November 1, 2006.

Dear Commissioners:

Re: Pembina Valley Water Cooperative Water Request From The Sandilands Glacio-Fluvial Complex.

I am writing to you as a concerned Manitoba Citizen that has spent my career, doing groundwater investigations for the Province. I am not now working for anyone. I have the impression that the PVWC Sandilands groundwater request brushes aside this areas recharge contribution to the regional groundwater systems. One evidence is the fact they are planning to build 50 miles of pipeline so as to put their aquifer intake system right into the western edge of the regional groundwater recharge area. The Sandilands glacio-fluvial complex recharges a large portion of the fresh ground water systems south of the Trans Canadan Highway and east of the Red River. This proposal appears to me to be similar to putting a pipeline up above a dam, like the Shellmouth, and saying look loads of water; no problem. Disregarding down stream water users. It should also be remembered that they point out in their 2005 report (pg. 1 paragraph 2) that if they got this water they would likely be asking for 6 times as much . Furthermore I do not see the rush, the chances of them needing an emergency supply is not immediate. There are other alternatives. In my view there is time to carry out proper studies and to have a reasonable ground water management plan for the Sandilands aquifers and Associated Regional Groundwater Resources east of the Red River.

Ground water Recharge and Management Plan

As I have stated in previous comments the Sandilands Glaciofluvial complex ground water recharge capability is not known. Various preambles can be made - Professional judgements stated but the fact remains that the area has not been studied sufficiently to allow a realistic long term average recharge number to be stated. An abstract of the work required is provided in the Assiniboine Delta Aquifer Management Plan located on the Water Stewardship web site. Needless to say without the studies mentioned in it, the ground water management described in it, could not have been done. While there is no doubt that differences can be pointed out between the Sandilands Glaciofluvial Complex and the Assiniboine Delta Aquifer; in the water intake areas there is a lot of similarity. Based on the studies of groundwater recharge, in the Assiniboine Delta, the results of which have also been reviewed by outside experts, plus the standing of the passing of water usage and time, and making corrections for the fact the precipitation in the Assiniboine Delta area is in the order of 18 inches per annum and the precipitation in the Sandilands area about 23 inches per annum I would expect that once studies have been carefully done the Sandilands long term average ground water recharge rate will be found to be between 2 and 3 inches per annum. While it is true that pumping a well will change the directions of ground water flow and possibly the rates of downward groundwater movement in the vicinity of the well; water is virtually incompressible so that if a particular pumping situation does draw more water than the average recharge rate, it has to be taken from some other part of the hydrologic system. The authors mention determining a pre-development ground water

recharge rate as being a myth. In my view stating you need to proceed with aquifer development to be able to determine the long term average aquifer replenishment rate is mythical. I totally disagree that determining a pre-development recharge rate is a myth anymore than banking deposits and withdrawals are myths. In any event this region has already seen considerable aquifer development ie: Steinbach. Making sure that the regional water developments are not endangered, now or in the future, is certainly of ultimate importance..

Groundwater Usage

To my knowledge no one knows the present human ground water usage for the region south of the Trans Canada Highway and west of the Sandilands. Also, to my knowledge, the contributions to streams and wet land areas and other natural phenomena have not been evaluated. No effort appears to have been made to evaluate the future ground water needs of the region. The Town of Stienbach apparently was close to having water supply problems this last summer. It is no secret that the south east Manitoba Region is rapidly growing both in human, business, livestock and agricultuiral water needs. Until these factors are addressed and determined it seems to me poor water management to be allowing the export of water from the region.

As I have stated until the water bank account of the area; evaluation of groundwater recharge, and the present and future groundwater needs of the region are determined, exporting water is in my view a natural resources management miscue.

Bedrock Aquifer Salt Water Boundary?

Lying along and to some extent east of the Red River from Winnipeg southerly there is a zone in the bedrock aquifers where the in the water west of that line is brackish or saline and unuseable. There is some question as to the present stability of this saline water front; some suggest it is not moving easterly others suggest it is gradually moving east. If it is in fact moving it would be due to the over usage of fresh water from the regional groundwater system east and north-east of it.. This is another factor that should be very carefully reviewed before any additional stress is placed on the regional groundwater system.

Geology

I noted several changes between the presentations of the 2005 report and the rewrite. I refer to Section B in the 2005 report and Fig. 4.3 in the rewrite for comparison. This is complex geology and there are just not enough testholes around the pumping well to allow a proper interpretation of the local geolgy. For example in the westerly direction it is some two miles from the pumping well to the first test hole/observation well 18. It is my interpretation that the so named upper and lower sands are interconnected at the site of observation well18. What the geology is easterly from this well to the pumping well site would require additional test drilling. Similar remarks can be made, especially in the north-westerly and south-westerly directions.

The impression given that the water from the sand aquifers cannot get to the carbonate bedrock aquifers is questionable. Water, as anyone who has worked with it knows has very capable ways of working its way throughout various soil and bedrock complexes. If this were not true there would be very little groundwater in the bedrock aquifers east of the Red River. Detailed studies

would probably find these pathways.

. In essence it is my view that even if the bank account of the aquifer system was available, for large scale requests like this one, more geologic investigations need to be carried out.

Seventy-two Hour Pumping test:

While the recharge concerns make the constructing of production wells and the preforming of aquifer pumping tests for the purpose of taking water away from the area premature; much is said in the 2005 and 2006 PVWC reports of the 72 hour pumping test that was done. To me most of the test is invalid. The pumping system broke down after 3 hours and 44 minutes. Once this had happened it is good practice, especially on such important work, to stop the testing, with the exception of taking water level recovery observations and to allow 24 hours or longer time period , depending on when the test broke down, for full aquifer recovery and stabilization before restarting the test work. Starting large scale pumping stresses the aquifer. Suddenly stopping sends another stress through the aquifer system. Then immediately restarting causes a third pulse. All this interferes with the possibilities of properly assessing the location and attributes of positive and negative hydraulic boundaries within the system. This in turn interferes with the assessment of the areal aquifer parameters. As far as can be seen the test was restarted very soon after the breakdown. Therefore because aquifer stabilization was not done in my view all the rest of the test data and analysis is of questionable validity. That is I do not agree with the explanations for ignoring the breakdown stated in the 2005 report. Also I do not agree as discussed below with the pressing on with the test and using the late drawdown curves affected by geologic hydraulic boundaries as suitable transmissivity and storage coefficient values for long term predictions. In my view the boundaries should have been analysed for and the data corrected and then aquifer structure, transmissivity and storage coefficient values determined for making long term predictions. However as discussed below due to the erratic nature of the observation well layout and vertical construction features calculating these corrections would be virtually impossible.

Observation well layout

While a goodly number of observation wells were used for the test there are very few inside the pumping well main drawdown area. For example in the westerly or down the apparent ground water flow direction there are no test holes or observation wells for some two miles. In my view it is proper practice for a number of observation wells to be established near the pumping well. These are usually laid out with one line up and down the apparent ground water flow direction and the other perpendicular to that line. A suggested outlay for such a case as is involved here is as follows. Establish fully penetrating observation wells at 50m,100m,200m,400m,880m,1600m and 3200 m in the north westerly or apparent down stream direction from the pumping well. Then similarly in the south easterly, south westerly and norther easterly directions. Thus a cross of observation well lines is formed In this manner if aquifer boundary conditions are encountered their locations can be determined by standard methods of analysis and the long term effects of these conditions determined. Of course, as the above is a suggested layout for the main aquifer, there would have to be other observation wells in the upper parts of the hydro-geologic structure, located in the underlying bedrock and at various longer distances from the pumping well, either using established wells or constructing new ones.

I realize that in some cases completing the geographic aspects of this work would require working into relatively pristine areas - but for such an important proposal with its long term water supply implications this should either be done or the test site moved to a location where proper studies can be undertaken.

The observation well design

While it is technically interesting to have some observation wells with screened intakes at different depths (usually set in "nests" along location lines so as to be removed from the immediate vicinity of the main observation wells) within the aquifer being pumped the main feature of observation wells in the main aquifer being pumped is that they should be fully penetrating to screen full exposed depths of the aquifer. This is especially so in this case where the pumping well screen is essentially fully penetrating. As far as I can determine none of the reported test observation wells are constructed in this manner. All the observation wells are much shorter in exposure to the aquifer than the pumping well. This is called partial penetration.. In relatively uniform aquifers partially penetrating observation wells can be got bye with by correcting for partial penetration effects. The aquifer tapped into here does not appear to be of that nature. The observation wells shown for the test presented are scattered and at various depths. I did not observe any attempts to correct for partial penetration effects in these reports. In any event due to the early time pumping failure event such attempts at correction would have been questionable.

Alternatives

I did not observe any discussion of the potential for pumping from the large supply of brackish water in the bedrock aquifer under the Morris area and desalinizing it for emergency standby water supply. With only infrequent usage of it, I can imagine a few electric windmills establishing a power bank account with Hydro that could easily be drawn on for emergency water processing This alternative may not be as expensive as everyone likes to portray. Other peoples water supplies would not have to be touched.

Further; surely under extreme low flow conditions a temporary riffle (possibly interlocked concrete construction blocks) could be placed across the Red River channel to keep the PVWC water intake inundated? Considering how infrequently it would be needed this seems an inexpensive approach.

I did not observe any mention of negotiating with the City of Winnipeg for a connection to provide an emergency water supply of the magnitude being proposed. Nor is there discussion of the construction of reservoirs; such as the City of Winnipeg uses, for emergency supply.

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