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Sent: Tuesday, September 11, 2018 8:28 AM

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Subject: Flint CCT Study

DEQ has approved the scope of services for the additional pipe loop corrosion control study provided by ARCADIS and Cornwell Engineering on July 24, 2018. The study will expand the original scope to include testing of brass meters, brass faucets, and galvanized pipe.

The additional scope of services is attached to this memo. Please let me know if you have any questions.

Eric

Eric J. Oswald, Director

Drinking Water and Municipal Assistance Division

Michigan Department of Environmental Quality

Mission: ***Safeguarding Michigan's Drinking Water and Environmental Health***

Vision: ***Michigan Values and Invests in Safe and Reliable Water***

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WORK PLAN FOR FLINT PIPE LOOP MATERIALS ADDTION

Prepared by

CORNWELL ENGINEERING GROUP

With

ARCADIS

July 24, 2018

The ongoing lead pipe loop study will be expanded to include testing of brass meters, brass faucets, and galvanized pipe. This document outlines the approach proposed to accomplish that objective. It should be noted that prior to beginning the additional pipe loop study, it may be decided to change meters for another material; especially if it is determined that all existing meters will be replaced. Copper pipe with lead solder could be the substituted material. That change should not affect the work plan.

WORK PLAN FOR TESTING ADDITIONAL MATERIALS

This work plan supplements the on-going studies using lead pipes. All sampling protocols and operations will remain the same but will now also include the additional items described below. Refer to the lead pipe SOP for detailed procedures (Flint Pipe Rig CCT Study Project Description and Standard Operating Procedures, February 2018). Once the contract modification is in place, the existing SOP will be modified and updated to include the new materials.

1. The existing lead pipes loops will continue to be operated until at least one year of operation has been completed. Operation for one year is designed to capture all seasonal water quality conditions. The lead pipes will therefore operate until at least May 30, 2019 since it is believed all chemical feeds and adjustments were completed and stable by June 1, 2018. The one-year time period includes the time for the piped to reach steady state.
2. Testing will only be done on GLWA water, not a 95%/5% GLWA/GCDC water blend. This is based on a separate submittal showing the GLWA alone and the blended water quality to be the same. The original scope for the lead line loop study will also be changed to only test GLWA water.
3. For the corrosion control study of galvanized pipe, meters, and fixtures, four orthophosphate doses will be tested as selected from the lead service line (LSL) pipe study and the coupon study. All tests will be at ambient pH. One of the orthophosphate doses will be set at the existing GLWA dose.
4. For the brass meters, three meters will be put in series and tested at the three orthophosphate doses. Therefore, 12 meters will be tested in total. The meters will be placed in series to dampen variability and to produce higher lead levels that allow for better differentiation of

results. Three meters will also produce a larger volume of water within the meters for subsequent lead analysis.

5. The set up for faucets will be similar to the meters.
6. Three galvanized lines will be tested in parallel at each dose—triplicate testing. Therefore, 12 galvanized lines will be needed.
7. Based on the design referenced in items 4, 5, and 6, there will be 20 new systems tested. Four new rigs will be constructed; each will be holding three galvanized pipes, one 3-series meter, and one 3-series faucet. Each of the four rigs will be fed a different orthophosphate doses (to be determined by LSL and coupon study results).
8. For budgeting purposes, it will be assumed that the new materials (galvanized pipe, meters, and faucets) loop study will operate for ten months. It is estimated that about five to six months may be required to stabilize the galvanized pipes. Therefore, there will be four to five months of stable operation for the galvanized lines. This stable operation would roughly be in the spring and summer of 2019. These warmer months are considered to have the highest corrosion potential.

SET UP AND STUDY PLAN

A detail sample collection plan, including appropriate data entry forms, will be developed based on modification to the existing forms. Operator daily tasks will be re-established. All sampling protocols and operating protocols will be finalized. This document will be delivered to Flint and DEQ for review, as well as to EPA as desired.

All additional equipment will be finalized and ordered. The new test rigs will be constructed through a subcontract to Confluence Engineering Group who was involved in the original construction of the pipe rigs now at Flint. The new rigs will be similar to the existing in terms of functionality but will be built around standard shelving to save cost. If desired, design sketches can be also forwarded prior to construction.

OPERATIONS

Cornwell will have an on-site engineer or chemist to operate the loops five days per week. During the five-day week, the operator will check operations regularly with a schedule very similar to the existing SOP (used for the lead loop study). Water flow schedules to the existing and new rigs will be staggered so that additional water is not needed to be piped in to the test area. Sampling will also be staggered. Each pipe or equivalent will be sampled twice weekly for lead. On site analysis will be conducted for chlorine, orthophosphate and pH.

Operating time for the new rigs is included for 10 months. *Any additional time required or any change in scope will necessitate an amendment to this scope and fee.*

During the five-day work week, the on-site operator will upload data daily to management for review.

Monthly progress updates will be provided to the City and others. The managers can hold on-site (Flint) update meetings with Flint, DEQ, and EPA as desired during their visits.

The City will supply the new harvested materials and assist in the new rig set up. Cornwell will work with Flint to accomplish this.

DELIVERABLE

A final report will be prepared summarizing the data for the lead pipe and the brass and galvanized testing phases. A key element of the report will be the recommended CCT for the GLWA/GCDC permanent blended water supply. Recommendations regarding CCT will include recommendations for WQPs.

An on-site meeting and presentation of the final recommendation is included.

START UP AND POST CCT DATA REVIEW

After CCT and WQP recommendations have been made and implemented, Cornwell will be available to assist in any change-over questions. WQP and lead data will be reviewed. Any recommendations to modify CCT or WQPs based on full-scale results will be made. It is believed that there are sufficient hours budgeted to assist for approximately four months. Exact time availability will depend on the need and time required and could be lower or higher than budgeted.

SCALE ANALYSIS

Cornwell will obtain two pipes extracted from the loop system at study conclusion to conduct scale analysis.

CITY OF FLINT, MICHIGAN
MUNICIPAL WATER DISTRIBUTION SYSTEM OPTIMIZATION ENGINEERING
AMENDMENT 3

ADDITIONAL REQUESTED OPTIMIZATION SERVICES

SCOPE OF SERVICES

Task 16 – Pipe Loop Corrosion Control Study

The ongoing lead pipe loop study will be expanded to include testing of brass meters, brass faucets, and galvanized pipe. This scope outlines the approach proposed to accomplish that objective. It should be noted that prior to beginning the additional pipe loop study, it may be decided to change meters for another material; especially if it is determined that all existing meters will be replaced. Copper pipe with lead solder could be the substituted material. That change should not affect the work plan.

Task 16.1 – Work Plan for Testing Additional Materials

This work plan supplements the on-going studies using lead pipes. All sampling protocols and operations will remain the same but will now also include the additional items described below. Refer to the lead pipe SOP for detailed procedures (Flint Pipe Rig CCT Study Project Description and Standard Operating Procedures, February 2018). Once the contract modification is in place, the existing SOP will be modified and updated to include the new materials.

1. The existing lead pipes loops will continue to be operated until at least one year of operation has been completed. Operation for one year is designed to capture all seasonal water quality conditions. The lead pipes will operate therefore until at least May 30, 2019 since it is believed all chemical feeds and adjustments were completed and stable by June 1, 2018. Some of the one-year test period will be spent allowing the pipes to reach steady state
2. Testing will only be done on GLWA water, not a 95%/5% GLWA/GCDC water blend. This is based on a separate submittal showing the GLWA alone and the blended water quality to be the same. The original scope for the lead line loop study will also be changed to only test GLWA water.
3. For the corrosion control study of galvanized pipe, meters and fixtures, four orthophosphate doses will be tested as selected from the lead service line (LSL) pipe study and the coupon study. All tests will be at ambient pH. One of the orthophosphate doses will be set at the existing GLWA dose.
4. For the brass meters, three meters will be put in series and tested at the three orthophosphate doses. Therefore, 12 meters will be tested in total. The meters will be placed in series to dampen variability and to produce higher lead levels that allow for better differentiation of results. Three meters will also produce a larger volume of water within the meters for subsequent lead analysis.
5. The set up similar to the meters will be done for faucets.
6. Three galvanized lines will be tested in parallel at each dose—triplicate testing. Therefore, 12 galvanized lines will be needed.
7. Based on the design referenced in 4, 5 and 6, there will be 20 new systems tested. Four new rigs will be constructed, each holding 3 galvanized pipes, one 3-series meter, and one 3-series

faucet. Each of the three rigs will be fed a different orthophosphate doses (to be determined by LSL and coupon study results).

8. For budgeting purposes, it will be assumed that the new materials (galvanized pipe, meters and faucets) loop study will be operate for ten months. It is estimated that about 5 to 6 months may be required to stabilize the galvanized pipes. Therefore, there will be 4 to 5 months of stable operation for the galvanized lines. This stable operation would roughly be in the spring and summer of 2019. These warmer months are considered to have the highest corrosion potential.

A detailed sample collection plan including appropriate data entry forms will be developed based on modification to the existing forms. Operator daily tasks will be re-established. All sampling protocols and operating protocols will be finalized. This document will be delivered to the City and MDEQ for review, and to USEPA as desired.

Task 16.2. USEPA and MDEQ Interface

MDEQ and USEPA will receive updates and will be involved in the decision as to when stabilized conditions have been reached etc. A time allocation has been made for phone call updates and monthly progress updates.

Task 16.3 – Loop Study Operation

Arcadis will have an on-site engineer or chemist to operate the loops 5 days per week. During the 5-day week, the operator will check operations regularly with a schedule very similar to the existing SOP (used for the lead loop study). Water flow schedules to the existing and new rigs will be staggered so that additional water is not needed to be piped in to the test area. Sampling will also be staggered. Each pipe or equivalent will be sampled twice weekly for lead. On site analysis will be conducted for chlorine, orthophosphate and pH.

Operating time for the new rigs is included for 10 months. *Any additional time required or any change in scope will necessitate an amendment to this scope and fee.*

During the 5-day work week, the on-site operator will upload data daily to management for review.

Monthly progress updates will be provided to the City and others. The managers can hold on-site (Flint) update meetings with Flint, DEQ, and EPA as desired during their visits.

Task 16.4 Final Report

In conjunction with Task 14.5, a final report will be prepared summarizing the data for both the lead pipe study portion and the brass/galvanized pipe study. A key element of the report will be the recommended CCT for the GLWA/GCDC permanent blended water supply. Recommendations regarding CCT will include recommendations for WQPs.

An on-site meeting and presentation of the final recommendation is also included.

Task 16.5. Start-up and Post-CCT Data Review

In conjunction with Task 14.5, after CCT and WQP recommendations have been made and implemented, Arcadis will be available to assist in any change-over questions. WQP and lead data will be reviewed. Any recommendations to modify CCT or WQPs based on full-scale results will be made. It is believed

that there are sufficient hours budgeted to assist for approximately 4 months. Exact time availability will depend on the need and time required and could be lower or higher than budgeted.

Task 16.6 Scale Analysis

Arcadis will obtain two pipes extracted from the loop system at study conclusion to conduct scale analysis.

Task 16.7 – Pilot Equipment Selection, Procurement and Set Up

The City will supply the new harvested materials and assist in the new rig set up. Arcadis will work with Flint to accomplish this.

All additional equipment will be finalized and ordered. The new test rigs will be constructed through a subcontract to Confluence Engineering Group who was involved in the original construction of the pipe rigs now at Flint. The new rigs will be similar to the existing in terms of functionality but will be built around standard shelving to save cost. If desired, design sketches can be also forwarded prior to construction.

FEE

Arcadis shall perform the scope of services associated for the not to exceed price of \$759,175 in accordance with the terms set forth in the Agreement. A tabular summary of the budget and level-of-effort is provided in Attachment 1.

ATTACHMENT 1.
BUDGET AND LEVEL OF EFFORT SUMMARY

FEE PROPOSAL SUMMARY									
SCOPE ADDITIONS									
Task No	Description	Arcadis		EE&T (Cornwell Group)		Confluence Engineering		TOTAL	
		Hours	Cost	Hours	Cost	Hours	Cost	Hours	Cost
16	PIPE LOOP CORROSION CONTROL STUDY	180	\$ 43,507	4382	\$ 692,516	189	\$ 48,153	4751	\$ 784,175
16.1	Work Plan for Testing Additional Materials	6	\$ 1,354	126	\$ 16,638			132	\$ 17,992
16.2	Ongoing USEPA and MDEQ Interface	30	\$ 6,768	144	\$ 20,513			174	\$ 27,281
16.3	Loop Study Operation (10 months)	120	\$ 29,971	3960	\$ 598,466			4080	\$ 628,437
16.4	Deliverables (included in Task 14)	0	\$ -	0	\$ -			0	\$ -
16.5	Start-up Assistance and Data Review (included in Task 14)	0	\$ -	0	\$ -			0	\$ -
16.6	Scale Analysis (2 additional)	0	\$ -	40	\$ 19,240			40	\$ 19,240
16.7	Pilot Equipment Selection, Procurement and Set Up	24	\$ 5,414	112	\$ 37,659	189	\$ 48,153	325	\$ 91,226
	UNUSED FUNDS CREDIT FROM TASKS 1-15	--	\$ (25,000)					0	\$ (25,000)
	TOTAL	180	\$ 18,507	4382	\$ 692,516	189	\$ 48,153	4751	\$ 759,175