SUMMIT
ENVIRONMENTAL CONSULTANTS LTD. ISO 9001 AND 14001 CERTIFIED
#17A - 100 KALAMALKA LAKE RD.
VERNON, BC V1T 7M3
TEL 250 545-3672 FAX 250 545-3654
www.summit-environmental.com

March 23, 2005

Reference: 729-01.01

Ms. Rosemary Smart
Hagensborg Waterworks District
P.O. Box 25
Hagensborg, B.C. V0T 1H0

Dear Ms. Smart:

Re: Final Report - Hydrogeologic Evaluation, Hagensborg Waterworks District

In accordance with our proposal dated September 29 2004, Summit Environmental is pleased to submit this letter report presenting our hydrogeologic evaluation of the Hagensborg Waterworks District.

Project Background

The Hagensborg Waterworks District (HWD) has received one-time funding from Land and Water B.C. (LWBC) to assist with development of drought management and emergency water supply options. In accordance with the LWBC mandate, the focus of this work was to identify and evaluate potential long-term water supply options for the HWD. The project tasks and objectives were to:

1. Obtain and review existing hydrogeologic information for the HWD area,
2. Assess the present-day applicability and "reasonableness" of John Motherwell and Associates's 1997 (JMA) water supply evaluation findings and recommendations;
3. Identify and evaluate potential emergency groundwater supply source options; and
4. Complete a summary report presenting our findings, conclusions, and recommendations.

At with your request we limited our assessment of the potential for implementing a cooperative water-sharing agreement with the Snootli Fish Hatchery, as this potential water supply alternative was to be investigated by the HWD Board of Trustees. However, we understand that several water system upgrades were completed in 2002 and were therefore considered in our assessment. These upgrades included:

- Installation of new holding tanks and new debris screening equipment at the Snootli Creek water intake;
- Installation of new 12-inch water line extending from the new holding tanks to the main water line along Highway 20;
- Replacement of approximately 66 m (200 feet) of old 4-inch water line; and

- Replacement of approximately 2.4 km of old 4-inch water line with new 6-inch water line in the west part of the water system.

These upgrades were completed to improve system water quality and increase the water system delivery rate and pressure.

Although not the focus of this work, surface water quality issues discussed in JMA's report and during discussions with you have also been included in this analysis of potential water supply options as they directly impact development of an emergency and long-term water supply. The HWD is apparently resistant to implementing a surface water quality treatment system, likely consisting of hypochlorination, as required by the Province. This disinterest is apparently due to possible health concerns related to water chlorination and a reluctance to relinquish local control over the community water quality and system operation.

Summit's assessment of hydrogeologic conditions at the HWD property, our assessment of the JMA report and recently completed system upgrades, and our recommendations regarding development of a long term and emergency water supply are provided below. Personnel and organizations contacted while completing this work are listed in Attachment 1.

Task 1 – Review of available geologic and hydrogeologic data

Very little published data regarding the geology and water resources of the Hagensborg area is available. JMA (1997) developed a reasonable summary of geologic and hydrogeologic data for the Hagensborg area. In general, extensive deposits of glacial, alluvial and fluvial sediments are present in valley bottoms with extremely steep sides. Much of the town is located within the generally flat Bella Coola River 100-year flood plain, with fluvial and alluvial materials situated adjacent to the bedrock valley sides. No lithologic and stratigraphic data for the Hagensborg area valley bottom is available as this information was not submitted with local water well records.

Based on MWLAP water well database, nine well records are available for the Hagensborg area. The most productive wells in Hagensborg are those owned by the Department of Fish and Oceans' (DFO) Snootli Fish Hatchery (MWLAP, 2005). These seven wells range in depth from 28 m (92 ft.) below ground surface (bgs) to 33.5 m (110 ft.) bgs, with one well drilled to 183 m (600 ft.) bgs. Reported production from these wells ranged from 40 imperial gallons per minute (igpm) to 350 igpm.

Most wells located in the nearby communities of Nusatsum and Thorsen Creek also demonstrated good water production capability, with several wells producing over 50 ipgm from wells that are generally less than 35 m deep.

Thus, the available well production data appears to illustrate that an abundant groundwater resource is available in deeper valley bottom sediments.

Local water quality information is also generally unavailable, however anecdotal information provided by Mr. Hank Unrau of Aqua Drilling out of Williams Lake, B.C. indicated that water obtained from the shallow valley bottom sediments near the river commonly contain high concentrations of iron, while better quality groundwater is often obtained near the valley sides. High iron concentrations are primarily an aesthetic concern because of taste and odour issues. Human health issues are less of a concern unless iron concentrations are extremely high.

Task 2 – Review of 1997 Motherwell Water System Analysis, and Recent System Upgrades

In 1997, HWD contracted with JMA to complete a comprehensive assessment of the HWD water supply system, and to identify, evaluate, and recommend supply alternatives and improvements. JMA's proposed work was intended to address limitations in the HWD water supply which failed to meet minimum provincial criteria for fire protection, water pressure, and water quality.

The main components of JMA's proposed system upgrades included:

- Augment the existing 4-inch water line with 6-inch line to provide adequate water supply and pressure to the approximate west half of the system;
- Install two 100,000 imperial gallon (Ig) reservoirs at each end of the system to balance system operation and provide emergency fire protection water (including installation of additional fire hydrants); and
- Install hypochlorination water treatment on the main water line from the Snootli Creek intake to meet Provincial drinking water quality guidelings.

Overall, JMA's analysis of the HWD existing water supply system, and proposed scope of system upgrade work appear generally reasonable; no work was proposed that doesn't need to be completed to maintain system functionality and compliance with Provincial guidelines. Although part of the old 4-inch line was replaced, to meet fire protection water quantity and pressure criteria, an emergency reservoir must be installed and the remainder of the system 4-inch line must be upgraded. To meet water quality guidelines, either surface water treatment must be installed or the entire system converted to a clean groundwater source. These findings are further discussed below.

JMA's estimated capital cost for the recommended work in 1997 was approximately $1,350,000 or approximately $5,800 per connection. To assess whether this estimated cost was reasonable, numerous Provincial and water engineering experts were contacted by Summit to obtain approximate costs incurred by other small water systems when performing similar supply upgrades. Unfortunately, summary information regarding overall system upgrade costs in small communities is not readily available for the Province. However, one relevant example was obtained from the Arbutus water system located on Mayne Island, B.C. This remote system with approximately 57 connections developed costs for installing a new fire protection water tank, installing water treatment, and improve the water delivery piping. The estimated cost per

connection for these upgrades was approximately $7,200, which is reasonably close to the HWD per connection costs estimated by JWA.

To further assess the "reasonableness" of JMA's recommended costs, approximate costs for completing main parts of the proposed work were researched. Overall, JMA's proposed costs appear reasonable to somewhat low based on average costs for similar work in the Province. For example, recent costs for installing a water tank average around $2/gallon, or approximately $200,000 for a 100,000 gallon tank, which is similar to costs used by JMA. Rough costs for installing hypochlorination systems at other water system upgrades ranged from approximately $100,000 to $200,000, which concur with JMA's estimate of $168,000 for the HWD. The overall reasonableness of JMA's costs estimates is also supported by his estimated cost for installing fire hydrants. JMA estimated approximately $3,000 per hydrant; this cost estimate is still valid today.

JMA used an estimate of approximately $30/foot for installation of 6-inch pipeline. Cost estimates for performing this work obtained from knowledgeable provincial and water system design and installation personnel start around $80/foot and may extend higher, depending upon local conditions. However, replacing approximately 2.4 km of old 4-inch water line with 6-inch line in 2002 cost the HWD approximately $20/foot, significantly lower that JMA's estimate. This disparity will likely result in lower costs for replacing water pipeline compared to those estimated by JMA.

A discrepancy exists between JMA's recommended reservoir size of 200,000 gallons (two 100,000-gallon tanks), and the Provincial minimum reservoir size of 25,000 gallons for the entire water system. JMA does not provide any information to support this recommendation for a larger reservoir size.

JMA also evaluated costs associated with obtaining and using two wells from the DFO Fish Hatchery as a main water supply, but concluded that the cost of refurbishing, operating and maintaining these wells would be more expensive than installing and operating surface water treatment.

Task 3 – Evaluation of potential drought and emergency groundwater supply options

Current HWD water supply requirements can be summarized as follows:

- Based on information provided by JMA, the total amount of water needed to maintain the current supply to existing connections is approximately 500 imperial gallons per day (igpd) for each of 232 connections. The total consumption is thus approximately 116,000 igpd which is equal to about 80 igpm continuous flow.

- JMA recommended a minimum water pressure of 35 psi in the water system to provide sufficient pressure for domestic use and fire protection. JMA also recommended two

hours of water supply at 400 igpm for fire protection. Current (2004) Provincial minimum water pressure requirements are 20 psi, and the minimum fire protection quantity is 400 igpm for one hour (Land and Water B.C., 2004). Implementing the minimum flow and pressure requirements would reduce costs by reducing the amount of reservoir storage necessary to meet minimum fire protection flow requirements.

HWD water quantity and quality issues and options can be summarized as follows:

- Development of an adequate emergency or fire protection water supply can only addressed by the addition of reservoirs;
- Increasing water system pressure to Provincial minimums can only be addressed by upgrading all of the remaining four-inch water lines; and
- Problems with inadequate water quality can only addressed by installation of a continuous water treatment system, or switching the entire water supply system to a clean groundwater source.

Task 4 – Recommendations and Discussion

Recommendations

Based on the above findings, several recommendations for managing potential emergency and long-term water supply problems are provided. These recommendations are based on the following assumptions:

- JMA's predictions of the number of connections and current and predicted water use remain valid;
- JMA's proposed locations for water storage tanks are still valid; and
- Based on information provided in the March 9, 2005 HWD Trustee Meeting, two water wells with a combined supply of approximately 80 gpm may be available for use by the district.

Overall, in our opinion the best option for an developing emergency and long-term water supply is for HWD to follow JMA's general approach and improve the HWD water system supply, distribution, and treatment systems as follows:

1) The remaining section of 4-inch water supply pipeline should be upgraded in accordance with JMA's recommendations. Using a replacement cost of $20 per foot, the cost for upgrading the remaing four-inch line will be approximately $150,000 to $200,000. Completing this upgrade will facilitate the effectiveness of other system upgrades.

2) Switching from surface water to ground water will address long-term water quantity and quality problems. By implementing this option, the potential for temporary disruption of the HWD water supply will be greatly reduced as groundwater sources are generally not subject to

physical disruption. Provincial water quality requirements are results-based, thus if a groundwater supply without treatment meets drinking water quality standards, no additional treatment is necessary. Therefore, switching to groundwater would address the HWD community water chlorination and associated health concerns. Potential groundwater supply options include:

- Install two new water wells with one located at each proposed storage tank location. The estimated cost to drill and equip two 50 igpm wells should range from approximately $80,000 to $120,000 depending upon the amount of equipment required.

- Tie the two hatchery wells into the improved water supply system to supplement water production from the two new wells and to provide for an emergency water supply source if those wells are available. This option also allows for future increased groundwater demand. Costs associated with integrating the hatchery wells into the system should also be relatively low, likely ranging from $30,000 to $70,000, depending upon equipment requirements.

- Alternatively, as suggested by JMA, use the two hatchery wells as the sole groundwater supply for the system. The wells may be rehabilitated to increase production rates. However this option does not allow for increased water demand due to future increased connections. Approximate costs for this alternative would likely be as estimated by JMA.

3) We also recommend that additional water storage be constructed at the water system. One potential way to reduce construction costs, however, would be to reduce each reservoir tank size from 100,000 gal to 25,000 gal, thus reducing the approximate cost from approximately $500,000 to perhaps $150,000. Using a reduced reservoir size should still provide adequate system pressure and would meet Provincial fire protection minimum requirements.

Discussion

Although implementing all of these improvements will cost a significant amount of money, attempting to reduce costs by only implementing individual system components will not be effective. The primary problem with implementing individual system improvements is that each individual upgrade depends upon other upgrades to be effective. For example, there is no point in installing new fire hydrants or reservoirs because the much of the existing piping and water supply system will not support the minimum fire protection flow and quantity. Installing new reservoirs will not address existing water pressure problems or fire protection quantities for a significant part of the HWD system because of pipe limitations. Installing only a water treatment system will not address water supply problems. Switching from surface water to groundwater will resolve water quality problems, but cannot be completed without completing pipe upgrades and installing water supply reservoirs.

As stated above, water quality protection is based on meeting specific regulatory water quality criteria. The Provincial Drinking Water Protection Regulation 5 (2)(b) states that *"ground water that, in the opinion of a drinking water officer, is at risk of containing pathogens"* must be treated. Available information indicates that groundwater that meets the water quality criteria is available in the HWD area. Conversations with several Provincial drinking water authorities has indicated some flexibility in approving reasonable water system upgrades for small water systems. Therefore, conversion to a clean non-treated ground water source should be a reasonable option for meeting water quality goals.

Detailed assessment of potential funding options was beyond the scope of this assessment. However, we recommend that after the HWD has identified the water system upgrades that will be implemented, refined costs for implementing the improvements can be developed in consultation with Provincial drinking water supply authorities.

In conclusion, based on information provided by the Provincial Drinking Water authorities, switching from surface water to groundwater supply that is funded by the Province may be the least objectionable option available to HWD. By allowing the Province to assume operation of the water supply system, much of the required system upgrade costs will be borne by the Province. By switching to groundwater, emergency and long-term water supply issues will be addressed and the current chlorination and associated health concerns expressed by community water system users should be alleviated.

Although the HWD community may prefer to retain responsibility for the water system, the benefits of having the Province pay for most of the upgrades may be worth this change.

We trust is completes our current assignment to your satisfaction. Please call if you have any questions or if we can provide any additional assistance.

Yours truly,

Summit Environmental Consultants Ltd.

Reviewed By

Daniel Watterson, P.Geo.
Senior Hydrogeologist

Hugh Hamilton, Ph.D., P.Ag.
Senior Environmental Scientist

Attachment: Attachment 1 – Persons or Organizations Contacted for this Study

REFERENCES

John Motherwell and Associates Engineering Ltd. (JMA). 1997. Hagensborg Waterworks District Report on System Development. 24p.

Land and Water B.C. 2004. Design Guidelines for Rurual Residential Community Water Systems. 23p.

Ministry of Water, Land and Air Protection. 2005. Online Database of Groundwater Wells. http://wlapwww.gov.bc.ca/wat/aquifers/index

ATTACHMENT 1 – Persons and Organizations Contacted for this Study.

Field Drilling Contractors Ltd.
25320 Fraser Hwy, Aldergrove, B.C. V4W1Z8
(604) 857-2266

Hank Unrau
Aqua Drilling Services
Box 4827
Williams Lake, B.C. V2G2V8

Barry Boettger
Provincial Drinking Water Officer
Office of Provincial Health
4th Floor
1515 Blanshard St.
Victoria, BC V8W3C8

Bill Worobetz
Head Utility Engineer
Land and Water B.C.
Water Use Planning and Utilities Branch
3rd Fl 1175 Douglas St
Victoria, BC V8W2E1

Merv Fortieth
Terasen Utility Services
604-785-9523

Ron Johnston 250-770-3523
Bob Rippen 250-851-7340
Interior Health Authority

Phil Muirhead
North Shore Community Health
604-983-6700

Denny Ross-Smith
Small Water Users Association
250-229-2262

Bob Hrasko
Black Mountain Irrigation District
250-765-5169