

January 5, 2018

Mr. Jon Haukaas
Director of Public Works
Engineering Department, City of Blaine
10801 Town Square Drive NE
Blaine, MN 55449

Sent via e-mail to Jhaukaas@blainemn.gov

Re: Proposal for WTP4 DBP testing and WTP1-3 sampling

Dear Mr. Haukaas:

Barr Engineering Co. appreciates the opportunity to submit a proposal to provide continued engineering services for planning and design of the City of Blaine's future water supply and treatment system in the northeast part of the city. This proposal provides for sampling and bench testing of future Water Treatment Plant No. 4 (WTP4) well water for evaluation of disinfection by-product (DBP) formation potential and for sampling and analysis of raw well water and treated water from WTP1, WTP2, and WTP3.

Project understanding

Background

Barr recently completed pilot testing and a feasibility study for WTP4. The feasibility report described formation of DBPs as a potential risk of the new system and recommended additional bench testing to evaluate the magnitude of this risk. DBPs can be formed in the distribution system when residual free chlorine reacts with organic matter and other constituents in the treated water. The extent of DBP formation that occurs depends on the specific water chemistry and the amount and type of organic matter in treated water. In particular, the relatively high concentrations of total organic carbon (TOC) in water from Wells 20 and 21 may provide more DBP pre-cursor material than other new and existing Blaine wells. However, the TOC concentrations in other well water is not well-characterized, so the DBP formation potential of the new wells versus existing wells cannot be evaluated. Jar testing should be completed prior to design and construction to better assess the DBP of the different source wells. This can be done using simulated distribution system (SDS) tests, in which pre-oxidized and filtered aliquots of water from each well would be chlorinated with sodium hypochlorite to achieve the target free chlorine residual.

This testing should be performed in early 2018, for incorporation in WTP4 detailed design. This information will directly inform chemical dosing rates and treatment processes for WTP4 detailed design.

To address these uncertainties, Barr recommends the following activities:

- Sample WTP4 raw well water from wells 18, 19, 20, and 21, simulate greensand filter treatment in the lab, and perform a simulated distribution system (SDS) bench test on treated water
- Sample and analyze finished water from WTP1, WTP2, and WTP3 for parameters affecting chlorine demand and DBP formation.

This proposal encompasses these activities.

Objectives

The following objectives will guide the sampling and bench testing work proposed here:

- Further define future feed water quality to WTP4 relevant to DBP formation
- Identify the sodium hypochlorite doses required to provide 1-2 mg/L free chlorine residual (or other target identified by City) in WTP4 well waters
- Evaluate the potential for formation of regulated DBPs groups trihalomethanes (THMs) and haloacetic acids (HAAs) under identified chlorine doses for WTP4 water, using time periods relevant to Blaine's distribution system
- Determine how groundwater TOC concentrations compare between existing and new wells.

Proposed scope of work

Details of the scope of work we will perform to meet the objectives listed above are included below.

Task 1: WTP4 analysis of DBP formation potential

Under Task 1, Barr will work collaboratively with the City to sample water from the WTP4 wells and collect information needed for the bench tests. Barr will then perform SDS bench testing at our lab. The Barr scope of work under Task 1 includes:

- Collect water samples from wells 18, 19, 20, and 21 to be used in lab analysis and bench testing.
- Work with city to determine range of anticipated residence times in distribution system.
- Work with city to understand free chlorine targets for distributed water.
- Develop a bench testing protocol to define test objectives and the bench testing procedure which will include:
 - aeration
 - sodium permanganate dosing
 - greensand filtration
 - chlorine dosing
 - SDS testing
 - final sample preparation for external analysis
- Gather required bench testing supplies.
- Perform bench tests in Barr's water treatment lab, including sodium permanganate dosing, greensand filtration, chlorine dose analysis, and SDS testing.
- Coordinate with a laboratory to obtain sample bottles for the bench testing program, coolers and chain of custody forms, and cost of shipping the transportation of samples to the laboratory.

- Send well water samples to external lab for TOC analysis.
- Send treated samples to external lab for analysis of TOC, total trihalomethanes (TTHM), and five regulated haloacetic acids (HAA5).
- Evaluate bench test results and discuss findings in a memo.

Task 1 meetings

- After completion of the draft bench testing protocol, Barr will hold one call with City staff to review the testing plan and collect information about distribution system residence time and chlorine residual targets.
- One call with City staff at end of task to review findings and implications

Task 1 deliverables

- Draft and final bench testing protocol
- Summary memo of bench test results to be used in WTP4 detailed design
- Lab reports

Task 1 work by City

- City will provide access to the four well sites for collection of water from WTP4 wells.

Task 1 assumptions

- Sampling: four raw well waters for TOC; four treated well waters for TOC, TTHMs, and HAA5s; four SDS samples for TOC, TTHMs, and HAA5s
- Equipment included in the proposal: two days of use fee for Barr's water treatment lab, which covers laboratory equipment and supplies
- Well sampling: conducted on a single day at Blaine wells by one Barr staff
 - Need to coordinate with the City to operate the wells and select a facilitate pumping that will not create ice issues

Task 1 Optional services not included in the base fee noted below

- Detailed evaluation of sources of chlorine demand in WTP4 well waters, including additional sampling parameters and discussion.
- An additional sampling event for the SDS test, which allows for characterization of DBP formation potential given two different residence times in the distribution system.

Task 2: WTP1-3 sampling

As mentioned previously, one part of the DBP formation potential risk evaluation is comparison of water quality between new WTP4 wells and existing supply wells.

The Barr scope of work under Task 2 includes:

- Collect finished water samples from WTP1, WTP2, and WTP3
- Coordinate with a laboratory to obtain sample bottles coolers and chain of custody forms, and cost of shipping the transportation of samples to the laboratory.

- Send finished water samples to external lab for analysis.
- Evaluate sampling results and discuss findings in a memo.

Task 2 meetings

- One call with City staff at end of task to review findings and implications (can be same meeting as for Task 1 findings)

Task 2 deliverables

- Summary memo of bench test results for use in WTP4 detailed design

Task 2 work by City

- City will provide access to the sites and direct Barr staff for collection of water from WTP1, WTP2, and WTP3.

Task 2 optional services

- Analysis for other parameters of interest in WTP1-3 well water or finished water. This could include but is not limited to:
 - Parameters with federally regulated MCLs or state health risk limits (HRLs) (e.g. metals, VOCs)
 - Parameters associated with lead and copper corrosion in distribution systems (e.g. alkalinity, pH, chloride, sulfate)
 - Parameters associated with chlorine demand and chloramine formation (e.g. ammonia)
 - Other parameters of interest to the City

Project management

Project management will involve project updates and correspondence with City staff and the project team, at frequency requested by City staff.

Personnel availability

The Barr team committed to this project include staff with whom you are familiar, and will consist of:

- **Brian LeMon** — principal in charge and QA/QC
- **Chad Haugen** — project manager
- **Ali Ling** – environmental engineer (bench testing planning, oversight, and reporting)
- **Bailey Hadnott** – environmental engineer (bench testing)
- **Ben Meemken** – environmental engineer (well sampling)

Project schedule

The proposed project schedule for the pilot testing and feasibility study is provided in the following table. This work is intended to be incorporated into detailed design for future WTP4, which should begin in January or February 2018.

Work task	Deliverable date	Task Duration
Draft bench testing and sampling plan	Two weeks following notice to proceed	Two weeks
Collect water samples	Three weeks following notice to proceed	One week
Conduct bench testing	Five weeks following notice to proceed	Two weeks
Draft bench testing and sampling results memo	Eight weeks following notice to proceed	Three weeks, which includes 10-day laboratory TAT.

Fee estimate

The estimated fee for each work task (described above) are provided in the table below. These fees are estimated and include time and materials fees. If during the execution of the work it appears that more effort or materials are needed we will notify you in advance before exceeding the amount shown below. The fee for each task can also be negotiated based on the final work scope.

Work task	Fee estimate
Task 1: WTP4 analysis of DBP formation potential	\$ 14,800
Task 2: WTP1-3 sampling	\$ 3,800
Contingency	\$2,800
Total	\$ 21,400

If the City is interested in any of the optional services identified in this letter, please contact either Brian or Chad and we can work with you to develop a scope and budget to provide them.

In conclusion

Thank you for the opportunity to propose on this project. If you have questions about our team's proposal scope or budget, feel free contact Chad Haugen (952-842-3618 or chaugen@barr.com) or Brian LeMon (952-832-2774 or blemon@barr.com).

This scope of work will be performed according to the terms of the master service agreement between Barr and the City. If the terms of this proposal are acceptable to the City of Blaine, please date and sign in the space provided below. Keep one copy for your records and return the other to Barr Engineering Co.

Sincerely,



By: Brian LeMon, PE
Its: Vice President, Principal in Charge



Chad Haugen
Project Manager

Accepted this ___ day of _____, 2018

CITY OF BLAINE

By _____

Its _____