

**NATIONAL WATER RESEARCH INSTITUTE**

**Final Panel Meeting Report #5:  
Surface Water Augmentation – IPR Criteria Review**

Based on an Expert Panel Meeting Held June 2-3, 2015  
(Expert Panel Meeting #5)

*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)

July 2, 2015  
Fountain Valley, California

[www.nwri-usa.org/ca-panel.htm](http://www.nwri-usa.org/ca-panel.htm)

## ABOUT NWRI

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

*For more information, please contact:*

National Water Research Institute  
18700 Ward Street  
P.O. Box 8096  
Fountain Valley, California 92728-8096 USA  
Phone: (714) 378-3278  
Fax: (714) 378-3375  
[www.nwri-usa.org](http://www.nwri-usa.org)  
[www.nwri-usa.org/ca-panel.htm](http://www.nwri-usa.org/ca-panel.htm)

Jeffrey J. Mosher, Executive Director  
Gina Melin Vartanian, Editor

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## ACKNOWLEDGMENTS

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The Expert Panel (Panel) on “Development of Water Recycling Criteria for Indirect Potable Reuse through Surface Water Augmentation and the Feasibility of Developing Criteria for Direct Potable Reuse” was formed at the request of the Drinking Water Program of the California Department of Public Health (CDPH) in 2013.

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.

The Panel would like to thank State Board staff for the information, materials, and suggestions received from the State Board staff as part of the fifth Panel Meeting. In particular, the Panel thanks Mr. Randy Barnard, Mr. Mark Bartson, Mr. Brian Bernados, Ms. Jing-Tying Chao, Mr. Robert Hultquist, Ms. Karen Larson, Mr. Mike McKibben, and Dr. David Spath of the State Board staff for their assistance. The Panel also appreciates the support of Mr. Bruce Burton, Chief of the Northern California Drinking Field Operations Branch, who serves as the State Board staff project representative on this effort.

In addition, the Panel thanks the National Water Research Institute for administering and organizing the Panel’s efforts. Specifically, the Panel would like to thank Ms. Brandi Caskey, Ms. Suzanne Faubl, Ms. Jaime Lumia, Mr. Jeff Mosher, and Ms. Gina Vartanian. The Panel would also like to recognize the State Board’s Direct Potable Reuse (DPR) Advisory Committee for participating in the fifth Panel Meeting.

## **DISCLAIMER**

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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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## ACRONYMS

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CCR	California Code of Regulations
CDPH	California Department of Public Health
CPRC	California Potable Reuse Committee
DDW	State Water Resources Control Board Division of Drinking Water
DPR	Direct potable reuse
IPR	Indirect potable reuse
MCL	Maximum contaminant level
NL	Notification level
NWRI	National Water Research Institute
PWS	Public Water System
RWQCB	Regional Water Quality Control Board
State Board	State Water Resources Control Board
SWA	Surface water augmentation
SWSAP	Surface water source augmentation project
TOC	Total organic carbon
WRA	Water Recycling Agency



## **1. PURPOSE OF THE REPORT**

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The purpose of this report is to provide the State Water Resources Control Board (State Board) with the Expert Panel's recommendations based on information provided by State Board Division of Drinking Water (DDW) staff at the Panel meeting held June 2-3, 2015, regarding the draft document titled "Surface Water Augmentation Using Recycled Water," prepared by the State Board DDW staff and dated May 15, 2015.



## 2. PURPOSE AND HISTORY OF THE PANEL

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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<sup>1</sup>. 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.

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<sup>1</sup> 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., P.E. 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](http://www.nwri-usa.org/ca-panel.htm).

### 3. PANEL MEETING #5

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A two-day meeting of the Panel (Panel Meeting #5) was held on June 2-3, 2015, at the Hotel Irvine, Irvine, California. The specific focus of the meeting was on the State Board's draft IPR-SWA Criteria, although time was devoted to key DPR issues.

#### 3.1 Background Material

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

- “*Surface Water Augmentation Criteria – Review: General Notes for the Expert Panel*,” prepared by the State Board DDW staff and dated May 15, 2015.
- “*Surface Water Augmentation Using Recycled Water*,” prepared by the State Board DDW staff and dated May 15, 2015.
- *Draft Final Panel Meeting Report #4: Surface Water Augmentation – IPR Criteria Review (Dated April 8, 2015) – Volume I (Panel Meeting #4: March 11-12, 2015)*, submitted April 8, 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.
- Tchobanoglous, G., J. Cotruvo, J. Crook, E. McDonald, A. Olivieri, and R.S. Trussell (pending). *Framework for Direct Potable Reuse*, WateReuse Association, Alexandria, VA, draft dated May 14, 2015.

#### 3.2 Meeting Agenda and Logistics

Staff from NWRI, the Co-Chairs of the Panel, and 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 IPR-SWA Criteria.
- 2) Finalize Panel report from Panel meeting #4.
- 3) Receive an update on activities of the DPR Advisory Group.
- 4) Consider Panel Conceptual Approval of the draft IPR-SWA criteria.
- 5) Receive an update on the DPR pilot project in San Diego, California.
- 6) Receive input on bio-analytical tools.
- 7) Initiate a discussion of the draft “DPR Framework” document under development as it relates to key DPR issues.

The Panel met in a closed session on the first day to discuss and finalize the Panel Report from Meeting #4, focusing mostly on the Panel's edits/questions to State Board DDW staff on the draft IPR-SWA criteria and DDW's response to those edits/questions contained in the May 15, 2015, revised draft criteria. The Panel finalized Report #4 during that time.

Following the initial closed session, the Panel met with State Board DDW staff to review and discuss the Panel's proposed edits/questions to the May 15, 2015, draft criteria; these edits are contained in Panel Report #5 (based on the June 2-3, 2015, Panel meeting). The Panel also discussed unsolicited comments sent to the State Board and then to the Panel Co-Chairs on two subjects related to the draft reservoir criteria and, as part of this report, are providing the Panel's input to State Board DDW staff (see Section 4.3).

The second day included an open session providing an update on the Panel's recommendations to the State Board DDW staff regarding the May 15, 2015, draft criteria and on additional questions from meeting attendees. The Panel noted that, while it is willing to entertain certain questions as part of the open sessions, all questions/concerns should be submitted to DDW staff as part of the State Board public rule-making process. During the second day open session, the Panel also received an update from the State Board's DPR Advisory Group by Member Julie Labonte of MWH, as well as presentations by Dr. R. Shane Trussell of Trussell Technologies on "Demonstrating Redundancy and Monitoring to Achieve Reliable Potable Reuse" and Dr. Richard Bull (Panel Member) on "Potential Use of Bio-analytical Screening Methods for AWT/DPR Facilities." Finally, the Panel held a closed session on day two to begin to identify key DPR topics and initiate planning for the next Panel meeting on September 23-24, 2015.

### **3.3 Meeting Attendees**

All Panel members participated at the meeting except Dr. Tim Wade, who had a prior commitment. Drs. Kara Nelson and Jörg Drewes participated via a web-enabled conference call. Other attendees included NWRI staff, State Board DDW 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

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A key focus of this Panel meeting was to continue to review the draft *Surface Water Augmentation Criteria* (dated May 15, 2015) prepared by State Board DDW staff to respond to Panel Report #4 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 Statements.
- Recommendations to the State Board on the May 15, 2015 Draft Criteria.
- Response to Unsolicited Comments.

### 4.1 General Statements

The Panel commends the effort by the State of California, specifically the State Board's DDW, to develop draft SWA criteria 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. In this respect, the Panel recognizes and appreciates the State Board DDW staff response to Panel questions and recommendations contained in Panel Report #4.

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.

The following sections contain a note on finalizing the Panel report from Meeting #4, a summary of the Panel's clarifications on unsolicited comments sent to State Board DDW staff on two subjects related to the draft SWA reservoir criteria, and the Panel's comments and recommendations of the draft document dated May 15, 2015 (i.e., annotations on the draft DDW staff document).

### 4.2 Discussion with State Board DDW Staff on the Draft Final Panel Meeting Report Covering the March 11-12, 2015, Panel Meeting #4 (draft dated April 8, 2015) and Finalization of Panel Report #4

The Panel briefly discussed remaining questions with State Board DDW staff at the June 2015 meeting on the Draft Final Report dated April 18, 2015 (Panel Report #4). The Report was finalized without any modifications.

### 4.3 Clarification of Draft DDW Reservoir Criteria Based on Panel Meeting #4 Discussions

The Panel also discussed and clarified several comments made to State Board DDW staff, as well as during the Panel open session, that (i) misinterpreted the proposed DDW criteria, resulting in a perceived requirement for reservoir operation under steady-state conditions, and (ii) proposed an alternative apparent retention time requirement. The Panel provides the following clarifications:

#### *(i) Reservoir Operation and Steady-State*

A comment was made that the draft DDW reservoir criteria are based on the assumption that reservoirs are operated under steady-state conditions. While steady-state assumptions were used in some calculations (e.g., Section 4.4.2 of Panel Report #4) to illustrate general features and trends related to reservoir augmentation, the draft criteria do not in any way require such operational constraints. Consider for example the existing text (see Section 4.4 below) describing the  $t_r$  requirement of 6-months (§64668.30[b]), which states:

*Monthly, the SWSAP PWS shall calculate and record the theoretical retention time. The theoretical retention time shall be value (in units of months) resulting from dividing the volume of water in the reservoir at the end of each month, by the total outflow from the reservoir during the corresponding month.*

The monthly calculation of  $t_r$  allows for day-to-day variation in flows in/out and requires only compliance with the 6-month  $t_r$  value over the monthly averaging window, thus not requiring regimented steady-state operation. Moreover, significant flexibility exists for reservoirs with nominal  $t_r$  values greater than 6-months. The value of residence time was recognized in early regulatory concepts and provides time to respond to treatment upsets and also allows for *in situ* reaction and reduction of contaminants.

#### *(ii) Alternative Requirement of $V/Q_{in} > 4$ Months*

A comment was made that DDW and the Expert Panel consider defining retention time as  $V/Q_{in}$  (advanced treated water)  $\geq 4$  months as measured daily. The Panel notes that the proposed use of  $V/Q_{in}$  of  $\geq 4$  months measured daily is not a measure of residence time per se, but rather represents the theoretical dilution factor for a 1-day pulse of advanced treated wastewater in the reservoir. Assuming 30 days/month, this corresponds to a theoretical dilution of 1:120.

Further, as the proposed Panel recommendations contain the 1:100 or 1:10 plus 1-log additional treatment requirements, use of the  $V/Q_{in}$  as defined above would contain two different dilution requirements: (1) a theoretical dilution of 1:120 of advanced treated wastewater (as noted above); and (2) the more rigorously quantified dilution of 1:100 or 1:10 achieved at the reservoir outlet using tracer studies and hydrodynamic modeling (as stated in the Panels' recommendations). Thus, the above proposed use of  $V/Q_{in}$  does not represent nor mandate a minimum requirement for average residence time in the reservoir. The Panel believes that there is significant benefit to specifying a minimum  $t_r$  value (as defined by the Panel in 64668.30 (b) –

see Section 4.4 below); it defines in a simple way time to respond to treatment plant upsets, defines a meaningful period of time for *in situ* treatment, and also places simple requirements on reservoir operation with respect to the delivery of augmented surface waters to downstream treatment plants and, ultimately, to water consumers.

**4.4 Review and Recommendations on the State Board DDW Staff Draft Surface Water Augmentation Using Recycled Water Regulations (Title 22 CCR, Division 4, Chapter 3, Dated May 15, 2015)**

The following section contains (via annotations on the draft State Board DDW staff document) the Panel’s comments and recommendations of the draft subject document dated May 15, 2015. The additional recommended modifications and discussions with State Board DDW staff at the June Panel meeting are shown below in strike-out and **blue highlighted** added text. The Panel understands the Section numbers may change, but found that using the format noted below is an easier way to provide the Panel’s recommendations.

**BEGINNING OF RECOMMENDATIONS ON DRAFT REGULATIONS**

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NOTE: Red text refers to Panel Report #4

SBDDW-15-00X  
Surface Water Augmentation Using Recycle Water  
May 15, 2015

**TITLE 22, CALIFORNIA CODE OF REGULATIONS**

**DIVISION 4, CHAPTER 3**

**ARTICLE 1. Definitions**

**§60301.120. Augmented Reservoir.**

"Augmented Reservoir" means a surface water reservoir used as a source of domestic drinking water supply that receives recycled municipal wastewater (CONSIDER DEFINING AS "ADVANCED TREATED WATER") from a Surface Water Source Augmentation Project (SWSAP). "Surface water" has the same meaning as defined in section 64651.83 of Chapter 17.

*p. 16*

NOTE: Authority cited: Sections 13521 and 13562, Water Code; and Section 116271, Health and Safety Code. Reference: Sections 13520, 13522, 13522.5, 13523, 13523.1, 13524, 13560, 13561 and 13562.5, Water Code; and Section 116551, Health and Safety Code. *[Current baseline A/R note for SWA; will vary; to be addressed later.]*

**§60301.851. Surface Water Source Augmentation Project or SWSAP.**

"Surface Water Source Augmentation Project" or "SWSAP" means a project involving the planned placement of recycled municipal wastewater into a surface water reservoir that is used as a source of domestic drinking water supply. "Surface water" has the same meaning as defined in section 64651.83 of Chapter 17. *p. 16*

**§60301.852. Surface Water Source Augmentation Project Public Water System or SWSAP PWS.**

"Surface Water Source Augmentation Project Public Water System" or "SWSAP PWS" means the public water system(s) that plans to utilize or is utilizing an augmented reservoir as a source of drinking water, and is responsible for meeting the requirements of Chapter 17 and the applicable requirements of this Chapter. "Surface water" has the same meaning as defined in section 64651.83 of Chapter 17. *NA*

**§60301.853. Surface Water Source Augmentation Project Water Recycling Agency or SWSAP WRA.**

"Surface Water Source Augmentation Project Water Recycling Agency" or "SWSAP WRA" means an agency that is subject to water-recycling requirements for a Surface Water Source Augmentation Project (SWSAP) from a Regional Water Quality Control Board (Regional Board) and is, in whole or part, responsible for applying to the Regional Board and/or State Board for a permit, obtaining a permit, operation of a SWSAP, and complying with the terms and conditions of the permit and the requirements of this Chapter. "Surface water" has the same meaning as defined in section 64651.83 of Chapter 17. *p. 16*

**ARTICLE 5.3. Indirect Potable Reuse: Surface Water Augmentation**

As written, it seems that only Points One and Two of 60320.300 are required, but that it is the Panel's understanding that ALL the criteria are required. Please clarify.

**§60320.300. General Requirements.**

(a) Prior to augmentation of a reservoir using a SWSAP, each SWSAP WRA and each SWSAP PWS participating in the SWSAP shall submit a joint plan to the State Board and



RWQCB for review and written approval that, at a minimum, addresses the elements in paragraphs (1) and (2) below. The joint plan shall be signed by the person or persons with authority and responsibility to operate the SWSAP in compliance with the requirements of this Article and ensure that each SWAP WRA and SWAP PWS implement the actions designated in the joint plan. In the event of any subsequent change in applicable authority, responsibility, operation, or ownership of a SWSAP WRA or SWSAP PWS, including the addition of any participating SWSAP WRA or SWSAP PWS, a revised joint plan shall be submitted to the State Board and RWQCB for review and written approval. A revised joint plan shall also be submitted to reflect any change in the information provided pursuant to paragraphs (1) and (2) below, and to address any State Board or RWQCB concerns. A revised joint plan required by this section shall be submitted not less than sixty (60) days prior to the effective date of any change reflected in the revised joint plan.

(1) Corrective actions to be taken in the event that a the delivery of recycled municipal water to an augmented reservoir fails to meet the water quality requirements of this Article.

(2) The procedures the SWSAP WRA shall implement for notifying a SWSAP PWS, State Board, and Regional Board of:

(A) operational changes that may adversely affect the quality of the recycled municipal wastewater to be delivered to an augmented reservoir, and

(B) the events and actions in paragraph (1). *NA, see note p. 17*

(b) Prior to design and operation of a SWSAP, a SWSAP WRA shall demonstrate to the State Board and Regional Board that the SWSAP WRA possesses adequate financial, managerial, and technical capability to assure compliance with this Article. *60321(c), p. 17*

(c) Prior to augmentation of a reservoir using a SWSAP, a SWSAP WRA shall demonstrate that all treatment processes are installed and will be operated by the SWSAP WRA, as designed, 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 section 60323, Article 7 of Chapter 3. *60321(d), p. 17*

(d) If a SWSAP WRA fails to complete compliance monitoring required pursuant to this Article, compliance may be determined based on available data. 60321(e), p. 17

(e) A SWSAP WRA shall ensure that the recycled municipal wastewater used for a SWSAP is from a wastewater management agency that is not in violation of the effluent limits or water quality requirements that pertain to surface water augmentation pursuant to this Article, as established in the wastewater management agency's Regional Board permit. 60321(a)(3) and (f), p. 17.

(f) If a SWSAP WRA has been directed by the State Board or Regional Board to suspend augmentation of a reservoir pursuant to this Article, augmentation of the reservoir shall not resume until the SWSAP WRA has obtained written approval from the State Board and Regional Board. 60321(g), p. 17 - 18

**§60320.302. Advanced Treatment Criteria. 60321.005, p. 19-22**

A SWSAP WRA shall ensure the continuous treatment, with full advanced treatment meeting the criteria in this section, of the entire recycled municipal wastewater stream prior to delivery to an augmented reservoir. 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 SWSAP WRA shall select for use a reverse osmosis membrane such that:

(1) each membrane element used in the SWSAP 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 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 a permeate of no less than 15 percent (15%);  
(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 an alternative surrogate parameter and corresponding limit approved by the State Board), as verified through monitoring no less frequent than weekly.

(b) For the reverse osmosis treatment process, a SWSAP WRA shall propose, for State Board review and written approval, on-going performance monitoring (e.g., conductivity, 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.

(c) To demonstrate a sufficient oxidation treatment process has been designed for implementation, the SWSAP WRA shall conduct testing demonstrating that an oxidation treatment process will provide no less than 0.5-log (69 percent) reduction of 1,4-dioxane.

(1) A SWSAP WRA shall submit a testing protocol, as well as the subsequent results, to the State Board for review and written approval. The testing shall include challenge or spiking tests, using 1,4-dioxane, to demonstrate the proposed oxidation treatment process will achieve the minimum 0.5-log reduction under the proposed oxidation treatment process's normal full-scale operating conditions.

(2) A SWSAP WRA shall establish, and submit to the State Board for review and written approval, surrogate and/or operational parameters that reflect whether the minimum 0.5-log 1,4-dioxane reduction design criterion 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. *Section 60321.005(d), p. 22*

(d) During full-scale operation of the oxidation treatment process designed pursuant to subsection (c), a SWSAP WRA shall continuously monitor the surrogate and/or operational parameters established pursuant to subsection (c)(2). A SWSAP WRA shall implement, in full-

scale operation, the oxidation treatment process as designed pursuant to subsection (c).

*subsection (e), p. 22*

(e) Within 60 days after completing the first 12-months of monitoring pursuant to subsection (d), a SWSAP WRA shall submit a report to the State Board and Regional Board that includes:

(1) the results of the monitoring performed in subsection (d);

(2) the removal of 1,4-dioxane, as indicated by surrogate and/or operational parameter monitoring;

(3) a description of the efficacy of the surrogate and/or operational parameters to reflect the removal differential of 1,4-dioxane; and

(4) a description of actions taken, or to be taken, if the 1,4-dioxane did not meet the associated design criteria in subsection (c), the continuous surrogate and/or operational parameter monitoring in subsection (c)(2) fails to correspond to the differential 1,4-dioxane removal, or the surrogate and/or operational parameter established in subsection (c)(2) is not met. *subsection (f), p. 22*

(f) Within 60 days after completing the initial 12 months of operation of the reverse osmosis process (or alternative process approved pursuant to 60320.330), a SWSAP WRA shall submit a report to the State Board 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. *subsection (g), p. 23*

(g) Each quarter, a SWSAP WRA shall calculate what percent of results of the quarter's monitoring, conducted pursuant to subsections (b) and (d), 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 SWSAP WRA shall:

(1) submit a report to the State Board and Regional Board that identifies the reason(s) for the 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 State Board and Regional Board and, if required, comply with an alternative monitoring plan approved by the State Board and Regional Board. *subsection (h), p. 22 - 23*

(h) Each month a SWSAP WRA shall collect samples (~~grab or composite~~) representative (PLEASE TIE THE DEFINITION TO THE EXPECTATION CONTAINED IN DEVELOPING THE ENGINEERING REPORT REQUIRED BY THE CRITERIA; OTHERWISE, THE TERM IS UNDEFINED AND TOO BROAD) 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 SWSAP WRA may apply to the State Board and Regional Board 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 60320.312 and 60320.320. The effluent of the advanced treatment process shall not exceed an MCL. *subsection (i), p. 23*

**§60320.304. Lab Analyses. 60321.002, p. 18**

(a) Analyses for contaminants having primary or secondary MCLs shall be performed by a laboratory that has accreditation or certification pursuant to section 100825 of the Health and Safety Code utilizing drinking water methods approved by the State Board.

(b) Analyses for chemicals other than those having primary or secondary MCLs shall be described in the SWSAP WRA's Operation Plan prepared pursuant to section 60320.322.

**§60320.306. Wastewater Source Control. 60321, p. 16**

A SWSAP WRA shall ensure that the recycled municipal wastewater used for a SWSAP shall be from a wastewater management agency that:

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

(b) implements and maintains a source control program that includes, at a minimum;

(1) an assessment of the fate of State Board-specified and Regional Board-specified chemicals and contaminants through the wastewater and recycled municipal wastewater treatment systems,

(2) chemical and contaminant source investigations and monitoring that focuses on State Board-specified and Regional Board-specified chemicals and contaminants,

(3) an outreach program to industrial, commercial, and residential communities within the portions of the sewage collection agency's service area that flows into the water reclamation plant subsequently supplying the SWSAP, for the purpose of managing and minimizing the discharge of chemicals and contaminants at the source, and

(4) a current inventory of chemicals and contaminants identified and evaluated pursuant to this section, including new chemicals and contaminants resulting from new sources or changes to existing sources, that may be discharged into the wastewater collection system.

**§60320.308. Pathogenic Microorganism Control. 60321.003, p. 18 - 19**

(a) A SWSAP WRA shall design and operate SWSAP treatment processes such that the recycled municipal wastewater delivered to an augmented reservoir for use by a SWSAP PWS receives treatment as follows:

(1) For a SWSAP PWS implementing the requirements of section 64668.30(c)(1) of Chapter 17, the treatment train shall reliably achieve at least 8-log enteric virus reduction, 7-log<sub>10</sub> *GiardiaGiardia* cyst reduction, and 8-log<sub>10</sub> *CryptosporidiumCryptosporidium* oocyst reduction, consisting of at least two separate treatment processes for each pathogen (i.e., enteric virus, *GiardiaGiardia* cyst, or *CryptosporidiumCryptosporidium* oocyst). A separate treatment process may be credited with no more than 6-log<sub>10</sub> reduction, with at least two processes each being credited with no less than 1.0-log<sub>10</sub> reduction.

(2) For a SWSAP PWS implementing the requirements of section 64668.30(c)(2) of Chapter 17, the treatment train shall reliably achieve at least 9-log<sub>10</sub> enteric virus reduction, 8-log<sub>10</sub> *GiardiaGiardia* cyst reduction, and 9-log<sub>10</sub> *CryptosporidiumCryptosporidium* oocyst reduction, consisting of at least three separate treatment processes for each pathogen (i.e., enteric virus, *GiardiaGiardia* cyst, or *CryptosporidiumCryptosporidium* oocyst). A separate treatment

process may be credited with no more than 6-log<sub>10</sub> reduction, with at least three processes each being credited with no less than 1.0-log<sub>10</sub> reduction.

(b) The SWSAP WRA 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 State Board's review and written approval, or by using a challenge test approved by the State Board, 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 an 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 SWSAP WRA shall propose and include in its Operations Plan prepared pursuant to section 60320.322, 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 applicable pathogen reduction in subsection (a) is not met based on the on-going monitoring required pursuant to subsection (b), within 24 hours of such knowledge the SWSAP WRA shall 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 SWSAP WRA shall, within 24 hours of knowledge of such a failure, notify the State Board, Regional Board, and SWSAP PWS. Failures of shorter duration shall be reported to the Regional Board no later than 10 days after the month in which the failure occurred.

(d) The SWSAP WRA shall, within 24 hours of knowledge, notify the State Board, Regional Board, and SWSAP PWS and, unless directed otherwise by the State Board or the Regional Board, discontinue delivery of recycled municipal wastewater to the SWSAP augmented reservoir if:

(1) pursuant to the pathogen reduction requirements in subsection (a)(1), the effectiveness of the treatment train's ability to reduce enteric virus is less than 6-logs, *GiardiaGiardia* cysts reduction is less than 5-logs, or *CryptosporidiumCryptosporidium* oocysts reduction is less than 6-logs, or

(2) pursuant to the pathogen reduction requirements in subsection (a)(2), the effectiveness of the treatment train's ability to reduce enteric virus is less than 7-logs, **GiardiaGiardia** cysts reduction is less than 6-logs, or **CryptosporidiumCryptosporidium** oocysts reduction is less than 7-logs.

**§60320.312. Regulated Contaminants and Physical Characteristics Control. 60321.004, p. 19**

(a) Each quarter, as specified in the SWSAP's Operation Plan, a SWSAP WRA shall collect samples (grab or 24-hour composite) representative of the **applieddelivered** recycled municipal wastewater and have the samples analyzed for:

- (1) the inorganic chemicals in Table 64431-A, Chapter 15;
- (2) the radionuclide chemicals in Tables 64442 and 64443, Chapter 15;
- (3) the organic chemicals in Table 64444-A, Chapter 15;
- (4) the disinfection byproducts in Table 64533-A, Chapter 15.5; and
- (5) lead and copper.

(b) Each year, the SWSAP WRA shall collect at least one representative sample (grab or 24-hour composite) of the recycled municipal **wastewater – andwastewater and** have the sample(s) analyzed for the secondary drinking water contaminants in Tables 64449-A and 64449-B of Chapter 15.

(c) If a result of the monitoring performed pursuant to subsection (a) exceeds a contaminant's MCL or action level (for lead and copper), the SWSAP WRA shall collect another sample within 72 hours of notification of the result and then have it analyzed for the contaminant as confirmation. **(It is not clear what or how MCLs and action levels fit into the criteria since they apply at the tap and not at the delivery point to the augmented reservoir. It is the Panel's understanding that this section is intended as an early monitoring tool using MCLs and action levels and not for MCLs and lead and copper compliance monitoring.**



(1) For a contaminant whose compliance with its MCL or action level is not based on a running annual average, if the average of the initial and confirmation sample exceeds the contaminant's MCL or action level, or the confirmation sample is not collected and analyzed pursuant to this subsection, the SWSAP WRA shall notify the State Board and Regional Board within 24 hours and initiate weekly monitoring until four consecutive weekly results are below the contaminant's MCL or action level. If the running four-week average exceeds the contaminant's MCL or action level, the SWSAP WRA shall notify the State Board, SWSAP PWS, and Regional Board within 24 hours and, if directed by the State Board or Regional Board, suspend delivery of the recycled municipal wastewater to the augmented reservoir.

(2) For a contaminant whose compliance with its MCL is based on a running annual average, if the average of the initial and confirmation sample exceeds the contaminant's MCL, or a confirmation sample is not collected and analyzed pursuant to this subsection, the SWSAP WRA shall initiate weekly monitoring for the contaminant until the running four-week average no longer exceeds the contaminant's MCL.

(A) If the running four-week average exceeds the contaminant's MCL, a SWSAP WRA shall describe the reason(s) for the exceedance and provide a schedule for completion of corrective actions in a report submitted to the State Board and Regional Board no later than 45 days following the quarter in which the exceedance occurred.

(B) If the running four-week average exceeds the contaminant's MCL for sixteen consecutive weeks, a SWSAP WRA shall notify the State Board, Regional Board, and SWSAP PWS within 48 hours of knowledge of the exceedance and, if directed by the State Board or Regional Board, suspend delivery of the recycled municipal wastewater to the augmented reservoir.

(d) If the annual average of the results of the monitoring performed pursuant to subsection (b) exceeds a contaminant's secondary MCL in Table 64449-A or the upper limit in Table 64449-B, the SWSAP WRA shall initiate quarterly monitoring of the recycled municipal wastewater for the contaminant and, if the running annual average of quarterly-averaged results exceeds a contaminant's secondary MCL or upper limit, describe the reason(s) for the exceedance and any corrective actions taken 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 State Board. The annual monitoring in subsection (c) may resume if the running annual average of quarterly results does not exceed a contaminant's secondary MCL or upper limit.

(f) If four consecutive quarterly results for asbestos are below the detection limit in Table 64432-A for asbestos, monitoring for asbestos may be reduced to one sample every three years. Quarterly monitoring shall resume if asbestos is detected.

**§60320.320. Additional Chemical and Contaminant Monitoring. 60321.006, p. 23**

(a) Each quarter, the SWSAP WRA shall sample and analyze the recycled municipal wastewater delivered to the augmented reservoir, 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 State Board, based on the State Board's review of the SWSAP's engineering report; and

Comment: Because the linkage is unclear between reservoir monitoring and ATW monitoring, it is important that DDW clarify this relationship and how all the data collected will be reviewed and interpreted (as well as the basis for what is being requested).

For example, are the agencies being asked to monitor these compounds to protect the health of organisms in the reservoir? Can the agencies back off if they get a clean bill of health, or will they always need to monitor? Will the State Board have to make a decision, or is this done at the staff level? Say, hypothetically, if a compound is added to the list and the ATW monitoring identifies it, what triggers the consideration for reservoir monitoring? Or would it only be compounds that already have a notification level?

(2) Chemicals that the State Board has specified, based on a review of the SWSAP's engineering report, the augmented reservoir, and the results of the assessment performed pursuant to section 60320.306(b)(1).

(b) Each quarter, a SWSAP WRA shall sample and analyze the recycled municipal wastewater for State Board-specified chemicals having notification levels (NLs). If a result exceeds an NL, within 72 hours of notification of the result the SWSAP WRA 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 WRA 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, the SWSAP WRA 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 State Board.

(2) If the running four-week average exceeds the contaminant's NL for sixteen consecutive weeks, the SWSAP WRA shall notify the State Board, Regional Board, and SWSAP PWS within 48 hours of knowledge of the exceedance.

(c) A SWSAP WRA may reduce monitoring for the chemicals in this section to once each year following State Board written approval based on the State Board's review of the most recent two years of results of the monitoring performed pursuant to this section.

(d) Annually, the SWSAP WRA shall monitor the recycled municipal wastewater delivered to the augmented reservoir for indicator compounds specified by the State Board and Regional Board based on the following:

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

(2) the inventory developed pursuant to section 60320.306(b)(4);

(3) the ability of an indicator compound to characterize the performance of the advanced water treatment processes for removal of chemicals; presence of pharmaceuticals, endocrine disrupting chemicals, personal care products, and other indicators of the presence of municipal wastewater; and

(4) 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 State Board and Regional Board no later than the quarter following the quarter in which the results are received by the SWSAP WRA.

**§60320.322. SWSAP Operation Plan. 60321(b), p. 17 & 60321.007, p. 24 - 25**

(a) Prior to operation of a SWSAP, a SWSAP WRA shall submit an Operation Plan to the State Board and Regional Board for review and written approval. At a minimum, the Operation

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 State Board and Regional Board. The plan shall also identify an on-going training program that includes the elements of the training required pursuant to subsection (b) of this section. A SWSAP WRA shall be responsible for implementing the Operation Plan and ensuring that the Operation Plan is, at all times, representative of the current operations, maintenance, and monitoring of the SWSAP. The SWSAP WRA shall make the Operation Plan available to the State Board or Regional Board for review upon request.

(b) Prior to operation of a SWSAP, a SWSAP WRA shall, at a minimum, demonstrate to the State Board and Regional Board that the personnel operating and overseeing the SWSAP operations have received training for the purpose of:

(1) ensuring the proper operation of the treatment processes utilized pursuant to sections 60320.302 and 60320.308;

(2) being educated on California's Safe Drinking Water Act and its implementing regulations; and

(3) understanding the potential health risks hazards associated with the consumption of drinking water that does not meet California drinking water standards.

(c) 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 60320.312; and

(3) chemicals and contaminants required pursuant to section 60320.320.

(d) Within six months of optimizing treatment processes pursuant to subsection (c) and anytime thereafter operations are optimized that result in a change in operation, the SWSAP WRA shall update the SWSAP's Operation Plan to include such changes in operational procedures and submit the operations plan to the State Board and Regional Board for review.

§60320.326. Augmented Reservoir Monitoring. 60321.008, p. 25 – 26.

Should language be added somewhere to connect this section to Section 60320.320? The same lists of state-regulated contaminants are referenced in both sections; how are the results linked? This section includes what you have in the reservoir before you put water in, and then the monitoring after the effluent is added.

(a) Prior to augmentation of a reservoir using a SWSAP, the SWSAP WRA, in coordination with the SWSAP PWS, shall identify monitoring locations in the augmented reservoir, for State Board review and written approval, which are representative of the following throughout the volume of the reservoir impacted by the SWSAP:

- (1) Differing water quality conditions across the horizontal extent of the reservoir;
- (2) Each level in the reservoir corresponding to the depths in which water may be withdrawn; and
- (3) From the reservoir's epilimnion and hypolimnion.

(b) Prior to augmentation of a reservoir using a SWSAP, each month, the SWSAP WRA shall collect samples for no less than 24 consecutive months, from the monitoring locations established pursuant to subsection (a). The samples shall be analyzed for the contaminants in tables 64449-A and B of Chapter 15, TOC, total nitrogen, total coliform bacteria, temperature, dissolved oxygen, chlorophyll a, total and dissolved phosphorus, and other State Board-specified chemicals and contaminants based on a review of the SWSAP WRA's engineering report and the results of the assessment performed pursuant to section 60320.306(b)(1).

(c) The SWSAP WRA shall continue to conduct monthly monitoring pursuant to subsection (b) for no less than 24 months following a SWSAP WRA delivering recycled municipal wastewater to an augmented reservoir. In addition, if directed by the State Board, on-going monitoring shall include State Board-specified chemicals and contaminants based on SWSAP operations and the results of recycled municipal wastewater monitoring conducted pursuant to this Article.

(d) After completion of the 24-months of monthly monitoring conducted pursuant to subsection (c), a SWSAP WRA may apply to the State Board for reduced on-going monitoring. The SWSAP WRA shall obtain State-Board written approval prior to implementation of the

reduced monitoring. The reduced on-going monitoring frequency may be no less than once every 12 months.

(e) Notwithstanding subsection (b), (c), and (d), a SWSAP WRA shall monitor for any State Board-specified chemicals or contaminants, at the locations and frequencies specified by the State Board.

**§60320.328. Reporting. 60321.009, p. 26.**

(a) No later than six months after the end of each calendar year, a SWSAP WRA shall provide a report to the State Board, Regional Board, and all SWSAP PWS. Each SWSAP PWS shall be notified by direct mail and/or electronic mail of the availability of the report. The report shall be prepared by an engineer licensed in California and experienced in the fields of wastewater treatment and public water supply. The report shall include the following:

(1) A summary of the SWSAP's compliance status with the monitoring requirements and criteria of this Article during the previous calendar year;

(2) For any violations of this Article during the previous calendar year;

(A) the date, duration, and nature of the violation,

(B) a summary of any corrective actions and/or suspensions of delivery of recycled municipal wastewater to an augmented reservoir resulting from a violation, and

(C) if uncorrected, a schedule for and summary of all remedial actions;

(3) Any detections of monitored chemicals or contaminants, and any observed trends in the monitoring of the augmented reservoir required pursuant to section 60320.326;

(4) A description of any changes in the operation of any unit processes or facilities;

(5) A description of any anticipated changes, along with an evaluation of the expected impact of the changes on subsequent unit processes;

(6) The estimated quantity and quality of the recycled municipal wastewater to be delivered for the next calendar year, as well as the quantity delivered for the previous three years; and

(7) A summary of the measures taken to comply with section 60320.306 and 60320.300(e), and the effectiveness of the implementation of the measures; and

(b) No less frequently than every five years from the date of the initial approval of the engineering report required pursuant to section 60323, Article 7 of Chapter 3, the SWSAP WRA shall update the engineering report to address any SWSAP changes and submit the report to the State Board and Regional Board. The update shall include, but not be limited to, the anticipated increases in delivery of recycled municipal wastewater and a description of the expected impact the increase will have on the SWSAP's ability to meet the requirements of this Article.

**§60320.330. Alternatives. 60321.01, p. 18**

(a) A SWSAP WRA may use an alternative to a requirement in this Article if the SWSAP WRA:

(1) demonstrates to the State Board that the proposed alternative provides an equivalent or better level of performance with respect to the efficacy and reliability of the removal of contaminants of concern to public health, and ensures at least the same level of protection to public health;

(2) receives written approval from the State Board prior to implementation of the alternative; and

(3) if required by the State Board or Regional Board, conducts a public hearing on the proposed alternative, disseminates information to the public, and receives public comments.

(b) 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, but is not limited to, 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.

**DIVISION 4, CHAPTER 17**

**ARTICLE 9. Indirect Potable Reuse: Surface Water Augmentation**

In addition to meeting the applicable requirements of this Chapter, a water supplier augmenting its approved surface water utilizing a Surface Water Source Augmentation Project (SWSAP) shall meet the requirements of this Article and the applicable requirements of Article 5.3 of

Chapter 3. For the purpose of this Article, the water supplier shall be referred to as a Surface Water Source Augmentation Project Public Water System (SWSAP PWS). **NA**

**Section 64668.10. General Requirements and Definitions.**

(a) Unless noted otherwise, the following definitions are applicable for the purpose of this Article:

(1) “Augmented Reservoir” has the same meaning as defined in section 60301.120, Article 1, Chapter 3.

(2) “Surface Water Source Augmentation Project or SWSAP” has the same meaning as defined in section 60301.851, Article 1, Chapter 3.

(3) “Surface Water Source Augmentation Project Public Water System” or “SWSAP PWS” has the same meaning as defined in section 60301.852, Article 1, Chapter 3.

(4) “Surface Water Source Augmentation Project Water Recycling Agency” or “SWSAP WRA” has the same meaning as defined in section 60301.853, Article 1, Chapter 3. **NA**

(b) Prior to using an augmented reservoir as a source of supply, a SWSAP PWS shall submit an application for a permit or permit amendment, and have an approved joint plan with a SWSAP WRA, as required pursuant to section 60320.300 of Article 5.3, Chapter 3. The SWSAP PWS shall revise its emergency plan and operations plan required pursuant to sections 64660(c)(2) and 64661 to include the elements of the joint plan and, at a minimum, include the means of providing an alternative source of domestic water supply, a State Board-approved treatment mechanism, or other actions to be taken, to ensure a reliable supply of water is delivered that is, at all times, pure, wholesome, and potable, in the event that the surface water from the augmented reservoir, as a result of a SWSAP:

(1) **c**Could not be or has not been treated to meet California drinking water standards;

(2) **h**Has been degraded to the degree that it is no longer a safe source of drinking water, as determined by the State Board; or

(3) **r**Receives water that fails to meet subsection 60320.308(d).

***Section 64604, p. 12***



(c) A SWSAP PWS shall have sufficient control over the operation of an augmented reservoir to ensure their ability to comply with the requirements of this Article and the applicable requirements in Article 5.3 of Chapter 3. 64601(b), top of p. 10

§64668.20. Public Hearings. 64603, p. 11 – 12.

Prior to issuance of a permit or permit amendment by the State Board for augmenting its approved surface water source by utilizing a SWSAP, for no fewer than three public hearings held by the State Board, a SWSAP PWS shall:

(a) In coordination with and with the assistance of the SWSAP WRA, develop information for the purpose of being presented to the public at the public hearings and on the Internet. The information shall include, but not limited to, descriptions of the SWSAP, the municipal wastewater source, the treatment processes, monitoring, contingency plans, and anticipated State Board and Regional Board permit provisions.

(b) Provide the State Board, for review and written approval, the information the SWSAP PWS develops pursuant to subsection (a). Following the State Board's approval of the information, the SWSAP PWS shall place the information on a Web site owned and operated by the SWSAP PWS and in a repository (such as a local public library) that provides at least 30 days of public access to the information prior to the public hearings.

(c) Prior to placing the information required pursuant to subsections (a) and (b) in a repository, notify its customers and any public water systems that may receive drinking water impacted by the SWSAP of the following:

- (1) the location and hours of operation of the repository,
- (2) the Internet address where the information may be viewed,
- (3) the purpose of the repository and public hearing,
- (4) the manner in which the public can provide comments, and
- (5) the date, time, and location of the public hearing; and

(d) Deliver the public notification required pursuant to subsection (c), in a manner to reach public water systems and persons whose source of drinking water may be impacted by the SWSAP, by direct mail and using one or more of the following methods:

- (1) local newspaper(s) publication of general circulation; and/or
- (2) television and/or radio broadcast locally.

### **§64668.30. SWSAP Augmented Reservoir Requirements.**

(a) Prior to augmentation of a reservoir using a SWSAP, a reservoir shall have been in operation as an approved surface water supply pursuant to this Chapter for a period of time sufficient to establish a baseline record of reservoir raw water quality, including but not limited to the monitoring required pursuant to section 60320.326 of Chapter 3, 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 receiving recycled municipal wastewater from a SWSAP.

**(CONSIDER ADDING LANGUAGE THAT ALLOWS FOR DDW TO CONSIDER LESS THAN FIVE YEARS OF DATA -- MAYBE TWO YEARS OF COMPLETE AND REPRESENTATIVE RESERVOIR AND WATER TREATMENT PLANT OPERATIONAL DATA).** *64601, p. 9*

(b) An augmented reservoir shall have a theoretical retention time of no less than six months. Monthly, the SWSAP PWS shall calculate and record the theoretical retention time. The theoretical retention time shall be value (in units of months) resulting from dividing the volume of water in the reservoir at the end of each month, by the total outflow from the reservoir during the corresponding month. The total outflow shall include, but not be limited to, all outflows and withdrawals from the reservoir. If a month's theoretical retention time is determined to be less than six months, the SWSAP PWS shall, by the end of the subsequent month, submit a report to the State Board and Regional Board describing the corrective actions to be taken to ensure future theoretical retention times will be no less than six months. *64602(a), p. 10*

(c) Utilizing tracer studies and hydrodynamic modeling, a SWSAP PWS shall demonstrate to the State Board that, at all times under all operating conditions, the ~~total~~ volume of water

withdrawn from the augmented reservoir to be ultimately supplied as a drinking water during a 24-hour period contains no more than:

(1) one percent, by volume, of recycled municipal wastewater that was delivered to the reservoir during any preceding 24-hour period, or

(2) ten percent, by volume, of recycled municipal wastewater that was delivered to the reservoir during any the preceding 24-hour period, with the recycled municipal wastewater delivered by the SWSAP WRA having been subjected to an additional treatment process producing no less than a 1-log reduction of enteric virus, Giardia cysts, and Cryptosporidium oocysts, as noted pursuant to section 60320.308(a)(2).

(A) The additional treatment process need not be a unique type of process from other treatment processes utilized by the SWSAP WRA to meet the requirements of section 60320.308, but shall be independent of and not reliant on the other treatment processes.

(B) The SWSAP PWS, in consultation with the SWSAP WRA, shall obtain the additional treatment process information necessary for demonstrating that the requirements of section 60320.308(a)(2) of Chapter 3 and this paragraph will be met. 64602(b), p. 10

(d) To verify that the dilution requirements of subsection (c) are met, prior to the end of the sixth month of operation under hydraulic conditions representative of normal SWSAP operations, the SWSAP PWS shall initiate a tracer study utilizing an added tracer. The results of the tracer study shall be used to confirm validate the hydrodynamic modeling required in subsection (c) to ensure that compliance with the requirements in Subsection ( c ) have been demonstrated, and, if necessary correct the modeling and the operational constraints in a manner that ensures compliance with the requirements in subsection e. Prior to performing the tracer study, the SWSAP PWS shall submit a tracer study protocol for State Board review and written approval. 64602(d), p. 11 (with below).

(e) Notwithstanding a change in operation allowed pursuant to the SWSAP PWS's permit, prior to initiating a change in operation, including physical changes to the reservoir, that may impact the hydraulic characterization utilized to determine compliance with the requirements of this section, the SWSAP PWS shall notify the State Board and;

(1) demonstrate that the hydraulic characterization used to comply with this section remains valid under the new operation, or

(2) if requested by the State Board, demonstrate compliance pursuant to this section under the new hydraulic conditions. *64602(d), p. 11 (with above).*

## **END OF RECOMMENDATIONS ON DRAFT REGULATIONS**

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### **5. Panel’s Preliminary Conclusions and Next Steps on the IPR-SWA Draft Criteria**

The Panel discussions to date have built on the 1996 Framework document developed by the California Potable Reuse Committee (CPRC) (included in Volume II of this report) to look into the feasibility and safety of potable reuse of recycled water following advanced treatment. While the Panel agrees with the CPRC report, 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 and subsequent draft State Board DDW SWA criteria have resulted in a number of 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 contained above in Section 4.4. The intent of the Panel is to: a) review the revised draft SWA criteria; b) provide any additional comments and/or questions to State Board staff, if necessary; and c) prepare a “preliminary” conceptual approval letter/report on 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

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### 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](http://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

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### **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.

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### **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 WaterReuse 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.

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### **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.

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**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.

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**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 *ReNUWI*t (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.

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**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.

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**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.

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**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.

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**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.

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**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.

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**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.

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**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.

# 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 #5 PRELIMINARY DRAFT Agenda June 2-3, 2015

#### LOCATION

The Hotel Irvine  
17900 Jamboree Road  
Irvine, CA 92614  
\*\*\*Saddleback Conference Room\*\*\*

#### CONTACTS

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

#### Meeting Objectives:

- Finalize Panel Report #4
- Panel Initial Review the State Board's draft criteria for surface water augmentation
- Consider Conceptual Approval of IPR-SWA Criteria—Report #5
- Begin focusing on reviewing the feasibility of developing criteria for DPR

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#### Tuesday, June 2, 2015

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#### 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	Review and Discuss DDW staff SWA Revised Criteria based on Panel Report #4	Moderated by Co-Chairs
10:30 am	<b>Break</b>	
10:45 am	Review and Discuss DDW staff SWA Revised Criteria based on Panel Report #4	Moderated by Co-Chairs
12:00 pm	<b>Lunch</b>	

**Closed Session Starts 12:45 pm (Includes DDW staff)**

12:45 pm	Presentation on Draft SWA Criteria	State Board staff
1:30 pm	Panel Follow-Up Questions/Discussion/Initial Recommendations	Moderated by Co-Chairs
2:30 pm	<b>Break</b>	
3:30 pm	Discussion and Recommendations on Report #5 (Consider Conceptual Approval of IPR-SWA Criteria)	Moderated by Co-Chairs
4:30 pm	Wrap up	Co-Chairs
5:00 pm	<b>ADJOURN</b>	

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**Wednesday, June 3, 2015**

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**Open Session Starts 8:30 am**

8:30 am	Welcome and Introductions	Co-Chairs
8:45 am	Co-Chair Summary of IPR-SWA Recommendations	Co-Chairs
9:00 am	DPR Advisory Group Update	Julie Labonte
9:30 am	DPR Topic Presentation: Potential Use of Bio-Analytical Screening Methods at AWT/DPR facilities	Dick Bull
10:30 am	<b>Break</b>	
10:45 am	DPR Topic Presentation: Status Report on DPR Pilot Demonstration Facility	Shane Trussell
<b>12:00 pm</b>	<b>Lunch</b>	

**Closed Session Starts 1:00 pm**

1:00 pm	Discussion on DPR National Framework Document: Develop Outline and Time frame to address Feasibility of Developing DPR Criteria	Moderated by Co-Chairs
2:30 pm	Wrap up and Next Steps (Meeting Calendar)	Co-Chairs
3:00 pm	<b>ADJOURN</b>	

## APPENDIX E: Meeting Attendees

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### 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., 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., P.E., 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) (on phone)
- Joan B. Rose, Ph.D., Michigan State University (East Lansing, MI)
- David Sedlak, Ph.D., University of California, Berkeley (Berkeley, CA)

### National Water Research Institute:

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

### State Water Resources Control Board, Division of Drinking Water:

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

### Utility Representatives:

- Albert Lau, P.E., Director of Engineering and Planning, Padre Dam Municipal Water District
- Jeff Pasek, Watershed Manager, City of San Diego
- Toby Roy, Water Resources Manager, San Diego County Water Authority

### Others:

- Julie LaBonte, State Board DPR Advisory Committee member
- Brian Pecson, Trussell Technologies, Inc.
- R. Shane Trussell, Trussell Technologies, Inc.