Surface and Groundwater Chemistry of Western WI

ESTABLISHING AN ENVIRONMENTAL BASELINE

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ABSTRACT

The expansion of silica sand mining and concentrated animal feeding operations in western WI over the past decade has generated concerns about potential contamination of surface water and groundwater systems. However, the baseline chemical characteristics of the regional hydrologic system have never been documented. This investigation represents the first comprehensive analysis of surface water and groundwater chemistry throughout western WI, an area that encompasses sampling sites in the northeastern upper Mississippi River watershed between Barron and Tomah. The dissolved metal content of surface water sites (n=54) and municipal groundwater wells (n=13), has been quantified with each site sampled multiple times (2-4) over the past 4 years to evaluate temporal variations in water chemistry. Geochemical analysis of Paleozoic stratigraphy (n=50) constrains trace metal concentrations in regional aquifers.

Initial results demonstrate that surface water and groundwater in the region is very clean, with virtually all trace metals well below EPA drinking waters standards. The single exception is phosphorous, which exceeds applicable standards in both surface water and groundwater and is an important component of regional lake eutrophication events. This environmental baseline is vital to the development of reasonable and responsible environmental safeguards that will facilitate economic growth and sustainable development while protecting water resources in western WI.

RESULTS

SURFACE WATER

BEDROCK INFLUENCE

Our initial sampling showed a correlation between the bedrock composition and the surface water trace elements. For example, Calcium was more prominent in the carbonate dominated west and Iron was more prevalent in the east, which is underlain by Proterozoic bedrock (Figures 6-8).

TEMPORAL INFLUENCES

Figures 1-5: Theses regional maps illustrate the regulatory limit of Chromium, Nickel, Arsenic, Lead, and Phosphorus. The four top maps show trace element results well below their regulatory standards. Phosphorus (lower left map) all over western Wisconsin well exceeds the surface limit.

Figures 9 (above): This is a graph comparing temporal differences in surface water phosphorous levels. The initial results show that even in the dry summer season surface water phosphorus is still prevalent. Our research team is starting to further examine temporal differences in phosphorus.

INITIAL CONCLUSIONS

The abundant Surface Water and Groundwater in western Wisconsin is very clean, with virtually every trace metal concentration below EPA drinking water standards. The singular exception is phosphorous, which is high in both surface water and groundwater. The high levels of phosphorous in groundwater may play a role in lake eutrophication events. Potential sources of high phosphorus in groundwater include regional bedrock and anthropomorphic sources (agriculture, septic).

Figures 10-14: These graphs compare trace elements found in each respective aquifer. They are all well within the limits, except phosphorus which exceeds limits in the Alluvial, Wonewoc and Mt. Simon Formations. This large quantity of phosphorus in the groundwater may indicate the bedrock itself as a source.

PROCEEDURES

Water Sample collection:
- GPS location, temperature, and pH
- Rinse both 500mL Nalgene bottle and cap 3 times in stream
- Submerge bottle 1 cm below the surface of the flowing water
- Fill and cap bottle underwater
- Store in cooler for transport

Sample Processing Procedure:
- Take 40mL of sample and place into a label filtered vial
- Filter through 45μm vacuum filter
- Acidify sample using 10% nitric acid (HNO3) to a pH of 2 or less
- Samples are run on the HR-ICPMS within one week
- Follow EPA Method 200.8 Guidelines

GROUNDWATER FROM MUNICIPAL WELLS

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