Trussell
TECHNOLOGIES INC

February 28, 2018

Derek Rayner, P.E., QSD/P, LEED GA
Deputy Director
414 Washington Street
Calistoga, CA 94515

Subject: Professional Services to Reduce THHMs / HAA5s In Domestic Drinking Water System and Reduce THMs in Wastewater Effluent Discharge

Dear Derek,

We are pleased to submit the enclosed proposal for professional services to support the City of Calistoga with control of disinfection by-products in the drinking water system and in the wastewater effluent discharge.

Based on our experience with other projects and the information you have provided, we have developed a scope of work that provides strategies to control disinfection by-products at all three locations:

- Dunaweal WWTP: cost effective addition of ammonia, upstream of chlorination
- Napa water supply: TTHM stripping or peroxidation at Dunaweal pump station
- Kimball WTP: treatment process further optimization.

We believe these solutions will build off of and complement the work that you have already done. Please find our proposed scope of services and professional fee attached. We look forward to working with you.

Respectfully,
Trussell Technologies, Inc.

John Kenny, P.E.

Enclosure: Scope of Work, Duration, and Budget

SCOPE OF WORK
City of Calistoga Disinfection By-Product Control
Drinking Water System & Wastewater Effluent Discharge

This scope of work describes the professional services to be provided by Trussell Technologies, Inc. ("Trussell Tech") to assist the City of Calistoga ("City") in controlling total trihalomethanes (THHMs) and the five regulated haloacetic acids (HAA5s) in the domestic drinking water system, and dibromochloromethane (DBCM) and dichlorobromomethane (DCBM) in the wastewater effluent discharge. The strategies for controlling the disinfection by-products are: (1) addition of ammonia upstream of chlorination at the Dunaweal wastewater treatment plant (WWTP), (2) evaluation of TTHM stripping of the water supply from the City of Napa at the Dunaweal pump station or the use of preoxidants where the chlorine is boosted, and (3) further treatment process optimization at the Kimball Water Treatment Plant (WTP) to control HAA5 formation. These strategies are expected to bring disinfection by-products under the limits with a margin of safety. This work is divided into the following tasks.

TASK 1 – WWTP Ammonia Addition Conceptual Design

Ammonia is currently removed from the wastewater through the biological nitrification process (Biolac) at Dunaweal WWTP. In the absence of ammonia, sodium hypochlorite readily reacts with precursors to form DBCM and DCBM. The re-introduction of ammonia back into the wastewater, changes the chemistry of chlorination and can significantly reduce DCBM and DBCM formation. Trussell Tech will review water quality information collected by operational staff on secondary effluent ammonia, as well as free chlorine and total chlorine residual information to confirm the viability of the ammonia addition strategy. Trussell Tech will review existing disinfection drawings and design criteria. Trussell Tech will conduct proof-of-concept bench-scale testing, which will include an evaluation DBCM and DCBM formation with and without ammonia. Trussell Tech will provide a conceptual design of the ammonia addition system, including design criteria, a process flow & instrumentation sketch, a basic control description and estimated costs to support the implementation of a pilot ammonia addition system by the City. The conceptual design will be provided in a technical communication. It is assumed that the City will ship the sample of filter effluent to the Trussell Tech lab in Pasadena for the proof-of-concept testing.

TASK 2 – Kimball WTP Bench-scale Evaluation

Strategies to limit the formation of HAA5 and TTHMs during drinking water treatment include (1) optimizing the removal of DBP precursors and (2) identifying optimum conditions for treatment processes. Trussell Tech will review water quality, existing operational strategies, drawings, operational data on the Kimball WTP, and results from preliminary bench-scale testing conducted by the City. After review, Trussell Tech will conduct a week-long, bench-scale process optimization study at its Pasadena Water Quality Laboratory. Testing will be undertaken with a sample of the raw water supply to Kimball WTP. The results from the evaluation, and a summary of operational recommendations, including chemical costs, will be presented in a technical communication.

Bench-scale testing may include an evaluation of pH control, alternative coagulants, and alternative coagulant doses, and the use of the JC-9450 pre-oxidant. It is assumed that the City will ship the sample of raw water to the Trussell Tech laboratory in Pasadena, as well as provide samples of their coagulants and the JC-9450. The bench-scale testing will be conducted during the summer or fall of 2018 (which is generally when it is harder to meet HAA5 limits).

TASK 3 – Dunaweal Pump Station TTHM Evaluation

TTHMs are elevated in the water supply coming from the City of Napa, which is boosted at the Dunaweal pump station. Two potential options for the removal of already-formed TTHMs are the use of preoxidants where chlorine is added and air stripping. Trussell Tech will review the City's TTHM Locational Running Annual Average (LRAA) data, the results of additional samples collected by the City at the Dunaweal pump station, and results of preoxidant pilot testing conducted by the City. Based on the results of this sampling and testing, Trussell Tech will evaluate the alternatives and recommend a preferred alternative. The evaluation will include consideration of the ability to conservatively meet TTHM targets, below the maximum contaminant level (MCL), as well as feasibility of implementation and costs. The evaluation will be provided in a technical communication.

Proposed Schedule

The proposed schedule to complete this scope is approximately 8 months.

Scope			Schedule							
Task	Subask	Description	Mar	Apr	May	Jun	July	Aug	Sep	Oct
1	**Task 1: WWTP Ammonia Addition Conceptual Design**									
	1.1	Review operational water quality, design criteria and drawings								
	1.2	Proof of concept bench-scale testing of ammonia addition								
	1.3	Conceptual design of ammonia injection system for piloting								
2	**Task 2: Kimball WTP Bench-scale Evaluation**									
	2.1	Review water quality data, drawings and operational conditions								
	2.2	Conduct a bench-scale evaluation of HAA5 and TTHM control strategies								
	2.3	Provide summary of results and conclusions in technical memorandum								
3	**Task 3: Dunaweal Pump Station TTHM Evaluation**									
	3.1	Review TTHM LRAA data and additional samples collected by City								
	3.2	Review preoxidant pilot testing results from City								
	3.3	Evaluate stripping versus preoxidant for TTHM control								

Proposed Fee

The proposed schedule to complete this scope is $49,739. The following figure provides a breakdown of this effort.

Trussell Technologies Professional Service Fee

City of Calistoga Disinfection By-Product Control: Drinking Water System & Wastewater Effluent Discharge

Scope			Budget						
Task	Subtask	Description	Trussell Technologies Hours				Labor Cost	ODCs	Total Cost
			RRT	BP	JK	EO			
1	**Task 1: WWTP Ammonia Addition Conceptual Design**		**2**	**9**	**44**	**20**	**$14,278**	**$100**	**$14,383**
	1.1	Review operational water quality, design criteria and drawings		2	16	4	$4,080		$4,080
	1.2	Proof of concept bench-scale testing of ammonia addition		1	4	16	$3,840	$100	$3,945
	1.3	Conceptual design of ammonia injection system for piloting	2	6	24		$6,358		$6,358
2	**Task 2: Kimball WTP Bench-scale Evaluation**		**10**	**2**	**8**	**92**	**$21,470**	**$1,000**	**$22,520**
	2.1	Review water quality data, drawings and operational conditions	2		2	16	$3,838		$3,838
	2.2	Conduct a bench-scale evaluation of HAA5 and TTHM control strategies	4		2	40	$8,756	$1,000	$9,806
	2.3	Provide summary of results and conclusions in technical memorandum	4	2	4	36	$8,876		$8,876
3	**Task 3: Dunaweal Pump Station TTHM Evaluation**		**4**	**2**	**36**	**26**	**$12,836**	**$0**	**$12,836**
	3.1	Review TTHM LRAA data and additional samples collected by City	1		8	6	$2,819		$2,819
	3.2	Review preoxidant pilot testing results from City	1		8	6	$2,819		$2,819
	3.3	Evaluate stripping versus preoxidant for TTHM control	2	2	20	14	$7,198		$7,198
Total			**16**	**13**	**88**	**138**	**$48,584**	**$1,100**	**$49,739**

Trussell Technologies Personnel	**Rate**
RRT = R. Rhodes Trussell, Ph.D., P.E., BCEE	$299/hr
BP = Brian Pecson, Ph.D., P.E.	$240/hr
JK = John Kenny, P.E.	$180/hr
EO = Emily Owens-Bennett	$180/hr

*Total costs include 5% markup on ODCs