December 5, 2006

MEMORANDUM

To: John Stolzenberg, Chief of Research Services, Wisconsin Legislative Council

From: Ken Bradbury, WGNHS, Daniel Feinstein, USGS

Subject: Comments on the revised version of the GeoSyntec Consultants report prepared for the City of Waukesha entitled, *The Regional Ground Water Flow System in Southeastern Wisconsin, Based on the Findings of the United States Geological Survey: Groundwater in the Great Lakes Basin: The Case of Southeastern Wisconsin,* revised November 13, 2006.

We thank you for the opportunity to comment on the revised Geosyntec report. We will keep our remarks brief.

The Geosyntec revised report revised November 13, 2006 emphasizes two main points based on the findings of the modeling work performed by the Wisconsin Geological and Natural History Survey and by the U .S. Geological Survey for southeastern Wisconsin. These points are:

- According to the results of the model, the prepumping divide for groundwater moving toward Lake Michigan through the deep sandstone aquifer was located to the west of the City of Waukesha in western Waukesha County;
- The water being withdrawn today by City of Waukesha wells is old water that would have moved toward Lake Michigan if it were not for the effect of pumping from the deep sandstone aquifer in southeastern Wisconsin.

These points correctly report the model findings. However, we would like to emphasize two additional points that might be important for whatever implications are drawn from our work in terms of claims on Lake Michigan water. These additional points are:

- According to the results of the model, the prepumping flow below southeastern Wisconsin through the deep sandstone aquifer was about 3 million gallons per day while the flow withdrawn today by the deep wells in southeastern Wisconsin is about 33 million gallons per day – more than 10 times the natural rate.

- The largest source for this additional water being directed downward toward the deep pumping centers is from the Mississippi River Basin in the form of newly recharged water being diverted (directed away) from streams tributary to the Mississippi River – this source accounts for about 70% of the replenishing water. The remaining 30% is derived from sources in the Lake Michigan Basin - this fraction of the water withdrawn from deep wells could be considered an existing diversion from the Great Lakes Basin.

We will not comment on the term "tributary groundwater" or on how it is used in the Geosyntec revised report. "Tributary groundwater" is not standard usage for the Wisconsin Geological and Natural History Survey, does not appear in USGS glossaries of hydrologic terms, and does not appear to be used in ground-water textbooks. The term does appear in documents related to Great Lakes agreements, legislation, law, and policy and should be defined by experts in those fields.

For completeness, we mention typographic errors we found in the caption to Figure 2 in the revised report. The corrections are in bold face:
*"The **deep sandstone aquifer** groundwater divide (red line) under prepumping conditions relative to the western extent of the Maquoketa shale (black line) and flow of water in the aquifer (red – **downward flow** and blue – **upward flow** – arrows.)"*