection of public health. The careful integration and implementation of these two programs, as well as a clear criteria that defines the process for adaptive management, is needed as part of developing regulations to consider and respond to potential risks to the public through the their drinking water supply and which contaminants are of concern today and which could be of concern tomorrow.

Pathogens and Chemicals Comments (60321.001, 60321.003, and 60321.005)

- If alternative treatment processes are proposed, it is unclear what criteria will be used to evaluate "equivalency." The State Board should provide the rationale for determining what constitutes equivalent treatment and reliability.

  DDW RESPONSE: The alternative must provide "at least the same level of protection to public health." The rationale is that if the standard criteria are deemed protective of public health, then an alternative that's at least as protective would necessarily also have to be protective. The intent of this section is to be non-prescriptive, to ensure flexibility for future changes in treatment technologies. There are too many variables to identify the specific criteria too be used in regulation, or even guidance. The proponent will have to demonstrate to DDW that the alternative provides at least the same level of protection. DDW has been making case-by-case decisions for many years and will use its experience with approving alternatives to consider appropriate criteria. If necessary, DDW seeks input from outside experts to help make such determinations.

  *It should be noted that, if the Panel decides the standard criteria are acceptable, then a criterion that allows for an alternative that is **at least** as protective, must also be acceptable.*

  PANEL INPUT: The Panel noted the following were needed to clarify the above draft criteria language and implementation of the approach:

  a) Add the following BOLD text to the draft criteria language directly after "equivalency" in the first sentence – **with respect to the removal and reliability of contaminants of concern.**
  b) Identify an example(s) in the DDW documentation/guidance of a process/approach that has been successfully used by the State and/or U.S. Environmental Protection Agency (EPA) to address this type of "equivalency" analysis/decision making (e.g., see EPA Pathogen Equivalency Committee process: http://water.epa.gov/scitech/wastetech/biosolids/criteria.cfm; while the committee only deals with pathogen equivalency, this provides some guidance for setting up an alternative treatment process scheme for chemicals and microorganisms).

- What is the basis for the log reduction criteria listed in Section 60321.003, particularly those included in Part (c)?

  DDW RESPONSE: DDW would like further clarification regarding this comment. For example:
  *1) Is the comment asking **only** for supporting information for subsection (c)? DDW agrees that should be provided, and will.*
  *2) Is the Panel **also** asking for further information regarding the overall log-reduction criteria (12-log enteric virus, 10-log Giardia cyst, and 10-log Cryptosporidium oocyst reduction)? If so, on what aspects does the Panel need further information?*

  PANEL INPUT: The Panel noted that providing supporting information as identified above under item #1 was sufficient.

- Clarify and/or correct requirements contained in the groundwater replenishment regulations and how they are included as part of the draft IPR criteria. For example, the total organic carbon (TOC) limit to verify reverse osmosis (RO) performance is different

than that imposed for groundwater recharge projects, and there appears to be no TOC limit for the treated recycled water. The rationale for these changes should be provided.

DDW RESPONSE: A TOC limit of 0.5 mg/L (as is used in the groundwater recharge criteria) was not included because it seemed unnecessary. However, upon reflection, it makes sense to include the 0.5 mg/L limit for SWA. It's consistent with DDW approach with groundwater recharge and will protect against use of degrading membranes. Thank you.

PANEL INPUT: The Panel notes that there is no scientific basis tied to public health protection to support the use of TOC as a criteria limit. The Panel noted that the SWA criteria needs to provide (a) an option for the use of more effective surrogates for testing and monitoring the RO process, and (b) an option for allowing the use of "equivalent" alternative treatment process(s) to RO.

- Provide technical rationale and references supporting assumptions for microbial log reduction credits that could be given to the reservoir – and how it is measured.

  DDW RESPONSE: DDW believes the rationale and references for the log reduction for viruses was provided.

  DDW does not currently have a means for determining reservoir LRVs for other organisms, which is why they're not included in the criteria. Please let us know what other information is needed by the Panel.

  PANEL INPUT: The Panel deleted the State Board's proposed LRVs criteria; therefore, no additional input is needed.

- Clarify criteria and the technical basis for allowing or not allowing log reduction credits in reservoirs.

  DDW RESPONSE: The rationale for allowing or not allowing organism LRVs is the current status of the science on quantifying the log reduction. DDW knows how to calculate an LRV for virus based on measurable variables. However, there is currently no correlation between LRV and measurable variables for the other organisms. Beyond time for viruses, other potential credits proposed during the Independent Advisory Panel meetings for the San Diego project were deemed to be not significant enough by that panel of experts. DDW is open to recommendations from this Panel.

  PANEL INPUT: The Panel deleted the State Board's proposed LRVs criteria; therefore, no additional input is needed.

Monitoring Comments 60321.008 "Monitoring between a SWSAP Recycled Water Discharge and Domestic Water Supply Withdrawal Point")

- Adding water with lower total dissolved solids could cause the mobilization of certain water constituents present in sediments by solubilization depending upon local geology. Is this a potential problem? If so, how will it be recognized and managed?

DDW agrees this needs to be considered and looks forward to the Panel's suggestions, particularly with the potential for elevating nutrients that may result in algal blooms, etc.

PANEL INPUT: The Panel has no additional input and encourages State Board staff to consider the above comment as part of their ongoing process for evaluating the general chemistry associated with the routine monitoring of reservoir water quality.

- The Panel was interested in the State Board's opinions about potential public health threats associated with toxic inorganic substances.

DDW RESPONSE: DDW looks forward to the Panel's opinions and suggestions regarding this issue, including examples of additional potential inorganic threats. Currently, DDW believes the issue will be addressed via existing DW standards and new standards as they're developed and adopted.

PANEL INPUT: The Panel has no additional input and encourages State Board staff to consider the above comment as part of their ongoing process for evaluating the general chemistry associated with the routine monitoring of reservoir water quality.

- Sanitary surveys and other structures need to be incorporated into this regulatory process and/or clearly explained if they are part of other CWA, CWC, and SDWA regulations.

DDW RESPONSE: DDW can provide the information, but seeks clarification as to what the Panel intends when it states, "need to be incorporated into this regulatory process." If the Panel is suggesting that DDW include frequencies of sanitary surveys into the regulation, then DDW disagrees.

1. It isn't appropriate for DDW to be regulating itself in its own regulations. The legislature and US EPA provide that 'service'. (See next comment).

2. The H&SC and US EPA establishes frequencies for sanitary surveys. If we think these projects should result in more frequent inspections, the Boards can do that administratively via internal policy. The frequencies in law are minimums; DDW/Boards can inspect and conduct surveys as often as needed.

3. It is the responsibility of the regulating agencies to conduct inspections and surveys of the regulated community, while meeting statutory mandates. DDW believes this topic is beyond the scope of the development of criteria specific to SWA, and thus beyond the charge of the Panel.

PANEL INPUT: See Panel input above under the heading "Pretreatment/Source Control Program Comments."

Comments on Other Topics: Reservoir Receiving Water Quality and Other Beneficial Uses, Operator Training/Certification, Public Education, and Health Surveillance

Reservoir Water Quality and Other Beneficial Uses

- The Panel cautions that the full set of beneficial uses for the reservoirs should be considered. Multiple beneficial uses can be allowed and are usually encouraged on

reservoirs, including boating, kayaking, and swimming. Therefore, impacts beyond those activities on drinking water should be considered as part of SWA. An example of potential impacts includes raising the temperature of the reservoir (which could increase the likelihood of algal blooms – specifically, cyanobacteria blooms – and create an environment more conducive to the growth and survival of thermophilic microorganisms, some of which could be opportunistic pathogens).

DDW RESPONSE: The effects of multiple uses on the drinking water quality are dealt with during implementation of the SWTR and other drinking water regulations. The SWA regulation must assure that the potable reuse project will not significantly degrade the quality or treatability of the reservoir water. Impairment of the reservoir with respect to uses other than augmentation with RW is beyond the scope of the regulation.

However, DDW agrees that impacts related to SWA with RW, beyond those already considered, need to be considered. DDW looks forward to suggestions from the Panel in this regard, like the example provided above. It should be noted that many details can be addressed via a project proponent's engineering report or operations plan, rather than within the regulation itself. Thank you for comment.

PANEL INPUT: The Panel notes it is their assumption that the above concerns should be adequately addressed as part of the local agency seeking SWA-IPR approvals through meeting CWA, CEQA, and SDWA requirements.

- The ecological function of the reservoir could change as part of a surface water augmentation IPR project. Thus, it may be necessary to initially characterize and then track water quality parameters, as well as biota, annually or more frequently to observe changes.

DDW RESPOSNE: DDW looks forward to the Panel's suggestions for specific water quality parameters to be added to the monitoring program to make it robust enough to characterize and identify problems related specifically to public health.

PANEL INPUT: The Panel notes it is their assumption that the above concerns should be adequately addressed as part of the local agency seeking SWA-IPR approvals through meeting CWA, CEQA, and SDWA requirements.

Operator Training and Certification

- POTW operators must be certified to ensure the proper and reliable operation of wastewater treatment plants to meet NPDES discharge requirements, and water system operators must be certified to ensure that systems are operated safely and produce safe potable water. The successful operation of IPR projects that adequately protect public health will continue to require some of both types of operators and certifications and may also require a new operator and certification that bridges the boundary between these two very distinct types of plants.

*DDW RESPOSNE: DDW agrees this is an area that needs consideration and resolution. However, this is not something that can be currently addressed in a regulation since this only beginning to get the attention of other organizations (e.g. CA-NV-AWWA). However, DDW anticipates ensuring the SWA project proponents address the concern on a case-by-case basis via their operations plan, where various options would be considered, including: 1) WW operators **also** obtaining DW certification, 2) Requiring the agencies to provide their operators intense training to better understand the ramifications of POTW upsets/issues, their relationship to DW, and remedial actions. DDW looks forward to the Panel's thoughts on this subject.*

PANEL INPUT: The Panel notes that handling the issue on a case-by-case basis is too ad hoc and that State Board staff (and/or the appropriate State agency) needs to investigate developing a program that ensures robust operator training for IPR projects. The Panel understands that the DPR Advisory Committee has engaged in this subject, as well as some professional organizations, and that State Board staff needs to fully engage to ensure the success of the efforts. The Panel looks forward to hearing the status of these efforts from State Board staff at future Panel meetings.

Emergency Operation and Water Supply

- Provision for emergency operation and water supply are absolutely necessary for the adequate protection of public health. A clear and transparent discussion of how this will be managed should be required of every project proposing a recycled water plan for potable reuse. The Panel will have additional comments on this subject as it reviews and better understands the definition of terms utilized within the criteria, specific objective(s) that the criteria are meant to achieve, and inter-relationship between the disparate sections in the draft criteria.

  DDW RESPONSE: DDW agrees. Each agency (PWS and RW) will have to establish a plan to address contingency actions to be taken in the event of emergencies. This would be in the form of a plan submitted for review and approval, with the cooperation of the PWS that owns and operates the reservoir. The PWS would update its emergency plan accordingly.

  PANEL INPUT: The Panel has no additional input at this time.

TABLE 2 - ADITIONAL INFORMATION TO BE PRODIVIDED BY SWB-DDW TO PANEL ON SWA CRITERIA COMMENTS (FROM PANEL REPORT#2)

ADDITIONAL COMMENTS FROM PANEL DISCUSSION AT MEETING #4

Monitoring Comments 60321.008 "Monitoring between a SWSAP Recycled Water Discharge and Domestic Water Supply Withdrawal Point"

- The document indicates that monitoring should be undertaken for the following reasons: providing baseline data to (1) determine potential impacts of the recycled water discharge on water quality and (2) identify treatment failures. The Panel questions the value of quarterly monitoring for detecting treatment failures. Additional clarification and specificity are needed regarding the location, parameters, and frequency of monitoring to address the above noted question.

  DDW misstated the purpose provided ("identifying failures"). Treatment plant process and effluent monitoring are the primary monitoring means for detecting treatment failures. The quarterly reservoir monitoring serves other purposes, such as data gathering for assessments, efficacy confirmation, a form of treatment reliability, and general monitoring of reservoir changes (or lack of). The specifics of the monitoring are provided in the draft regulation, but DDW will review the criteria to see if further clarification is needed.

  PANEL INPUT: The Panel recommends that the term "off-spec" replace the term "failure" in the draft criteria. The Panel also looks forward to reviewing the revised draft criteria and may have additional input.

- Pathogen monitoring will not *necessarily* provide failure information. The Panel believes that the State Board needs to consider an adaptive monitoring program with higher frequency testing initially and then scaled down as the number of samples increases (this can be addressed yearly to adjust the sampling strategy rather than just starting off with quarterly sampling). Human viruses may appear in reservoirs if there is recreation, as well as parasites from animals. In addition, the State Board should consider the need for both initial and future routine monitoring efforts in the reservoir prior to the introduction of treated source water. Factors such as sample location(s), seasonal variability, hydrodynamic changes, and the potential for surface runoff impacts need to be considered. More detail and scientific background is needed for Section 60321.008. New inputs of pathogens should not be seen when recycled water is added to the reservoir.

DDW will consider a more robust baseline monitoring program that takes into account those issues, as well as the locational concern noted, but would like clarity regarding why the Panel is advocating such monitoring.

PANEL INPUT: The Panel looks forward to reviewing the revised draft criteria and may have additional input.

- Because of concerns about potential public health and water quality problems, the Panel would like to review the constituents and characteristics to be included in the monitoring program. Specifically, the Panel would like to receive a copy of the regulation sections mentioned in Section 60321.008 (b)(1) and (b)(2). In addition, there seems to be a need to clarify the relationship between Section 60321.006 "Additional Chemical and Constituent Monitoring" (which is on treatment and reservoir monitoring) and Section 60321.008 (reservoir monitoring and frequency).

  DDW will clarify and provide the information. Thank you.

  PANEL INPUT: The Panel looks forward to reviewing the revised draft criteria and may have additional input.

Recommendations and Next Steps

The overall focus of the next Panel meeting is on continuing the Panel review of the draft IPR criteria. Given the uncertainty associated with understanding the draft reservoir criteria, the Panel recommends that this subject should be the initial focus of the next Panel meeting. The goal of the next meeting should be as follows:

DDW intends to finish providing a statement about the objectives and basis of each concept related to adequately protecting public health. DDW is considering furnishing SWA criteria in a non-regulatory form, to make better use of the Panel's time.

PANEL INPUT: The Panel looks forward to reviewing the revised draft criteria and may have additional input. At this point, the Panel would like to see a complete revised SWA criteria package with a clean-up of text taken from the groundwater recharge criteria, along with additional clarification and/or information on questions noted by the Panel.