



May 22, 2018

Amy E. Gilson, P.E.
Director of Public Works
City of Charlotte
111 E. Lawrence Avenue
Charlotte, Michigan 48813

RE: Professional Services Fee Estimate
Wellhead Protection Area Delineation
Bennett Park – Municipal Well Field
Charlotte, Eaton County, Michigan

Dear Ms. Gilson:

Wood Environment & Infrastructure, Solutions, Inc. (Wood), formerly Amec Foster Wheeler, is pleased to submit this professional services fee estimate and Scope of Work relating to the completion of a wellhead protection area (WHPA) delineation for the City of Charlotte, Michigan (City). Wood has assisted the City with hydrogeologic consulting activities related to the City's Bennet Park Municipal Well Field (Well Field) since 2009. The Scope of Work presented below was based in part on this previous work completed and on recent discussions with the City.

The existing WHPA delineation for the Well Field was completed in 1999 (Wellhead Protection Area Delineation for the City of Charlotte, March 12, 1999). This WHPA delineation was completed when the Well Field consisted of three production wells PW-1, PW-3 and PW-5, using a groundwater withdrawal flow volume of 917 gallons per minute (gpm). This flow volume of 917 gpm was based on the average day during the peak month in 1995. Details regarding the review and approval of this delineation were provided by the Michigan Department of Environmental Quality (MDEQ) in an Interoffice Communication, dated July 7, 1999 (MDEQ Memo). Although the MDEQ approved this 1999 WHPA delineation, they acknowledged there were technical issues with the calibration of the computer model used. Therefore, the approval included a modified WHPA delineation area that was of different orientation than that presented to MDEQ for review and approval.

Since this time in 1999, Wood has assisted the City with significant activities at the Well Field, including the abandonment and replacement of multiple production wells, and additional hydrogeologic activities. The City Well Field currently consists of three production wells with permitted capacities as follows:

- PW-5 – 1,400 gpm
- PW-6 – 1,600 gpm
- PW-7 – 1,460 gpm

Based on the above capacities provided by the City, the Well Field has a permitted firm capacity to withdraw up to 2,860 gallons per minute of groundwater from the same aquifer. The current

Wood Environment & Infrastructure Solutions, Inc.
46850 Magellan Drive, Suite 190
Novi, MI 48377

Tel (2482) 926-4008
Fax (248) 926-4009
www.woodplc.com

approved WHPA delineation area does not reflect either the new pumping well configuration, or the current maximum pumping capacities of the Well Field. Wood will complete hydrogeologic activities including assembling existing information, collecting water levels from area wells, completing a regional groundwater flow evaluation, preparing a computer model to reevaluate the City's WHPA delineation for the Well Field, along with associated reporting. Details regarding this Scope of Work are outlined below.

Scope of Work

Wood will complete a review of readily available geologic and hydrogeologic information from this area, including the 1999 WHPA Delineation Report and reports generated during our previous work at the Well Field. The regional conditions in the area will be evaluated through a review of select water well logs, geologic maps, and existing reports. From this data, an interpretation of the geological conditions of the Well Field and region, including aquifer hydraulic characteristics, will be determined.

The following scope of work is based on the assumptions presented above, that the 1999 WHPA Delineation Report is available, that the aquifer hydraulic and geologic characteristics that have been determined, and are determined to be appropriate for use in the computer modeling. The specific tasks required to complete the WHPA delineation are as follows:

- utilize off-site groundwater levels to assist with preparation of a potentiometric map for the region to be used to assist in calibration for the groundwater computer model
- complete computer simulations for one, five, and 10-year capture zones for each well location
- prepare a summary report and submit same to regulatory agencies
- coordinate activities with the MDEQ and the City

Typically, as part of WHPA delineations, groundwater levels are collected from an array of wells in the vicinity of the Well Field (private and public wells). Based on our prior experience, it is anticipated that groundwater levels will need to be collected from up to 10 to 15 wells from the same unconfined aquifer in the area of the City's Well Field. These water levels will be collected to confirm historic groundwater levels. The purpose of the water levels will be to assist with the preparation of a potentiometric map depicting regional groundwater flow direction and to provide calibration points to assist in calibration of the groundwater model. Wood understands that the City will assist in obtaining access to private wells in the vicinity of the site, collecting water levels, and completing an elevation survey of the wells referenced to United States Geologic Survey datum accurate to 0.01-foot. Wood understands that the City's municipal engineer will provide surveying services of which the costs for surveying are not included herein. The municipal engineer will accompany Wood during the collection of water levels and will survey the location and elevation of the wells being evaluated. Wood has assumed up to two days in the field will be needed to collect the water levels, a well drilling contractor will not be needed, and that stream flow information will be readily available for the Battle Creek River and other pertinent streams in the area.

Based upon our current understanding of the hydrogeologic conditions in the vicinity of the municipal wells, we plan to use the GFLOW computer model. GFLOW is a groundwater flow modeling system based on the analytic element method that models steady state flow in a single aquifer system. Wood has successfully used this model for the completion of WHPA

delineations of numerous other municipal wells sites in Michigan. To accomplish the modeling effort, we will calibrate the model and simulate capture areas for all three of the wells pumping simultaneously at the maximum permitted firm capacity of up to 2,860 gallons per minute. The summary report will be submitted to the MDEQ for review and approval.

Professional Fees

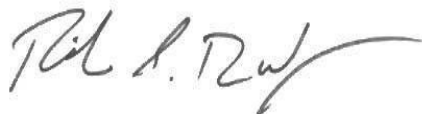
Our estimated budget to complete this work is \$24,775.00 on a time and material basis and is based on the above Scope of Work. Wood made certain assumptions in the preparation of this proposal. These assumptions include the following items:

- A sufficient number of wells installed within the unconfined aquifer in which the City wells are installed will be located, access granted to assist with model calibration, and installation of additional observation wells will not be necessary.
- Stream flow data will be readily available to be used for model calibration and stream gauging will not be required.
- We will provide a draft summary report for the City's review and will complete one round of editing to incorporate comments. Up to four hard copies and a digital copy of the summary report will be provided.

If this proposal is acceptable, please sign the attached Work Order No. 1 and the Master Services Agreement, and return copies to Wood. Work will be performed in accordance with the attached Master Services Agreement along with the Michigan Fee Schedule for Professional Services. We look forward to providing you with assistance on this project.

Thank you for the opportunity to provide this proposal to you. If you have any questions, please give me a call at 248-926-4008.

Sincerely,



Robin S. DeWyre, CPG
Senior Associate Geologist

Attachments: Work Order No. 1
Master Services Agreement
Fee Schedule