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8 **BEFORE THE**

9 **CALIFORNIA STATE WATER RESOURCES CONTROL BOARD**

10 HEARING IN THE MATTER OF CALIFORNIA
11 DEPARTMENT OF WATER RESOURCES
12 AND UNITED STATES BUREAU OF
13 RECLAMATION REQUEST FOR A CHANGE
IN POINT OF DIVERSION FOR CALIFORNIA
WATER FIX

**SUR-REBUTTAL TESTIMONY OF
DOUGLAS M. OWEN**

14 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

24 The City of Stockton operates a Delta Water Treatment Plant that uses surface
25 water from the Delta. The treatment processes include raw water ozone for oxidation and
26 disinfection, coagulation, flocculation, sedimentation, and ultrafiltration (membrane
27 filtration). Chloramines are currently used to provide a detectable residual in the
28

1 distribution system.¹

2 I have reviewed the Rebuttal Testimony of Dr. Susan Paulsen, Ph.D., P.E.² and
3 her firm's report on the effects of the CalFix Water Project on the City of Stockton in which
4 it was stated "*Because water intake operations are typically managed on an hourly or*
5 *sub-hourly basis, hourly or sub-hourly chloride concentrations are needed for drinking*
6 *water operators to understand the impacts on their operations.*"³ I have been asked to
7 provide an opinion regarding the frequency with which water intake operations are
8 changed to optimize performance in drinking water systems and the impact of chloride
9 concentrations on water treatment plant operations.
10

11 CONCLUSIONS

- 12 1. Contrary to the statement in the Exponent Report cited above³, drinking water
13 intakes are not managed on an hourly or sub-hourly basis. Treatment plants
14 operate best at a constant rate. Frequently varying flow adversely affects unit
15 processes because operational inputs, for example chemical feed rates, would
16 need to be modified frequently. The continual change in hydraulic behavior would
17 also adversely impact physical/chemical process performance such as
18 sedimentation and filtration.
19
- 20 2. The in-bank intake for the Delta Water Treatment Plant is relatively shallow
21 compared to deeper intakes that may be found in lakes and in surface water
22 impoundments created by dams. Deeper intakes may have multiple ports to allow
23 raw water to be collected at multiple depths and to search for the best water quality
24 based upon stratification that occurs with temperature or other physical and
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26 ¹ Our Water: A conversation about safe drinking water in the City of Stockton.

27 <https://www.youtube.com/watch?v=teKi7T6WOAE>.

28 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. 17.

1 chemical phenomena. The Delta is sufficiently shallow and has tidal behavior that
2 does not allow it to stratify at the location of the Delta Water Treatment Plant intake
3 on the San Joaquin River. Therefore, there is nothing that could be done to modify
4 water quality by changing the operation of the City of Stockton's intake on the San
5 Joaquin River. The City of Stockton can choose to close the intake, which would
6 have immediate flow and water quality implications for the treatment operations
7 that would need to be managed effectively. Modifying intake operations on an
8 hourly or sub-hourly basis would be very disruptive to operations and could affect
9 the ability of the treatment plant to meet other, health-related, water quality
10 requirements.
11

- 12 3. Chloride is not removed at the Delta Water Treatment Plant. The concentrations
13 provided in Dr. Paulsen's Rebuttal Testimony⁴ would not adversely affect any of
14 the treatment processes at the plant.
15
- 16 4. Chloride is not regulated as a primary, health-related, drinking water standard by
17 the United States Environmental Protection Agency (USEPA) or California State
18 Water Resources Control Board's Division of Drinking Water (DDW). It is
19 monitored as a secondary drinking water standard by both agencies, which relates
20 to aesthetics (taste, in the case of chloride). The recommended maximum level for
21 chloride set by DDW is 250 mg/L based on the average of four quarterly samples,
22 with an upper level of 500 mg/L. The City of Stockton references the 500 mg/L
23 value in their 2016 Drinking Water Quality Report⁵. Further, the DDW regulations
24 state that "no fixed consumer acceptance contaminant level has been
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28 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

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,
6 above which it switches to alternative supplies such as purchased water or
7 groundwater.⁷ Some water agencies establish these goals based upon
8 preferences from their municipal or industrial customers, or to assist in managing
9 salinity (measured as electrical conductivity) in their wastewater discharge permits
10 to the Delta. The 110 mg/L is lower than the allowable chloride concentrations that
11 have been imposed on the California Water Fix alternatives according to Mr.
12 Berliner in his cross-examination of Dr. Paulsen.⁸
13
14 6. These operational thresholds are not absolute maximums, such as primary
15 drinking water regulations, and are used as guidance to make decisions on the use
16 of sources and treatment requirements. Hourly or sub-hourly increases in the
17 source water chloride concentration would be dampened and diluted by water
18 contained in the treatment plant processes, stored in tanks in the distribution
19 system, and in distribution system piping. Therefore, if the City of Stockton were
20 concerned about increasing chloride concentrations, it would track the distribution
21 system concentration and if it had reason to believe that the source water
22 concentration would be elevated for an extended period – for example a week or
23 two or longer – it might either a) reduce its Delta pumping rate and increase the
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26 ⁶ Cal. Code Regs., tit. 22, § 64449(d).

27 ⁷ Uncertified Rough Draft of the Proceedings in the Matter of California WaterFix Petition Hearing, 5/23/17 at 22:6 – 22:12.

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

1 blend with other sources, or b) close its intake and shift to another source for
2 treatment as available to meet its total demand. In either case, it would do so after
3 deliberate discussions with its operators and preparation of the plant for changes in
4 flow and water quality if another source were to be utilized. They would not modify
5 their intake operations on an hourly or sub-hourly basis.
6

7 **BACKGROUND AND ANALYSIS**

8 **Drinking Water Operations**

9 Drinking water supply systems generally are made up of the source, treatment,
10 transmission/distribution system, and storage. Treatment plants are typically designed for
11 the maximum day flow. Peak hourly and instantaneous demands are accommodated by
12 storage in the distribution system. In this manner, it is not necessary to match the
13 treatment plant production to the instantaneous system demand. As a result, it is not
14 necessary to operate an intake on an hourly or sub-hourly basis to meet water quality or
15 quantity goals, contrary to the Exponent Report.⁹
16

17 Drinking water treatment plants operate best at a constant rate. Changing flow on a
18 frequent basis – such as the hourly or sub-hourly frequency suggested by Exponent⁹ and
19 Dr. Paulsen¹⁰ - results in constant variation in chemical feeds and doses, and hydraulic
20 behavior in physical/chemical processes such as sedimentation and filtration that
21 adversely impact performance. Therefore, operators typically change the intake flow at
22 most once or twice per day based upon the levels in the system storage. That is, they
23 use the plant to keep distribution storage tanks at levels that they know are appropriate
24 based upon typical daily demand profiles (for example, they may keep tank levels high in
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27 ⁹ Exponent, *Report on the Effects of the California WaterFix Project on the City of Stockton*, STKN-026, at p.
17.

28 ¹⁰ Uncertified Rough Draft of the Proceedings in the Matter of California WaterFix Petition Hearing, 5/23/17 at
48:22 – 49:2.

1 residential areas at 5:30 or 6:00 am because they know that everyone will be awaking
2 and using water for hygienic and cooking purposes as they get ready for their
3 day). Therefore, an operator may set the plant for a higher flowrate starting in the
4 morning to fill the storage tanks and then reduce the flow in the evening as the demand
5 may go down (after 9 pm or so). Based upon the system demand profile, they may also
6 keep the treatment plant flow constant on a day-to-day basis and allow the storage tank
7 elevations to decrease during higher usage periods and then refill overnight. The extent
8 of the changes is a function of the system storage (more storage reduces plant flow
9 changes) and the number of treatment plants (they may switch combinations of
10 higher/lower flow at individual plants to reduce flow rate changes at an individual plant).
11 There are many variations but the important aspect is that the operators will not change
12 the plant flow frequently.
13
14

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

19 However, an intake may have multiple ports with depth to allow for the best water
20 quality to be drawn at a given time. This is only effective in sources that stratify with
21 temperature because they are sufficiently deep and have minimal mixing, such as deeper
22 lakes or surface water impoundments created by a dam. The Delta is a relatively shallow
23 body of water, particularly at the location of the City of Stockton's Delta Water Treatment
24 Plant on the San Joaquin River on the southwest bank of Empire Tract. This relatively
25 shallow depth, coupled with the flowing water, does not allow for stratification. Therefore,
26 there is nothing that can be done to modify intake operations to modify water quality at
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1 shallow intakes. The City of Stockton has a choice to close the intake or reduce the flow
2 from the Delta and increase the blend from other sources. Contrary to the Exponent
3 report¹¹ and Dr. Paulsen's Rebuttal Testimony¹², it would not do this on an hourly or sub-
4 hourly basis because such actions would introduce variability that could jeopardize the
5 reliable performance of the drinking water treatment processes.
6

7 **Chloride removal in drinking water treatment at the City of Stockton**

8 While chloride is not removed by any of the processes at the City of Stockton's Delta
9 Water Treatment Plant, the concentrations presented in the modeling efforts would not
10 adversely impact the performance of any of the City of Stockton's water treatment
11 processes. Therefore, there is no reason related to the performance of the treatment
12 processes to change intake operations based upon chloride concentrations. Other
13 treatment plants that use water from the Delta, with intakes to the west of the City of
14 Stockton's where tidal influence and chloride concentrations may be higher, effectively
15 treat this drinking water source using similar treatment processes and meet all potable
16 drinking water standards.
17

18 **Regulations for chloride in drinking water systems**

19 As recognized on cross-examination of Dr. Paulsen, chloride is not regulated as a
20 primary drinking water standard by the USEPA or the DDW.^{13,14} Primary drinking water
21 regulations and maximum contaminant levels (MCLs) are established for health-related
22 contaminants. Chloride is monitored as a secondary drinking water standard by both
23 agencies, which relates to aesthetics. The USEPA does not enforce secondary
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25 ¹¹ Exponent, *Report on the Effects of the California WaterFix Project on the City of Stockton*, STKN-026, at p.
26 17.

27 ¹² Uncertified Rough Draft of the Proceedings in the Matter of California WaterFix Petition Hearing, 5/23/17 at
28 48:22 – 49:2.

¹³ Uncertified Rough Draft of the Proceedings in the Matter of California WaterFix Petition Hearing, 5/23/17 at
39:22 – 40:4.

¹⁴ Cal. Code Regs., tit. 22, § 64449.

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 Stockton 2016 Drinking Water Quality Report; www.stocktongov.com/files/ccr.pdf

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.

1 to Mr. Berliner's cross-examination of Dr. Paulsen.²¹

2 Operational thresholds are not absolute maximums, such as primary drinking water
3 regulations, and are used as guidance to make decisions on the use of sources and
4 treatment requirements. Because the City of Stockton does not remove chloride, the City
5 blends water from different sources to meet this threshold. That being said, hourly or
6 sub-hourly increases in the source water chloride concentration would be dampened and
7 diluted by water contained in the treatment plant processes, stored in tanks in the
8 distribution system, and in distribution system piping. Therefore, hourly or sub-hourly
9 increases would not be immediately evident in the delivered water and it would require
10 the entire system volume to be turned over before the raw water concentration would be
11 measured at the point of delivery to the customer (assuming that it would continue to be
12 elevated above the threshold). Therefore, if the City of Stockton were to change its
13 operation of its raw water intake from the Delta, it would track the system concentration
14 and if it had reason to believe that the source water concentration would be elevated for
15 an extended period – for example a week or two or longer – it might either a) reduce its
16 Delta pumping rate and increase the blend with other sources, or b) close its intake and
17 shift to other sources as available to meet its demand. In either case, it would do so after
18 deliberate discussions with its operations team and preparation of the plant for changes in
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28 ²¹ 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.

3 Executed on June 2, 2017 in Sacramento, California.

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6 Douglas. M. Owen
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