

April 11, 2013

Mr. Tim Wales, P.E.
City Engineer
City of Saratoga Springs
City Hall - 474 Broadway
Saratoga Springs, NY 12866

**RE: Proposed Amendment # 2 to Contract
Groundwater Source Exploration and Development 071911
Bog Meadow Parcel-Well Field Development Phase 3
City of Saratoga Springs**

Dear Mr. Wales:

Hanson Van Vleet, LLC (HVV) is pleased to submit this amendment and cost estimate to the Groundwater Source Exploration and Development 071911 contract, previously approved by the City Council on July 19, 2011. This amendment includes the next phase of work required to develop the new well field at the Bog Meadow parcel to supplement the existing City of Saratoga Springs water needs. It is our understanding that the New York State Department of Health (NYSDOH) has determined that the City needs approximately 1 to 2 million gallons per day (MGD) of additional water to supplement the existing system during times of drought and peak demand. The work performed to date indicates a well field at the Bog Meadow site, should be capable of approximately 1.9 MGD.

The next Phase of work will involve the installation, testing and analysis of three test/production wells. The wells will be designed and tested to be utilized as production wells along with the previously tested well for the City of Saratoga Springs. The results of the evaluation will be used to estimate the long term safe yield of the well field, the long term safe yield of each test/production well and any potential impacts to adjacent groundwater users.

Proposed Scope of Work

The proposed services provided under this proposed investigation are divided into three tasks. The phased approach provides information at the conclusion of each phase of work, thereby allowing optimum flexibility during the course of the project. The scope of work, technical approach and cost estimate to conduct the investigation are outlined below.

- Task 1: Installation of Test/Production Wells
- Task 2: Pumping Tests
- Task 3: Data Analysis and Reporting

Phase 1: Installation of Test/Production Wells

HVV will supervise and direct the installation of three test/production wells located adjacent to existing soil boring/monitoring wells MW-1 (B-1), MW-7 (B-7) and MW-9 (B-9). The test/production wells will be designed to meet current NYSDOH well design criteria, such that the well can be used as a production well, upon completion. A variance may be required for screened wells with less than 50-feet of casing; however, this is common practice and is not considered a significant concern.

The proposed test/production wells will be 18 by 10-inch gravel packed screened wells with 20 to 24-inch grout seals installed to a depth of approximately 25 feet. The screen will be a Johnson or equivalent high open area (HOA or Hi Flow) stainless steel well screen, set at the appropriate depth to maximize the efficiency for groundwater withdrawal. A Morie (U.S. Silica) or equivalent gravel pack will be utilized. The test/production wells will be installed by cable tool or dual rotary (Foremost Barber®) drilling methods. The well development will be performed by cable tool surge block methods to achieve the greatest well efficiency. Approximately 40 hours of well development will be necessary to achieve the optimum efficiency, yield and specific capacity at each test/production well. HVV will determine when sufficient development has been achieved. The specific well design criteria is summarized below.

Production Well ID	Design Soil Boring	Screen Setting (Depth in Feet)	Screen Length (ft)	Slot Size	Gravel Pack	Design Yield (gpm)
PW-2	MW-1 (B-1)	61-78	7	40	Morie # 1	769
PW-3	MW-9 (B-9)	40-46	6	60	Morie # 3	400
PW-4	MW-7 (B-7)	40-48	8	80	Morie # 2 & 3 mix	461

This proposal and scope of work assumes that the drillers will mobilized once to install all three wells. Well installation will continue until the three wells are installed.

Phase 2: Pumping Tests

A 72-hour pumping test will be performed on each test/production well to estimate the long term yield of the test/production wells, the long term yield of the well field and to determine any potential impacts from the use of the production wells.

Prior to initiating each pumping test, a step drawdown test will be performed on the test/production well. The step drawdown test is performed by incrementally increasing the pumping rate over set time periods (steps) to evaluate the specific capacity and short term performance of the well at various rates. The optimum pumping rate for the subsequent pumping test will be determined based on the results of the step drawdown test.

A constant rate 72-hour aquifer pumping test will be then be performed on each test/production well. At least one day prior to initiating each pumping test, water level measurements will be collected from all observation and test/production wells to assure static aquifer conditions before test initiation. HVV will install pressure transducers in each of the test/production wells and select observation wells, and utilize Solinst® electronic water level probes in others. Water level

measurements will then be collected continuously at predetermined intervals from the test/production well and all observation wells during the 72 hour pumping test.

A water quality sample will be collected prior to the conclusion of the pumping test to evaluate the water quality. Water quality analysis will incorporate the necessary New York State Sanitary Code Part 5 water quality requirements. A microscopic particulate analysis (MPA) sample will also be collected from each of the test/production wells. The MPA sample is collected to confirm that the aquifer is not considered "ground water under the direct influence" (GWUDI) of surface water. The MPA is collected over an 8 to 12 hour period prior to the conclusion of the test.

Upon completion of the pumping portion of the test, water level measurements will continue until the test/production well and nearby monitoring wells have recovered to 90% of their original static water level.

Phase 3: Data Analysis and Reporting

Subsequent to completing the 72-hour pumping tests, all data obtained will be analyzed using a combination of established standard industry evaluation methods. The results of the tests, in combination with the results of the test recently completed and all subsurface data, will be used to estimate the long term safe yield of each test/production well, the long term safe yield of the well field and any potential impacts to adjacent groundwater users.

After a complete evaluation of all the data, a final report will be prepared. The report will include a review of the methods used to install and test the wells, analysis of the aquifer pumping tests, water quality data; plots of all drawdown and recovery data; hydrographs of any precipitation and figures generated as part of the investigation. Additionally, the report will present conclusions and recommendations concerning optimum well yield and estimate the total well field yield.

ESTIMATED COST OF THE PROPOSED SCOPE OF WORK

The estimated costs for HVV to provide the service discussed herein are listed below for all anticipated consulting and subcontracting services:

Task 1:	Installation of Test/Production Wells (Assumes 3 wells)	
	HVV Services	\$ 25,200
	Drilling Contractor	<u>\$ 124,200</u>
	Total Task 1 Cost:	\$ 149,400
Task 2:	Pumping Test	
	HVV Pumping Test Supervision & Equipment	\$ 28,500
	Pump Contractor	\$ 57,450
	Laboratory (Part 5 Analysis and MPA)	<u>\$ 6,000</u>
	Total Task 2 Cost:	\$ 91,950

Task 3: Data Analysis and Reporting

HVV Analysis and Report Preparation	\$ 9,800
Total Task 4 Cost:	\$ 9,800

TOTAL COST	\$251,150
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These estimated costs do not include any costs for road building, snow removal, drill rig access to specific drilling locations and/or public meetings. The proposal assumes access to the three proposed test/production well locations will be provided by others. The road must be sufficient for a large drill rig to access each well location.

The costs are estimated, based on the depth and design of each test/production well.

Any additional work beyond the scope of this proposal and determined necessary as part of the investigation will be incorporated into our recommendations. Any such additional work would be invoiced at our standard rates plus expenses. No additional work, however, will be conducted or invoiced without prior authorization from the Client.

The intent of the proposal has been to outline the proposed services and estimate costs for the proposed hydrogeologic consulting services. If you select HVV to provide the proposed services and find the terms and conditions as set forth acceptable, please issue a purchase order, a City contract amendment or a letter of authorization, referencing this proposal.

Thank you for providing HVV the opportunity to be of service to the City of Saratoga Springs. If you have any questions about this proposal, please do not hesitate to contact me. I can be reached at (518) 371-7940.

Very Truly Yours,
Hanson Van Vleet, LLC



Kirby Van Vleet
Partner/ Senior Hydrogeologist

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