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Subject:

Blended GLWA and GCDC Water Quality Assessment and Impacts to Corrosion Control Treatment Study

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PURPOSE

Arcadis U.S., Inc. and Cornwell Engineering are conducting a corrosion control study (CCS) as a part of ongoing distribution system optimization efforts for the City of Flint (City). The City currently receives treated water from the Great Lakes Water Authority (GLWA) through control station II (CS II). The City boosts chlorine to approximately 2 mg/L and orthophosphate to at least 3.1 mg/L at CS II prior to distribution. In addition, the City has the ability to raise the pH of water received from GLWA if necessary to meet current optimal corrosion control treatment (OCCT) conditions. The CCS includes harvested lead service line pipe loops and is evaluating various orthophosphate doses to determine if additional corrosion control treatment enhancements can or should be made.

Long-term Flint water system operations include a backup supply from the Genesee County Drainage Commission (GCDC). To keep water in the pipeline from GCDC to the City fresh, GCDC water will be continuously blended with GLWA water at a 5:95 ratio at CS II.

The United States Environmental Protection Agency (USEPA) has indicated that they would like future phases of the CCS to include testing of the blended supply unless it can be demonstrated that it is not necessary. Such test conditions would be fraught with logistical challenges – the most significant of which is the fact that the GCDC pipeline to the City is not yet complete. As such it would require trucking of water to the Flint Water Treatment Plant (WTP) several times per week. There water would be stored and pumped into the line feeding the loops at a 5:95 GCDC:GLWA ratio. Approximately 400 gallons of GCDC

water are needed per day. It is assumed approximately 1200 – 1500 gallons would be stored at the Flint WTP, thus water in the tank could be two to three days old before it is fed to the loops. Additional storage may also be needed to cover longer periods of inclement winter weather.

The purpose of this memorandum is to evaluate the water quality impacts of blending GCDC and GLWA water and determine the likelihood that the blended water supply is likely to produce different CCS test results compared to testing with the GLWA supply alone.

APPROACH

Water quality data from the City of Flint and GCDC monthly operating reports (MORs) were used to compare treated water quality and estimate blended water quality. Michigan Department of Environmental Quality (MDEQ) provided GCDC MORs from December 2017 to April 2018. City MORs for the same period were pulled from the MDEQ Flint Water site. For the purposes of this analysis, GLWA water quality is Flint "raw" water quality and was measured at CSII prior to chemical adjustment. GCDC water quality was reported as "domestic water analysis" and is equivalent to distributed water quality and would be similar to that received by the City at CS II.

Daily values of key corrosion parameters and other parameters of interest (pH, alkalinity, hardness and chloride) were plotted and are presented as Figures 1 through 4. Note that data are limited to what is contained in the MORs and other parameters that might be of interest, such as aluminum or sulfate, were not available. The impact of the limited data availability is discussed in the following section.

RESULTS AND DISCUSSION

Parameters for Which Data are Available

Figures 1 through 4 present the results of the water quality comparison. For parameters whose concentration in the blended supply is proportional to its concentration in each of the respective sources, the estimated blended water quality is also presented.

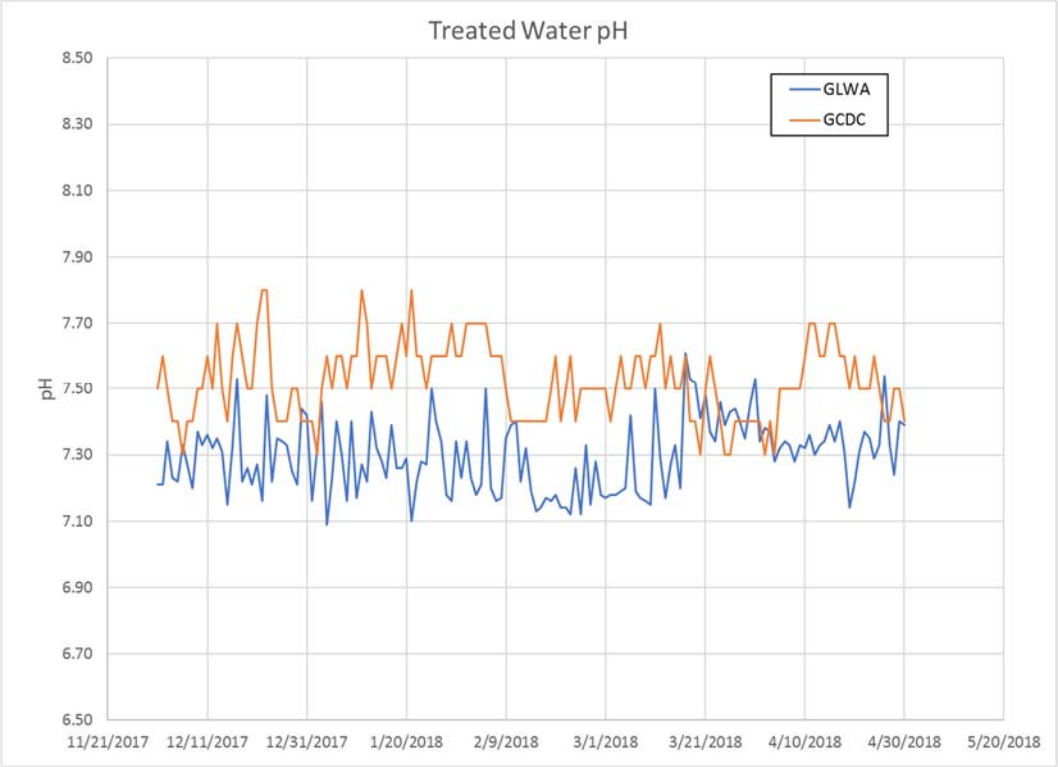

Figure 1. Comparison of GLWA and GCDC Treated Water pH

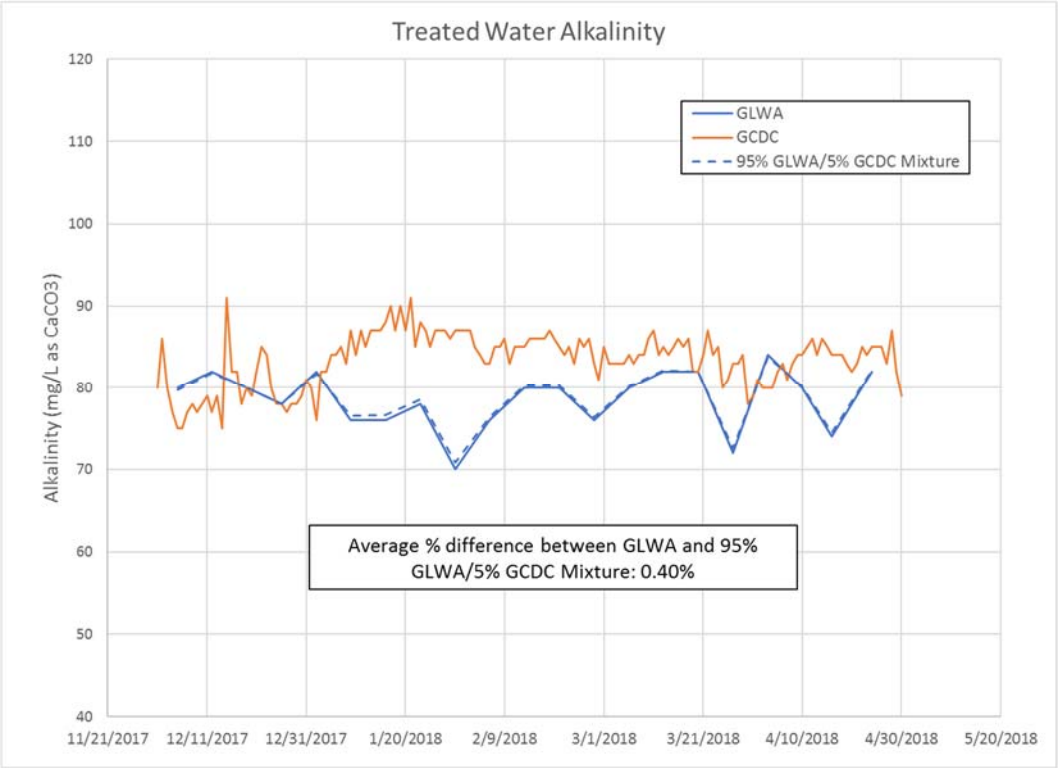

Figure 2. Comparison of GLWA and GCDC Treated Water Alkalinity

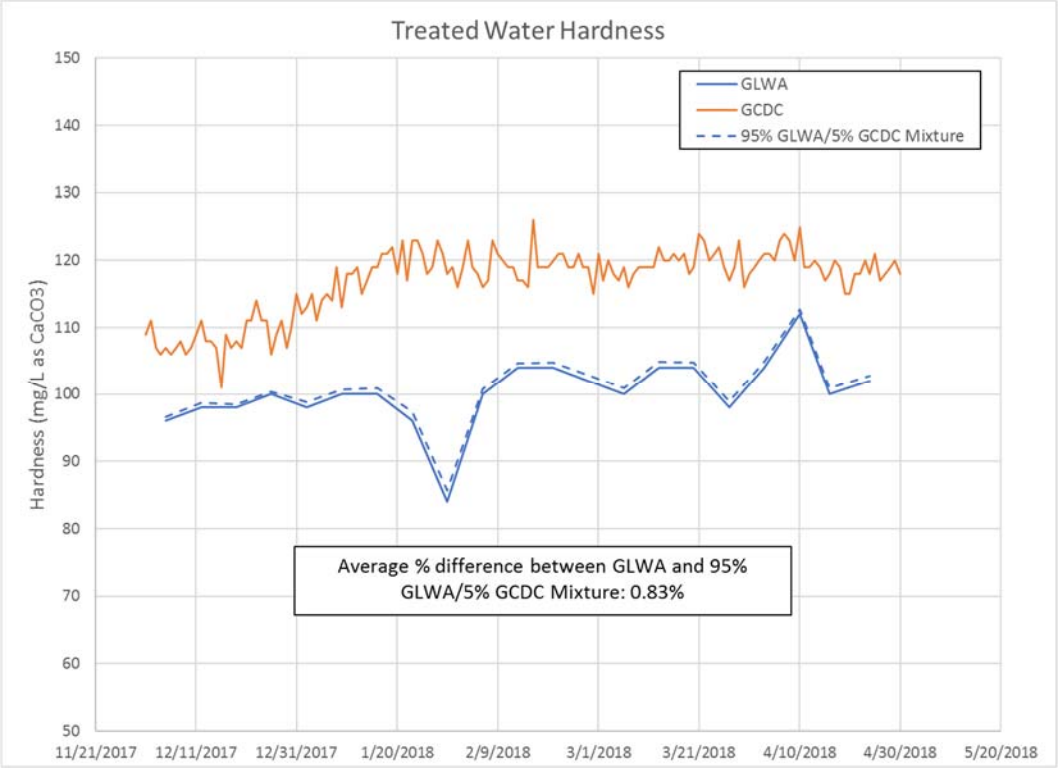

Figure 3. Comparison of GLWA and GCDC Treated Water Hardness

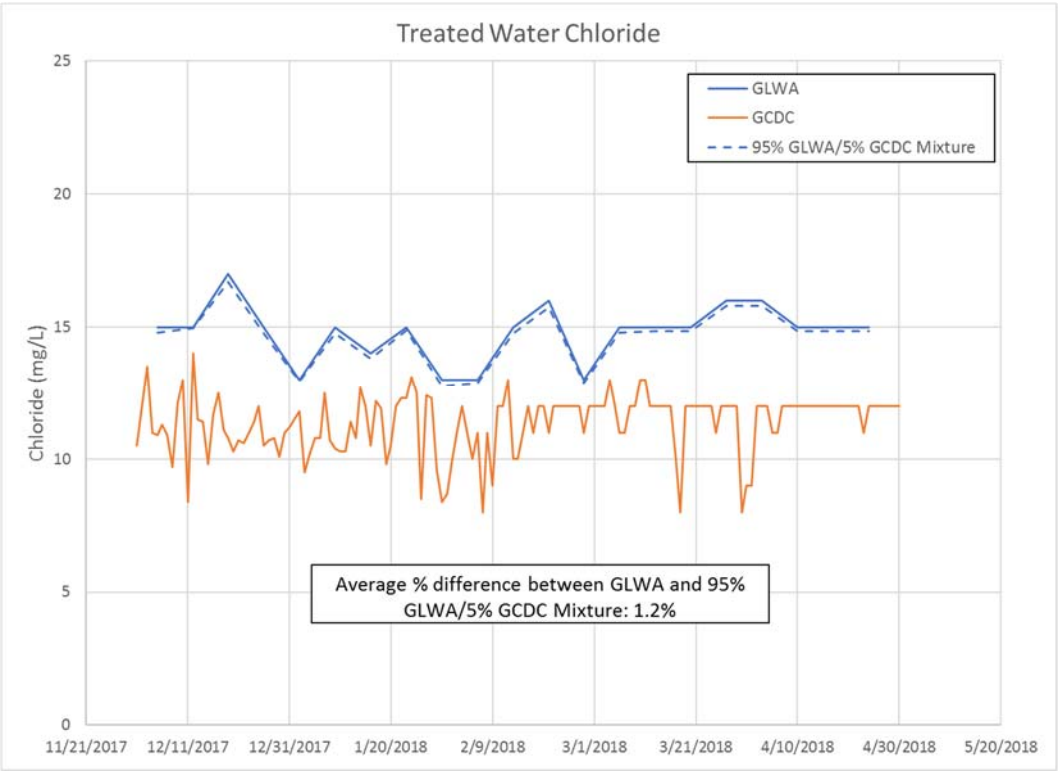

Figure 4. Comparison of GLWA and GCDC Treated Water Chloride

As can be seen in Figures 1 through 4, water quality from the GLWA and GCDC sources are similar. However, the most significant observation is that the blended water quality is nearly identical to the current Flint supply (GLWA) which is being used for the CCS. It should also be noted that pH will be adjusted prior to distribution in the Flint system, so any variance in pH should not be an issue.

Parameters for Which Data are not Available

In addition to the parameters above, there are other water quality parameters (e.g., aluminum, sulfate) which are also of potential interest, but not reported in the MORs. However, based on the blend ratio and the results shown in Figures 2 through 4, the concentrations would vary minimally from the current Flint (i.e, GLWA) supply due to the low proportion of GCDC in the blend, and as such are expected to have minimal impact on the results of the corrosion control study.

Impacts of Stagnation

USEPA has also expressed interest in understanding the impact of stagnation on GCDC water quality and the impacts to the CCS and corrosion control treatment. Specifically, what would be the impact to the blended water quality if GCDC water "stagnated" in a tank prior to being fed to the pipe loops and would this impact the results of the CCS.

The parameter of greatest concern associated with stagnation is chlorine residual. Loss of chlorine residual has been shown to impact corrosion in full-scale systems for a variety of reasons. However, in the context of the CCS, stagnation is not expected to have any significant impact on the study or determination of OCCT. As discussed previously, the low proportion of GCDC water in the blend has minimal impact on water quality, thus blended chlorine residual would be similar to that measured in the current GLWA supply at CS II. So, the impacts of any stagnation are negated by the fact that the residual will be adjusted prior to the pipe loops.

If USEPA still has concerns about the impacts of stagnation, then jar testing could be done in conjunction with the next phase of the CCS to validate the discussion and assumptions above regarding the impacts of stagnation on the CCS and corrosion control treatment effectiveness.

RECOMMENDATIONS

Based on the results of the water quality evaluation and the logistical challenges associated with using GCDC water during the CCS, it is recommended that the study proceed using the current GLWA supply. The GCDC:GLWA blend is nearly identical in quality to the current supply due to the low proportion of GCDC water in the blend. However, if USEPA still has concerns over the impacts of stagnation, jar testing can be conducted during the next phase of the CCS to determine the impacts of stagnation on the GCDC chlorine residual and blended water quality.