THE GEOLOGICAL SOCIETY OF MAINE

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GSM Fall Meeting, Friday, October 15, 2010

University of Southern Maine, Portland campus

12:00 - 1:00 Executive Board Meeting - Room 403 Luther Bonney Hall

1:00 - 3:00 GSM Mini - Symposium - Room 241 Luther Bonney Hall

1:00 pm *The AQUA Index: Risk Assessment of Land Use on High Yield Sand and Gravel Aquifers in Maine*, Mark Holden, CG, Environmental Geology Unit, Division of Environmental Assessment, Bureau of Land & Water Quality, Maine Department of Environmental Protection

1:20 pm *Regulation of Large Groundwater Withdrawals: Setting and Enforcing Standards for Resource Protection*, John T. Hopeck, PhD, Maine Department of Environmental Protection, Land and Water Bureau

1:40 pm *Ground Source Heating and Cooling - An Overview of New England Applications,* Cliff Lippitt, CG, S. W. Cole Engineers

2:00 pm *Concentration Trends And Water Level Fluctuations At Petroleum UST Sites,* Alan Kehew, Western Michigan University, Kalamazoo, Mi and American Hydrogeology Corporation, Portage, Michigan, Coauthor Patrick M. Lynch, American Hydrogeology Corp., Portage, Michigan

2:20 pm *Groundwater Contamination from Nuclear Power Plant Operations*, Matt Darois, Environmental Scientist, Radiation Safety And Control Services Inc., Stratham NH

3:00 - 3:30 Break

3:30 - 5 PM Keynote speaker: Paul Marinos, "The Geology of Athens, Greece", Talbot Auditorium, Luther Bonney Hall

5 - 5:30 Business meeting

5:30 - 6:30 Social hour

Parking: Park in the parking garage on Bedford Street (bldg 37 on the campus map). Push the button and take a ticket as you enter the garage. Bring the ticket with you to the meeting to get it validated for free parking. When you return to your car after the meeting you will be required to show the ticket to the attendant in the parking office on the ground floor of the garage.

Title: The AQUA INDEX: Risk Assessment of Land Use on High Yield Sand and Gravel Aquifers in Maine

Mark Holden, C.G., Maine Department of Environmental Protection

Abstract: The focus of this study is the high yield (> 50 gpm) significant sand & gravel aquifers (ATYPE=2) as defined and mapped by the Maine Geological Survey. There were 300 polygons used. The AQUA Index was developed to assess the relative risk due to human activities on high-yield sand and gravel aquifers. The Index is a decimal number between 0 and 1 where 0 represents significant risk and 1 indicates minimal risk . AQUA stands for Aquifer Quantitative Use Assessment. Theinitial procedure is to subtract the total road covered and road salt influenced acreage (75 foot buffer from centerline) from the total number of acres of an individual aquifer. The balance of the remaining acreage is divided by a factor based on the presence and relative risk of petroleum tanks (underground/aboveground storage tanks (USTs or ASTs)), former tank locations (i.e. possible legacy of contamination) and potential or actual sources of contamination to groundwater (as derived from Environmental Geographic Analysis Database (EGAD) Site Data). The resulting number, still in units of acres, is divided by the original acreage to give a unitless index which can also be expressed as a percent. A unit of 1 or 100% means minimal risk. In general, larger overall acreage in combination with remoteness from the effects of human activity resulted in a higher index. This index may be used to help determine which aquifers may still be conserved for future or present municipal, private, or commercial drinking water uses and which may have been already been ceded to business development or residential pressures. Overall, 49 high yield aquifer locations (16%) show minimal risk (AQUA Index of 1.0) from land uses (1,168 acres or 4% of total acres), 160 (53%) have indexes greater than 50 (moderate to low risk) (11,812 acres or 40% of total acres), and 91 (30%) have indexes less than 50 (moderate to significant risk) (17,933 acres or 60% of total acres (29,745)). 18% of the high yield sand and gravel aquifers at minimal risk (AQUA Index = 1) have public water supply wells. 33% of the aquifers with AQUA values between 1.0 and 0.5 have public water supply wells. 39% of the aquifers with AQUA values less than 0.5 have public water supply wells.

The link for this slide show is at:

http://www.maine.gov/dep/blwq/docgw/aqua_index/index.htm

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Paper No. 3-5

REGULATION OF LARGE GROUNDWATER WITHDRAWALS: SETTING AND ENFORCING STANDARDS FOR RESOURCE PROTECTION

HOPECK, John and COURTEMANCH, David, Bureau of Land and Water Quality, Maine Department of Environmental Protection, Station 17, Augusta, ME 04333, john.t.hopeck@maine.gov

Maintenance of minimum streamflows and minimum water levels in lakes and wetlands is necessary to protect aquatic resources and maintain water quality standards. These flows and water levels can be altered by individual large groundwater withdrawal projects, by the cumulative impact of other alterations and developments within the watershed, or by a combination of large and small projects. Projects with large groundwater demands may have adverse effects on nearby sensitive natural resources, such as wetlands, vernal pools, and small headwater streams, even if the total groundwater withdrawal is only a small fraction of flow through the larger watershed. These isolated projects and localized impacts can be managed within a regulatory framework that establishes minimum flows and water levels and defines reporting criteria and remedial actions. However, regulatory programs that use only the footprint or total area of the development as jurisdictional criteria may not capture many projects with significant groundwater withdrawal; alternative criteria should include the volume and rate of withdrawal and the distance to a protected resource.

Criteria for minimum flows and water levels must address the natural variability of these parameters in order to maintain, to the greatest possible extent, the physical and biological functions of the pre-development resource. Necessary streamflow and water level characteristics include maintenance of the depth, volume, and velocity necessary to provide habitat conditions for all life stages of indigenous aquatic organisms, provide water exchange and aeration, substrate scouring and sorting, temperature moderation, wetland replenishment, sediment erosion and deposition, and channel formation, ingress and egress to habitats, wetland maintenance, and pathways for migration, drift, insect emergence, organic matter and nutrient cycling. If adequate flow records are available from the watershed of concern, these parameters may be relatively easy to define, but this is generally not the case. Models adjusting measured flows to the relevant drainage area may be used, but are less accurate for smaller watersheds, particularly in the outwash deposits in which large extraction wells are generally located; surface topography in these deposits frequently underestimates the source area for baseflow to smaller streams.

Northeastern Section - 44th Annual Meeting (22–24 March 2009)

CONCENTRATION TRENDS AND WATER LEVEL FLUCTUATIONS AT PETROLEUM UST SITES

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ABSTRACT

Concentration trends of monitor wells utilized in Monitored Natural Attenuation at petroleum Underground Storage Tank (UST) sites can be used to predict achievement of regulatory standards if the data approximate a first-order decline trend. However, declining concentration trends often display seasonal and other fluctuations that complicate trend interpretation. Seasonal correlations between concentration and water-level elevation, including in-phase and inverse relationships, constitute one of the most common types of variation. The in-phase fluctuations are most common for monitor wells located in or near the source area of the release. This relationship may be the result of increased contact with the smear zone in the source area during periods of high water table. Conversely, inverse trends of water level elevation and concentration are most common in downgradient wells beyond the limit of the source area. In a year-long study of short-term fluctuations in BTEX and other parameters in a downgradient monitor well, the data suggest that the winter/spring recharge event significantly controls the concentration trends of BTEX as well as inorganic compounds in the well. Recharge and associated water table rise began in late fall and were soon followed by a slug of inorganic ions strongly influenced by road salt application. This slug of recharge diluted the concentrations of petroleum compounds and alkalinity (bicarbonate).

Electron acceptors including oxygen, nitrate, and sulfate, which is a component of road salt, are also contributed to the water table during recharge. Oxygen and nitrate were not detected in the monitor well samples and were most likely consumed quickly in biodegradation reactions at the top of the contaminant plume. Sulfate peaked during winter/spring recharge and then slowly declined during the summer and fall, along with redox potential. Alkalinity (bicarbonate) increased during this period, which may represent the coupled oxidation of organic carbon to CO_2 with sulfate as the electron acceptor. BTEX concentrations peaked in the fall probably due to the lack of diluting recharge. The slow changes in concentration over the summer and fall months, interpreted to be caused by biodgradation, contrast with the rapid changes associated with dilution during the recharge event.

Groundwater Contamination from Nuclear Power Plant Operations

The Geological Society of Maine Fall Meeting
October 15, 2010

USM Portland Campus

Matthew Darois, Environmental Scientist

Abstract

Several commercial nuclear power plant decommissioning projects completed during the mid 2000's encountered soil and ground water contamination, predominantly containing tritium, requiring remediation to meet cleanup requirements. The scope and extent of these remediation projects significantly increased the costs and duration of these projects. As a result, the nuclear industry organized several workshops with stakeholders to discuss the lessons learned from the decommissioning of commercial Nuclear Power Plants (NPPs).

In addition to the decommissioning projects, tritium has also been a consistent contaminant at active NPPs. Tritium-contaminated ground water has been identified at several NPPs and the contaminated ground water has migrated from the initial source area to the down-gradient facility boundaries and beyond. Based on these occurrences, the industry has developed a series of initiatives to help focus and manage these issues.

Throughout the development and implementation of ground water protection initiatives, NPP's have been met with challenges ranging from evaluating complex engineered systems structures and components for potential leakage, to developing comprehensive hydrogeologic conceptual site models to evaluate and monitor ground water quality. These challenges have been met with innovation and the collaboration of multiple disciplines to protect ground water quality. Development and implementation of the industry's ground water protection initiative is ongoing and continues to evolve and improve over time.