

VILLAGE OF WELLINGTON**UTILITY ENGINEERING SERVICES WORK AUTHORIZATION****Booster Station No. 1 – Phase 1: Water Quality Improvements****Water Treatment Plant Chlorine and Disinfection By-Product Analysis**

This Work Authorization authorizes Kimley-Horn and Associates, Inc. to perform services set forth herein and is issued pursuant to the Agreement for Consulting Services, between Wellington (“Client” or “Village”) and Kimley-Horn and Associates, Inc. (“Kimley-Horn” or “Consultant”), dated February 9, 2016 (“Agreement”). All terms and conditions of said Agreement are hereby incorporated and made part of this Work Authorization.

BACKGROUND

The current treatment processes utilized at the Village of Wellington’s Water Treatment Plant (WTP) include lime softening and conventional filtration as well as RO membrane treatment. Chlorine in the form of sodium hypochlorite is injected upstream of the filters and in the softeners to achieve a free chlorine residual within the filters. Filtered water flows via gravity to Clearwell No. 3 where the water is stabilized to reduce the potential formation of disinfection byproducts (DBP) by forming chloramines through the introduction of anhydrous ammonia. The lime softened and filtered water is then pumped either to the Finished Water Storage Tank No. 3 or Clearwell No. 4 (and subsequently Finished Water Storage Tank No. 4) to be blended with reverse osmosis permeate from the RO process trains. Currently, the treatment process blends approximately 55% of lime softened/filtered water with 45% of RO process water. However, based on an upcoming renewal and rehabilitation construction project, the projected blending will be approximately 70% lime softened/filtered water and 30% RO process water for a period of time. While the Village’s WTP and distribution system are currently not exceeding FDEP disinfection by-product (DBP) limits, occurrences of higher than desired DBPs have been measured at the WTP and in the distribution system near the Village’s Booster Pump Station No. 1.

The formation of DBP by the reaction of chlorine with organics present is dependent on a number of factors, including chlorine concentration, organic concentration, pH, type of organics, bromide concentration, temperature, and time of free chlorine contact. In general, the more Total Organic Carbon (TOC) in the source water, the higher the chlorine dose, and the longer contact time with free chlorine, the more DBPs will form. Addition of ammonia to drinking water in South Florida is commonplace in order to avoid formation of DBPs at concentrations greater than allowed by FDEP regulations. The rate of ammonia application must be carefully controlled to prevent overdosing and free ammonia being present in the distribution system as the water leaves the WTP. The rate of ammonia addition must be based on the rate of product water flow and concentration of free chlorine. Both of these should be measured accurately and continuously. It is important that the free ammonia concentration be maintained at a specific low level at all times during operation of the WTP.

The concentration of DBP, total chlorine, and free ammonia produced by the water treatment systems and placed into the distribution system piping have a significant effect on the formation of DBPs, decay in the chlorine residual concentration, and growth of nitrifying bacteria in the distribution system. DBPs, chlorine residual, and nitrifying bacteria are also influenced by water age and temperature; however, the WTP processes cannot affect temperature or water age. This

project will examine the treatment and distribution systems separately but accounting for the quality of water produced by the WTP as it impacts the distribution system.

The Village requested Kimley-Horn prepare a Chlorine and Disinfection By-Product Analysis at the WTP and in the distribution system. The analysis will be based on the current and projected WTP operating parameters with the existing chlorine and ammonia addition facilities, piping and structure residence times, and current as well as available chlorine/ammonia injection locations. The analysis will include data collection, data review, water sampling, DBP formation testing, assessing the existing chlorine and ammonia addition facilities, detention and chlorine contact times and DBP formation analysis. Recommendations for modifications needed to reduce DBP formation and lower the chlorine residual will be made based on the current operational parameters (55/45 lime/RO), the projected operational parameters during construction (70/30 lime/RO), and future conditions assuming there is no lime softening treatment facility.

The following is a list of the tasks that will be performed as part of this Study and a description of the scope of work involved for each task.

SCOPE

Task 1 – Data Collection

- A. Kimley-Horn will prepare for and attend a project kick-off meeting with Village staff to discuss the project schedule and objectives, including DBP removal targets.
- B. Kimley-Horn will review historical water quality information and data, water plant operating protocols and conduct one site visit at the WTP.
- C. Kimley-Horn will review the existing individual treatment processes, equipment capacities, operating ranges, and applicable instrumentation at the WTP.
- D. The Village will provide Kimley-Horn the following:
 1. *WTP Physical Data:* This includes existing as-built/design drawings and specifications, pump performance data, treatment performance data, tank configurations, and piping record drawings.
 2. *WTP Operating Data:* The Village will provide Kimley-Horn the last 3 years of daily flow, typical diurnal flow, treatment operations, chemical usage, compliance sampling data, additional sampling data, and process control data in electronic format (PDF or Excel).
 3. *Additional Water Quality Sampling at the WTP and in the Distribution System*
 - Kimley-Horn will provide the Village with a specific list and locations for additional sampling requirements at the WTP and in the distribution system. The Village will separately coordinate and pay for all water quality sample collection, transportation, and analysis. The recommended additional sampling data will generally consist of the following and for some parameters testing will be conducted on the lime and RO product waters separately:
 - Iron
 - Manganese
 - Hydrogen Sulfide, aqueous

- Ammonia
 - Organic Nitrogen
 - Nitrate
 - Nitrite
 - Total Organic Carbon (TOC)
 - Dissolved Organic Carbon (DOC)
 - Bromide
 - Disinfection Byproducts
 - Total Trihalomethanes (TTHMs) by species
 - Haloacetic Acids Five (HAA₅s) by species
 - Free Chlorine Residual
 - Total Chlorine
 - Chloramines (mono-, di-, and tri-)
 - Temperature
 - Alkalinity
 - pH
 - Total Dissolved Solids (TDS)
 - Conductivity
 - Chlorides
 - Sodium
 - Sulfate
- Kimley-Horn will coordinate with a water quality testing laboratory to determine the DBP formation potential in the water produced at the WTP. The Village will separately coordinate and pay for the DBP formation potential test collection, transportation, and analysis.
 - The testing will be conducted to develop time-based curves of DBP formation using water collected on site after softening and membrane treatment but prior to chlorination and chloramination.
 - This water will be transported to the laboratory where the water will be chlorinated and then samples drawn on a frequent interval, chlorine in that sample quenched, and the DBPs measured. By repeating this over a four-hour period a curve will be developed that predicts the increase over time of the DBP formation after the softened and membrane treated water is chlorinated.
 - This information will allow determination of the appropriate length of free chlorine contact time to avoid formation of DBPs in excess of the established goals.

E. Kimley-Horn will prepare a recommendation of finished water quality goals related to disinfection residuals and DBP concentrations. A meeting will be held with Village staff to reach concurrence on the disinfection related water quality goals.

Task 2 – Chlorine and Disinfection By-Product Analysis

A. Kimley-Horn will assess the type of ammonia used, the equipment used for application of chlorine and ammonia, location of chlorine and ammonia application, and ability to monitor water quality after addition of chlorine and ammonia.

- B. Kimley-Horn will evaluate the treatment processes and potential for DBP formation. Kimley-Horn will use the data collected under Task 1 to determine the longest possible free chlorine contact time without forming excessive DBPs.
- C. Kimley-Horn will review the distribution sampling data results to identify trends, changes in parameter concentrations, or other noticeable indicators of changes occurring in the distribution system that can be attributed to a specific cause. Kimley-Horn will generate recommendations for future sampling and/or operation of the Village's distribution system and booster chlorine operations. Distribution system modeling, including water age analysis, is not included in the scope of services but can be provided as an additional service if approved by the Village and if there is sufficient data to warrant conducting trial runs of the distribution model.
- D. Kimley-Horn will recommend improvements and/or modifications to the location of chlorine and ammonia applications, method of chlorine and ammonia applications, chlorine and ammonia dosage, online instrumentation, and monitoring devices or frequency of sampling based on the potential to reduce the DBPs in the WTP point of entry.

Task 3 – Documentation of Findings

- A. Kimley-Horn will prepare a Technical Memorandum summarizing this analysis. The memorandum will consist of a summary of the data collection, analysis methodology, analysis discussion, results, and recommendations. The memorandum will also contain a summary of operational modifications and/or improvements needed to implement the recommendations and a budget level opinion of probable construction cost for each improvement.
- B. Kimley-Horn will present the findings at a review meeting with Village staff to discuss the findings and receive comments from the Village for incorporation in the final memorandum. The Village's comments will be incorporated into a final findings memorandum.

ADDITIONAL SERVICES

Any services not specifically provided for in the above scope, as well as any changes in the scope requested by the Village, will be considered additional services to this Work Authorization and will be performed based on subsequent Work Authorizations approved prior to performance of the additional services.

INFORMATION AND SERVICES PROVIDED BY THE VILLAGE

Kimley-Horn assumes that the completeness and accuracy of all information provided by the Village, including plans and specifications prepared by others, can be relied upon in the performance of professional services.

ASSUMPTIONS

The Village and Consultant agree that the Consultant has based the project work effort and compensation upon the following assumptions:

1. The Village will separately coordinate and pay for all water quality sample collection, transportation, and analysis.
2. The Village will separately coordinate and pay for the DBP formation test sample collection, transportation, and analysis.

SCHEDULE

Services provided under this agreement will begin within 7 days of receipt of a signed agreement. Kimley-Horn will perform these services according to the schedule below:

- Draft results Technical Memorandum delivered for Village review within 8 weeks from receipt of information and sampling data as described under Task 1.
- Final results Technical Memorandum submitted to the Village within 4 weeks of receipt of the Village's review comments.

COMPENSATION


Kimley-Horn will perform the services described in the Scope of Services on a lump sum basis for \$22,550.

Accepted by:

Village of Wellington

Kimley-Horn and Associates, Inc.

Anne Gerwig, Mayor



Kevin Schanen, P.E., Sr. Vice
President

Date: _____

Date: 1/22/19

ESTIMATE FOR ENGINEERING SERVICES

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