Abstracts

Wednesday, April 30

Session G2: Groundwater Monitoring and Protection

10:00 – 11:30 am | Room 262

Relationships between Discharge and Water Quality in Florida Springs

Ann Shortelle and Erich Marzolf
Suwannee River Water Management District, Live Oak, Fla.

Abstract
The health of Florida springs are challenged by nutrient enrichment, primarily nitrate, and declining discharge. Elevated nitrate levels have been implicated in ecological changes in springs, primarily proliferation of filamentous and epiphytic algae. In addition, many Florida springs are experiencing declining discharge during periods of drought with some ceasing to flow completely. Many are considered impaired based upon a specific nutrient criterion (nitrate > 0.35 mg N-NOx/L). Changes in discharge are primarily governed by rainfall, but may also be influenced by groundwater withdrawals from the Upper Floridan aquifer. The existence of long-term temporal trends in nitrate concentrations and discharge in some springs is well established, however less is known about potential interactions between time, nitrate, other water quality constituents and discharge. Here we present evidence that Florida springs exhibit a variety of relationships between time, discharge and chemistry. Springs within the Suwannee River Water Management District exhibited positive, negative and no trend in nitrate while also showing a positive correlation between nitrate concentration and discharge. Similarly, there were springs which showed positive, negative and no trend in nitrate concentration while exhibiting no correlation with discharge. Similar patterns exist between concentrations of nitrate and potassium, an indicator of inorganic fertilizer, indicating variable inputs of fertilizer nitrogen among springs. Cost-effective nutrient and/or flow impairment remediation will be more easily implemented when proximal causes of declining health are accurately determined.

Determining the Sources of Water for Conduit "Sandboil" Springs at the Nature Conservancy's Nachusa Grasslands Preserve, Franklin Grove, Illinois

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Abstract
The Nachusa grasslands conservation area in north-central Illinois overlies a variety of heterogeneous structural and hydrogeologic systems, resulting from the close proximity of several major structural features, including the Sandwich Fault Zone and the Kankakee and LaSalle Anticlines. The resulting regional uplift and deformation produced a series of sandstone outcrops and conduit "sandboil" springs, spanning various sections of the approximately 5 km2 study area. The "sandboils" are nicknamed for the extremely pure quartz sand the springs bring to the surface. The purpose of this research is to determine the source of water generating the Nachusa Grasslands "sandboil" springs by utilizing geochemical and stable isotope groundwater and surface water analyses, as well as determine the presence or absence of mixing between hydrologic systems. The source of the springs has long been assumed to originate from the infiltration and interflow of meteoric water through the sandstone outcrops, which are located in close proximity to a majority of the Nachusa springs. However, the goal of the study is to provide sufficient evidence showing the spring water originates from a deeper groundwater source. Residential well logs, along with geophysical studies and sediment core analyses adjacent to the sandboil study sites, show the geology beneath the study area to consist of fractured St. Peter Sandstone overlying the Shakopee

and New Richmond Limestone-Dolostone formations. Major ion analyses show the spring water is dominated by a calclium-bicarbonate and magnesium hydrochemical facies consistent with water originating from a limestone aquifer unit. Water samples collected from monitoring wells and surface water sites near the sandboil springs also show a strong connection to a calcareous hydrologic unit, with some meteoric influence. Groundwater samples collected from the Shakopee-New Richmond formation yielded high concentrations of nitrates and nitrites, indicating agricultural contamination and a rapid connection between the surface and subsurface hydrologic systems. Stable Isotope analysis for d2H and d18O also showed a well-mixed system between two hydrologic units, both of which are dominated by young water.

The Ohio Ambient Ground Water Quality Monitoring Program Documents Water Quality Impacts

Christopher Kenah
Ohio Environmental Protection Agency, Columbus, Oh.

Abstract
The Ohio Ambient Ground Water Quality Monitoring Program (AGWQMP) samples raw water from 200 wells across Ohio to monitor general water quality of the source water for ground water-based public water systems. AGWQMP wells are mostly public water system wells with moderate to large production capacities. Some of the AGWQMP wells document water quality impacts that threaten the utility of the local aquifer including chloride, nitrate and sodium. In some cases, the use of the ground water resource has been lost because the water quality impact resulted in the abandonment of the wellfield. Several examples of water quality impacts will be selected, and variation in secondary parameters will be illustrated and utilized as additional lines of evidence to identify the source of the contamination.

These examples illustrate the frequency of local ground water quality impacts. The AGWQMP wells are not the most sensitive subset of wells in Ohio, so these ground water quality impacts present reasons for concern about the sustainability of the ground water resource. Every time a wellfield is lost to water quality impacts, it documents reduced ground water resources. When the wells are abandoned, we also lose monitoring points for the resource. It is true that Ohio is a water-rich state with significant rainfall that recharges widespread regional aquifers and that water tables are generally stable across Ohio. Nevertheless, we are losing ground water resources, and the data presented documents local impacts on the long term sustainability of Ohio's ground water resources.

Efforts to Characterize Ground Water Quality in Indiana through the Statewide Ground Water Monitoring Network

Kevin Spindler, Mitt Denney and James Sullivan
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Abstract
Since 2008, the Indiana Department of Environmental Management (IDEM) Drinking Water Branch, Ground Water Section has collected ground water samples across the State of Indiana as part of a Statewide Ground Water Monitoring Network (GWMN). The GWMN, which is made possible by Clean Water Act Section 106 funding, seeks to statistically determine background ground water quality in hydrogeologically-defined settings of the state. The sites sampled as part of the GWMN consist of public water supply and private residential drinking water wells. The GWMN site locations were selected in an effort to represent geographic areas of the state, as well as hydrogeologic sensitivities and generalized geologic settings. Typically, samples are analyzed for over 400 parameters; including alkalinity, anions/cations, metals, nitrate-nitrite, synthetic organic compounds, volatile organic compounds, and unregulated pesticide degradates. Of the 326 samples collected in 2012, the analytes that occurred above the drinking water Maximum Contaminant Limit (MCL) included Arsenic (23 samples/7.1%) and Nitrogen, Nitrate- Nitrite (17 samples/5.2%); the most occurrences above a Secondary MCL or EPA recommendation included Iron (180 samples/55.2%), Sulfate (15 samples/4.6%), and Strontium (35 samples/10.7%). The majority of Nitrogen, Nitrate-Nitrite exceedances occurred in shallow wells located in

vulnerable settings that had shallow water tables. Beginning in 2013, the GWMN's design was improved to address the distribution and clustering of sample sites. Under the new design, the total number of samples needed to statistically represent the total sample population of located well logs was estimated using a simplified version of the Yamane (1967) formula. Sample sites are randomly distributed within the twenty generalized hydrogeologic settings across the state, based on a stratified sampling procedure. Once the ground water quality in the general hydrogeologic settings has been statistically characterized, the data can be used to compare ground water quality between generalized settings; evaluate ground water/surface water relationships; and assist in the protection and utilization of source water and drinking water supplies. The data will also be distributed to interested parties. In addition to highlighting the evolution of the GWMN, this presentation will focus on the utility of ground water data collected and collaborative efforts underway maximizing knowledge gained.