

December 4, 2006

To: Members of the Special Committee on Great Lakes Water Resources Compact

From: Douglas Cherkauer and Timothy Grundl,
Professors of Geosciences, University of Wisconsin-Milwaukee

Re: Response to Waukesha Water Utility's proposal on Tributary Groundwater

An analysis and definition of the term "Tributary Groundwater" has been presented to the Special Committee on Great Lakes Water Resources Compact by the Waukesha Water Utility (WWU) in an undated and unsigned handout. The two of us, hydrogeologists at the University of Wisconsin-Milwaukee, are intimately familiar with the ground water situation in southeastern Wisconsin and would like to provide our thoughts and scientific perspectives on the proposal. We make no comments on the legal efficacy of the proposal as put forward by WWU but base our comments solely upon scientific principles.

We would like to point out that both of us have long experience dealing with scientifically complex and politically sensitive issues. Dr. Cherkauer is currently serving on the Southeastern Wisconsin Regional Planning Commission's (SEWRPC) Water Supply Advisory Committee and is part of a group of four hydrogeologists working with SEWRPC to assess the ground-water system of southeastern Wisconsin. He has previously served on SEWRPC's Technical Advisory Committee on Regional Water Supply Planning and is a long-standing member of the University of Wisconsin Groundwater Research Advisory Committee. One of Dr. Grundl's long time research directions is in assessing the geochemistry of the deep sandstone aquifer in SE Wisconsin including the distribution and sources of radium. He was appointed by Governor Thompson as a member of the technical oversight committee on the Crandon Mine project and was also appointed as a member of the WDNR Technical Advisory Committee on Aquifer Storage and Recovery.

WWU proposes in their last paragraph that "It makes more sense to interpret or define 'tributary groundwater' by its natural flow toward the Great Lakes, not the flow that is influenced by human activities". The term "tributary groundwater" is not a hydrogeological term that we are aware of, so it has no inherent scientific meaning. Lack of a clear definition of this term in the Compact draft is the crux of the argument raised by WWU.

While the definition WWU proposes seems beguilingly simple and straightforward, it is not. We believe that WWU's intent is to define "natural" flow [in

the sandstone aquifer] as that unaltered by human influence, i.e. before any wells existed. Unfortunately, this would also mean before any data existed on ground water levels and flow directions, because ground water levels are measured in wells and flow directions are driven by water levels.. There are no existing data to unequivocally define the boundary that WWU has suggested.

Estimates of the position of the suggested boundary are based on relatively few and often non-synchronous measurements made in the earliest sandstone aquifer wells in the region. These data have been used to calibrate the SE Wisconsin regional ground water flow model, which means that the model is designed to reproduce them and calculate the estimated position of the ground water flow boundary in the sandstone aquifer between the Great Lakes and Mississippi River systems. There is an unknown amount of uncertainty about the accuracy of the position of that boundary. No one can know exactly where that boundary was; the estimated position could be off by miles in SE Wisconsin, where substantial effort has been made in estimating its location. In other areas around the Great Lakes, the location of the natural boundary may be even less certain. Therefore, WWU's proposed definition of the boundary, or any other definition based on "tributary groundwater", will almost certainly open the Compact to legal challenges about the correctness of that boundary's position.

Furthermore, it must be pointed out that computer simulations with the SE Wisconsin regional flow model suggest that the total pre-development flow of ground water discharging to Lake Michigan from the deep sandstone aquifer was on the order of one million gallons per day (mgd). This is for the entire region of southeastern Wisconsin. There is a substantial difference between 1 mgd that was naturally flowing toward the Great Lakes and the 33 mgd that is presently being extracted from that aquifer (for the whole region). WWU alone pumps over 8 mgd, some 7 mgd greater than the natural "tributary groundwater" under WWU's definition.

WWU's proposal to define "tributary groundwater" appears to be internally inconsistent. Acceptance of WWU's proposal would have the effect of redefining large quantities of ground water from outside the Great Lake's watershed as "tributary groundwater", in contradiction to the basic hydrogeology of the situation.

We argue that any definition of the ground water boundary used in the Compact needs to be based on existing or obtainable information rather than estimates about past conditions. Two options seem logical to us.

1. Expand the use of the surface water divide (page 31, lines 19 to 21 in the Draft Compact) to include all ground water as well as surface water - both existing uses and new or increased diversions. All ground water within the surface divide would therefore be part of the Great Lakes system, treating it just like surface water. All ground water outside the surface divide would not be part of the Great Lakes system. Hence, a well in any aquifer drawing water from a screened (or open) interval lying outside the surface water divide would not be subject to the

Compact; a well drawing water from a screened interval located inside the divide would be.

2. Alternatively, define contributing ground water based on where replacement water comes from at the time of the pumping being examined. This can readily be accomplished in SE Wisconsin using the existing regional flow model for current conditions. Much information exists for these conditions, and if funds are available for the task, more can be collected. Use of this approach would require that all parties agree that they will accept the results of the model in SE Wisconsin. It is crucial to point out, however, that development of this model required thousands of person-hours and considerable fiscal support. Similar models don't exist for other parts of the Great Lakes watershed. They could be developed, but only with considerable effort.

Upon reflection, we want to point out that option 1 is unequivocal and immediately applicable because the position of the surface divide is known and invariant. This option could be applied at all locations around the Great Lakes immediately, and we think it would only require some minor alteration of the language defining the boundaries of the Basin and stating what is meant by "tributary groundwater". There is no ambiguity with this option; it will minimize confusion and future challenges. Until our knowledge of the aquifers in the Great Lakes basin becomes more complete, this seems like a defensible approach.

In contrast, option 2 is more complicated and will require considerable scientific research and model development to apply it throughout the Great Lakes system. In addition, the portion of presently pumped water which is from the Great Lakes basin under this option will vary from community to community, depending on proximity to the surface divide, the amount of water pumped and the flow direction within any deep aquifer and other factors.

We are sending this version of our comments electronically. We are requesting acknowledgement of receipt. This version will be followed by a hardcopy delivered by mail. We appreciate the opportunity to express our scientific views on an important and possibly contentious issue. If the Committee Chair would like us to appear before the Committee to enlarge upon our comments, we would be willing to be present at the next meeting on December 15, 2006.

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