	Testimony stricken per Oral Ruling Dated June 15, 2017, as shown in blue strike out text.DWR-930				
1 2 3 4 5 6	Spencer Kenner (SBN 148930) James E. Mizell (SBN 232698) Robin McGinnis (SBN 276400) DEPARTMENT OF WATER RESOURCES Office of the Chief Counsel 1416 Ninth St. Sacramento, CA 95814 Telephone: (916) 653-5966 E-mail: jmizell@water.ca.gov Attorneys for California Department of Water Resources				
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10	DEPARTMENT OF WATER RESOURCES				
12	AND UNITED STATES BUREAU OF RECLAMATION REQUEST FOR A CHANGE				
13	IN POINT OF DIVERSION FOR CALIFORNIA WATER FIX				
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15	I, Douglas M. Owen, do hereby declare:				
16	INTRODUCTION				
17	I previously stated my expertise in both my Statement of Qualifications (DWR-15)				
18	and rebuttal testimony (DWR-82), which remain relevant to this sur-rebuttal testimony.				
19	Specifically relevant to the subject of this sur-rebuttal, I also have worked side-by-side				
20	with water treatment plant operational staff and with operational departments to assess,				
21	optimize and improve water treatment plant performance, with a specific focus on water				
22	quality.				
23	The City of Stockton operates a Delta Water Treatment Plant that uses surface				
24 25	water from the Delta. The treatment processes include raw water ozone for oxidation and				
20	water from the Delta. The treatment processes include raw water ozone for oxidation and				
20 27	disinfection, coagulation, flocculation, sedimentation, and ultrafiltration (membrane				
21 28	filtration). Chloramines are currently used to provide a detectable residual in the				
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DWR-930

distribution system.¹

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I have reviewed the Rebuttal Testimony of Dr. Susan Paulsen, Ph.D., P.E.² and her firm's report on the effects of the CalFix Water Project on the City of Stockton in which it was stated "*Because water intake operations are typically managed on an hourly or sub-hourly basis, hourly or sub-hourly chloride concentrations are needed for drinking water operators to understand the impacts on their operations.*"³ I have been asked to provide an opinion regarding the frequency with which water intake operations are changed to optimize performance in drinking water systems and the impact of chloride concentrations on water treatment plant operations.

CONCLUSIONS

- Contrary to the statement in the Exponent Report cited above³, drinking water intakes are not managed on an hourly or sub-hourly basis. Treatment plants operate best at a constant rate. Frequently varying flow adversely affects unit processes because operational inputs, for example chemical feed rates, would need to be modified frequently. The continual change in hydraulic behavior would also adversely impact physical/chemical process performance such as sedimentation and filtration.
- 2. The in-bank intake for the Delta Water Treatment Plant is relatively shallow compared to deeper intakes that may be found in lakes and in surface water impoundments created by dams. Deeper intakes may have multiple ports to allow raw water to be collected at multiple depths and to search for the best water quality based upon stratification that occurs with temperature or other physical and

- 27 https://www.youtube.com/watch?v=teKi7T6WOAE.
 - ² Uncertified Rough Draft of the Proceedings in the Matter of California WaterFix Petition Hearing, 5/23/17. ³ Exponent, *Report on the Effects of the California WaterFix Project on the City of Stockton*, STKN-026, at p.
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¹ Our Water: A conversation about safe drinking water in the City of Stockton.

chemical phenomena. The Delta is sufficiently shallow and has tidal behavior that does not allow it to stratify at the location of the Delta Water Treatment Plant intake on the San Joaquin River. Therefore, there is nothing that could be done to modify water quality by changing the operation of the City of Stockton's intake on the San Joaquin River. The City of Stockton can choose to close the intake, which would have immediate flow and water quality implications for the treatment operations that would need to be managed effectively. Modifying intake operations on an hourly or sub-hourly basis would be very disruptive to operations and could affect the ability of the treatment plant to meet other, health-related, water quality requirements.

Chloride is not removed at the Delta Water Treatment Plant. The concentrations provided in Dr. Paulsen's Rebuttal Testimony⁴ would not adversely affect any of the treatment processes at the plant.

4. Chloride is not regulated as a primary, health-related, drinking water standard by the United States Environmental Protection Agency (USEPA) or California State Water Resources Control Board's Division of Drinking Water (DDW). It is monitored as a secondary drinking water standard by both agencies, which relates to aesthetics (taste, in the case of chloride). The recommended maximum level for chloride set by DDW is 250 mg/L based on the average of four quarterly samples, with an upper level of 500 mg/L. The City of Stockton references the 500 mg/L value in their 2016 Drinking Water Quality Report⁵. Further, the DDW regulations state that "no fixed consumer acceptance contaminant level has been

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⁴ Uncertified Rough Draft of the Proceedings in the Matter of California WaterFix Petition Hearing, 5/23/17. ⁵ City of Stockton 2016 Drinking Water Quality Report; www.stocktongov.com/files/ccr.pdf

DWR-930

1		established" ⁶ for chloride. Therefore, based upon the chloride concentrations
2		provided in Dr. Paulsen's testimony, there is no reason from a drinking water
3		regulatory perspective to operate intakes on an hourly or sub-hourly basis.
4	5.	Dr. Paulsen states in her Rebuttal Testimony that the City of Stockton has an
5		"operational threshold" for the chloride concentration in the Delta of 110 mg/L,
0 7		above which it switches to alternative supplies such as purchased water or
, 8		groundwater. ⁷ Some water agencies establish these goals based upon
9		preferences from their municipal or industrial customers, or to assist in managing
10		salinity (measured as electrical conductivity) in their wastewater discharge permits
11		to the Delta The 110 mg/L is lower than the allowable chloride concentrations that
12		have been imposed on the California Water Fix alternatives according to Mr.
13		nave been imposed on the Gamornia Water Fix alternatives according to wit.
14		Berliner in his cross-examination of Dr. Paulsen."
15	6.	These operational thresholds are not absolute maximums, such as primary
16		drinking water regulations, and are used as guidance to make decisions on the use
17		of sources and treatment requirements. Hourly or sub-hourly increases in the
18		source water chloride concentration would be dampened and diluted by water
19		contained in the treatment plant processes, stored in tanks in the distribution
20		system, and in distribution system piping. Therefore, if the City of Stockton were
21		concerned about increasing chloride concentrations, it would track the distribution
22		system concentration and if it had reason to believe that the source water
23 24		concentration would be elevated for an extended period – for example a week or
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20		two or longer – it might either a) reduce its Delta pumping rate and increase the
20	⁶ Cal. (Code Regs., tit. 22, § 64449(d).

⁷ Uncertified Rough Draft of the Proceedings in the Matter of California WaterFix Petition Hearing, 5/23/17 at 27

^{22:6 – 22:12.} ⁸ Uncertified Rough Draft of the Proceedings in the Matter of California WaterFix Petition Hearing, 5/23/17 at 38:15 – 40:19. 28

blend with other sources, or b) close its intake and shift to another source for treatment as available to meet its total demand. In either case, it would do so after deliberate discussions with its operators and preparation of the plant for changes in flow and water quality if another source were to be utilized. They would not modify their intake operations on an hourly or sub-hourly basis.

BACKGROUND AND ANALYSIS

Drinking Water Operations

Drinking water supply systems generally are made up of the source, treatment, transmission/distribution system, and storage. Treatment plants are typically designed for the maximum day flow. Peak hourly and instantaneous demands are accommodated by storage in the distribution system. In this manner, it is not necessary to match the treatment plant production to the instantaneous system demand. As a result, it is not necessary to operate an intake on an hourly or sub-hourly basis to meet water quality or quantity goals, contrary to the Exponent Report.⁹

Drinking water treatment plants operate best at a constant rate. Changing flow on a frequent basis – such as the hourly or sub-hourly frequency suggested by Exponent⁹ and Dr. Paulsen¹⁰ - results in constant variation in chemical feeds and doses, and hydraulic behavior in physical/chemical processes such as sedimentation and filtration that adversely impact performance. Therefore, operators typically change the intake flow at most once or twice per day based upon the levels in the system storage. That is, they use the plant to keep distribution storage tanks at levels that they know are appropriate based upon typical daily demand profiles (for example, they may keep tank levels high in

⁹ Exponent, *Report on the Effects of the California WaterFix Project on the City of Stockton*, STKN-026, at p. 17.
¹⁰ Uncertified Rough Draft of the Proceedings in the Matter of California WaterFix Petition Hearing, 5/23/17 at 48:22 – 49:2.

residential areas at 5:30 or 6:00 am because they know that everyone will be awaking and using water for hygienic and cooking purposes as they get ready for their day). Therefore, an operator may set the plant for a higher flowrate starting in the morning to fill the storage tanks and then reduce the flow in the evening as the demand may go down (after 9 pm or so). Based upon the system demand profile, they may also keep the treatment plant flow constant on a day-to-day basis and allow the storage tank elevations to decrease during higher usage periods and then refill overnight. The extent of the changes is a function of the system storage (more storage reduces plant flow changes) and the number of treatment plants (they may switch combinations of higher/lower flow at individual plants to reduce flow rate changes at an individual plant). There are many variations but the important aspect is that the operators will not change the plant flow frequently.

This well-established and effective operating philosophy affects intake operations. Because an operator does not change plant flows very often, there is nothing that needs to be done at the intake. And when the flow changes, it is simply a matter of pumping more or less water through the intake pipe.

However, an intake may have multiple ports with depth to allow for the best water quality to be drawn at a given time. This is only effective in sources that stratify with temperature because they are sufficiently deep and have minimal mixing, such as deeper lakes or surface water impoundments created by a dam. The Delta is a relatively shallow body of water, particularly at the location of the City of Stockton's Delta Water Treatment Plant on the San Joaquin River on the southwest bank of Empire Tract. This relatively shallow depth, coupled with the flowing water, does not allow for stratification. Therefore, there is nothing that can be done to modify intake operations to modify water quality at

shallow intakes. The City of Stockton has a choice to close the intake or reduce the flow from the Delta and increase the blend from other sources. Contrary to the Exponent report¹¹ and Dr. Paulsen's Rebuttal Testimony¹², it would not do this on an hourly or subhourly basis because such actions would introduce variability that could jeopardize the reliable performance of the drinking water treatment processes.

Chloride removal in drinking water treatment at the City of Stockton

While chloride is not removed by any of the processes at the City of Stockton's Delta Water Treatment Plant, the concentrations presented in the modeling efforts would not adversely impact the performance of any of the City of Stockton's water treatment processes. Therefore, there is no reason related to the performance of the treatment processes to change intake operations based upon chloride concentrations. Other treatment plants that use water from the Delta, with intakes to the west of the City of Stockton's where tidal influence and chloride concentrations may be higher, effectively treat this drinking water source using similar treatment processes and meet all potable drinking water standards.

Regulations for chloride in drinking water systems

As recognized on cross-examination of Dr. Paulsen, chloride is not regulated as a primary drinking water standard by the USEPA or the DDW.^{13,14} Primary drinking water regulations and maximum contaminant levels (MCLs) are established for health-related contaminants. Chloride is monitored as a secondary drinking water standard by both agencies, which relates to aesthetics. The USEPA does not enforce secondary

¹¹ Exponent, Report on the Effects of the California WaterFix Project on the City of Stockton, STKN-026, at p.

17. ¹² Uncertified Rough Draft of the Proceedings in the Matter of California WaterFix Petition Hearing, 5/23/17 at

¹⁴ Cal. Code Regs., tit. 22, § 64449.

¹ Uncertified Rough Draft of the Proceedings in the Matter of California WaterFix Petition Hearing, 5/23/17 at 39:22 - 40:4. 28

standards and establishes them as guidelines to assist public water systems in managing their drinking water for taste, color, and odor. For chloride, the primary aesthetic property that may affect consumer acceptance is taste.

The recommended maximum level for chloride set by DDW is 250 mg/L based on the average of four quarterly samples, with an upper level of 500 mg/L.¹⁵ The City of Stockton references the 500 mg/L value in their 2016 Drinking Water Quality Report.¹⁶ Further, the DDW regulations state that "no fixed consumer acceptance contaminant level has been established"¹⁷ for chloride. Therefore, based upon the chloride concentrations provided in Dr. Paulsen's testimony¹⁸ and the Exponent Report,¹⁹ there is no reason from a drinking water regulatory perspective to operate intakes on an hourly or sub-hourly basis based upon chloride concentrations.

City of Stockton's Operational Threshold for Chloride

The City of Stockton has an operational threshold for the chloride concentration in the Delta of 110 mg/L, above which it switches to alternative supplies such as purchased water or groundwater according to Dr. Paulsen.²⁰ Some water agencies establish these goals based upon preferences from their municipal or industrial customers, or to assist in managing salinity (measured as electrical conductivity) in their wastewater discharge permits to the Delta. I have not had discussions with the City of Stockton regarding this threshold, although it is clear that the 110 mg/L is lower than the allowable chloride concentrations that have been imposed on the California Water Fix alternatives according

¹⁵ Table 64449-B, Cal. Code Regs., tit. 22, § 64449.

¹⁶ City of S	tockton 2016	Drinking Water	Quality Report;	www.stocktongov.	com/files/ccr.pdf
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¹⁷ Cal. Code Regs., tit. 22, § 64449(d).

¹⁸ Uncertified Rough Draft of the Proceedings in the Matter of California WaterFix Petition Hearing, 5/23/17.

- ¹⁹ Exponent, Report on the Effects of the California WaterFix Project on the City of Stockton, STKN-026.
- ²⁰ Uncertified Rough Draft of the Proceedings in the Matter of California WaterFix Petition Hearing, 5/23/17 at 22:6 22:12.

to Mr. Berliner's cross-examination of Dr. Paulsen.²⁴

Operational thresholds are not absolute maximums, such as primary drinking water regulations, and are used as guidance to make decisions on the use of sources and treatment requirements. Because the City of Stockton does not remove chloride, the City blends water from different sources to meet this threshold. That being said, hourly or sub-hourly increases in the source water chloride concentration would be dampened and diluted by water contained in the treatment plant processes, stored in tanks in the distribution system, and in distribution system piping. Therefore, hourly or sub-hourly increases would not be immediately evident in the delivered water and it would require the entire system volume to be turned over before the raw water concentration would be measured at the point of delivery to the customer (assuming that it would continue to be elevated above the threshold). Therefore, if the City of Stockton were to change its operation of its raw water intake from the Delta, it would track the system concentration and if it had reason to believe that the source water concentration would be elevated for an extended period – for example a week or two or longer – it might either a) reduce its Delta pumping rate and increase the blend with other sources, or b) close its intake and shift to other sources as available to meet its demand. In either case, it would do so after deliberate discussions with its operations team and preparation of the plant for changes in /// /// /// /// /// ²⁴ Uncertified Rough Draft of the Proceedings in the Matter of California WaterFix Petition Hearing, 5/23/17 at 38:15 40:19.

1	flow and water quality if another raw water source were to be utilized. It would not modify				
2	its intake operations on an hourly or sub-hourly basis.				
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