Wisconsin Ground Water Association *Newsletter*

2nd Quarter 2013, Vol. 27, No. 2

PRESIDENT'S MESSAGE

Field work for the season is already in full swing and has our President, Jim Bannantine, out and about! So, we have a few general updates from the WGWA board, and Jim will return with his usual message in our next Newsletter.

The WGWA board is very pleased with the great turnout at the 2013 Annual Meeting. This year over 60 colleagues from the area attended the meeting. Attendees listened to presentations ranging from aquifer sustainability (keynote speaker Jim Jansen) to new state vapor intrusion guidance (Terry Evenson), and watched a demonstration on how to use the WGWA sand models (Kathi Reid). The full list of presentations is available on the WGWA website, and we hope to have slides up for each presentation in the near future. We were also very impressed with the caliber of student poster presentations and continuing research being done in our field.

We would like to invite you all to our next "Lunch and Learn," which will be held on June 13 at the Cambria Suites in Madison. The presentation, *Managing Groundwater in the Central Sands of Wisconsin,* will be given by Ken Potter.

Do you have a presentation that you would like to share with your colleagues at WGWA? We are interested in scheduling another luncheon later in the year and are looking for future presenters. Please contact any board member if you have a topic of interested and would like to get involved.

Finally, reserve the dates of September 20-21 to join the annual WGWA Field Trip held jointly this year at UW-Whitewater during the first annual Wisconsin Earth and Water Student Conference.

- WGWA Board

IN THIS ISSUE…

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GROUND WATER RELATED CONFERENCES, MEETINGS, EVENTS, AND COURSES

- May 18, 2013—**Sustainable Landscaping & Shoreline Enhancement Seminar:** 10:30 am, Oakland Town Hall, N4450 Cty Rd A, Cambridge, WI. Free two-hour event, hosted by Lake Ripley Management District and led by John J. Gishnock III, owner of Formecology, LLC. Pre-registration required at 608-423-4537 or ripley@oaklandtown.com
- May 24-25, 2013—**Door County Festival of Nature:** Enjoy guided trips to Nature Conservancy preserves and other natural areas, photography workshops, bird and wildflower outings, and more. Register here.
- June 1, 2013— **Tour de Marsh:** Explore the marsh by bicycle, including, Horicon Refuge Visitor Center (9:00 am -3:00 pm), Horicon Marsh Education Center (9:00 am-4:00 pm), and Marsh Haven (9:00 am-5:00 pm). www.horiconmarsh.org or 920-387-7890, Friends of Horicon Marsh International Education Center.
- June 10-12, 2013—NGWA's **Field Methods: Groundwater Sampling and Analysis.** Westerville, Ohio. Register here.

MEET YOUR PRESIDENT ELECT!

Ralph N. Smith, Wisconsin Ground Water Association President Elect 2013

Ralph received a B.A. in Geography (Soil Geomorphology) from the University of Wisconsin-Madison in 1985. He was on the UW-Madison Soil Science Department Academic Staff from 1986-1987 working mostly on nitrogen/corn experiments. From 1987-1989 he worked on behalf of the Cities of Waukesha and Brookfield as a Soil Scientist/Geologist for Aspen Services, Inc. disposing of radium-contaminated municipal sewage sludge (bio solids). In 1989 he studied Physical Hydrogeology at UW-Milwaukee. From 1990-1991, Smith was state lead for the State of Montana as a Hydrogeologist for the Solid Waste Program. In 1992 he started LandFarm Inc. In 1994 he worked for Blue Ridge Services in Bozeman, Montana as an Environmental Consultant. From 1996-2005 he worked as a consultant to find new markets for phlogopite mica. From 2000 to the present, Smith has worked for the State of Wisconsin as a Petroleum Hydrogeologist in the Bureau of PECFA (Petroleum Environmental Cleanup Fund Act). He likes to write articles for the WGWA Newsletter. He has a French 1834 J. Lete violin and likes to go fishing, hunting, and camping. He thinks he's funny.

WGWA LUNCH and LEARN—SAVE THE DATE

Don't miss the opportunity to meet with colleagues, have a nice lunch, and hear about groundwater issues in Wisconsin's Central Sands.

Managing Groundwater in the Central Sands of Wisconsin

Presented by Ken Potter

DATE: June 13, 2013
TIME: 11:30 am—1:30 pm
PLACE: Cambria Suites—5045 Eastpark Blvd, Madison, WI 53718

Registration details to be announced soon by email. Watch your inbox!

Get Yourself Published!

We are looking for articles for future editions of the WGWA newsletter. Articles should be 1 to 8 pages in length and can include photographs and graphics. Articles should be generally technical in nature focusing on groundwater or environmental topics, but not commercial or political.

To submit an article for publication, contact:

Lee Trotta, Editor lctrotta53072@yahoo.com

GROUND WATER RELATED CONFERENCES, MEETINGS, EVENTS, AND COURSES

(continued from page 2)

- June 13, 2013, 11:30 am—1:30 pm—WGWA Lunch and Learn: **Managing Groundwater in Central Sands of Wisconsin** presented by Ken Potter. Location TBD
- June 18, 2013—NGWA's **The Sustainable Wellfield: An Asset Management Short Course (#219).** Columbus Ohio. Register here.
- June 18-21, 2013—NGWA's **The New MODFLOW Course: Theory and Hands-On Applications (#258).** Las Vegas, Nevada. **Register here.**
- September 10-12, 2013—**Great Lakes Restoration Conference.** Milwaukee, Wisconsin. Save the date.
- September 20-21, 2013—**Wisconsin Earth and Water Student Conference** and AIPG/WGWA joint field trip at UW-Whitewater. More information here.

WISCONSIN EARTH AND WATER STUDENT CONFERENCE

We are pleased to announce the first annual **Wisconsin Earth and Water Student Conference** to be held September 20-21, 2013, at University of Wisconsin-Whitewater campus. This meeting is being jointly sponsored by the Wisconsin Chapter of the American Institute of Professional Geologists (AIPG, http://www.aipgwisconsin.org/), and the Wisconsin Groundwater Association.

DR. GEORGE STONE WILL BE THE KEYNOTE SPEAKER AT THE CONFERENCE

Student abstract submission deadline: **Tuesday, August 20, 2013**
Notification of abstract acceptance will be sent by e-mail on or before: **Friday, August 30, 2013.**

Both platform (oral) and poster presentations on research being conducted in the areas of earth and water are welcome. Topic areas include (but are not limited to) the following:

- Alternate Energy/Carbon Sequestration
- Aquatic Toxicology
- Environmental Economics and Sustainable Business Development
- Environmental Mapping & Information Management Systems
- Issues in Global Warming and Climate Change
- Mineral & Water Resource Assessment & Management
- Soils, Land Conservation and Habitat Restoration
- Water Quality

Abstracts should be submitted following the format as described here.

Students may compete for Best Student Platform and Best Student Poster awards.

More information about the conference can be found at: http://blogs.uww.edu/bhattacj/

SATURDAY FIELD TRIPS

A field trip covering the Paleozoic bedrock and glacial tills around Whitewater, with stops at various local quarries, a groundwater monitoring station that Jacobs has been monitoring for the last four years, and also stops at the Whitewater Creek. We are tentatively targeting this trip towards students from different disciplines who are interested in a variety of water-related issues, so that they can be exposed to a multidisciplinary perspective of how groundwater and surface water can interact in different spatial and temporal scales.

UPCOMING WEBINARS

- Northern Illinois University Outreach's **Hydrogeology of Karst Conditions Series. Part 1: Applied Methods on Karst Hydrology** (May 22, 2013) . More information here.
- Northern Illinois University Outreach's **Hydrogeology of Karst Conditions Series. Part 2: GroundWater Dye Tracing Applications and Methods** (May 29, 2013). More information here.

INTERESTING ARTICLES AND OTHER TIDBITS ON THE WEB

- Is your tossed out bottle of Prozac making fish happy? Mood-changing drugs enter waterways, affect fish, study finds

BREAKING NEWS!

The final part of PECFA is moving to DNR! PECFA will be 100% DNR.

Creating a 3D Hydrostratigraphy model of the Gulf Coast Aquifer in Texas

By Daniel M. Lupton[1] and Gil Strassberg[2]
Reprinted from "ArcNews", Spring 2013, Vol. 35, No. 1, p. 17

[1] Daniel Lupton, Hydrogeologist, Intera Inc., Austin Texas, USA.
[2] Gil Strassberg, Senior Product Engineer, Aquaveo LLC, Provo Utah, USA

Highlights:

- GIS-based workflows were used to support the development of a 3D subsurface model. The ability to integrate a wide array of spatial datasets into a single geodatabase, automate parts of the data processing, and visualize the results in real spatial context proved invaluable for this project.
- 2D cross sections are sketched in ArcMap. Each cross section is defined in a separate Data Frame, and a wide array of information such as borehole logs, digital elevation model, and geologic maps can be added to the cross sections.
- A workflow was developed to support the creation of a 3D model from the sketched cross sections. The model includes 3D features forming fence diagrams and volume objects describing the hydrogeology of the region in real 3D context.

Understanding the structure, extent, depth, and distribution of subsurface materials is important for many disciplines including geology, mining, oil and gas, hydrogeology and more. Traditionally, custom high-end 3D software packages were developed for creating subsurface models, with minimal interface to common GIS software. With advance of 3D capabilities in traditional GIS, a number of GIS-based packages were developed to integrate GIS into the world of 3D subsurface modeling and visualization.

In this article we describe the process of creating a subsurface model of the northern part of the Gulf Coast Aquifer, in Texas USA. The primary objective of this project, completed by Intera Inc, was to provide stratigraphic surfaces and sand thickness maps of the geological formations that compose the Gulf Coast Aquifer. The project is part of a long-term plan (sponsored by the Texas Water Development Board) to update Groundwater Availability Models (GAMs), that are used for water resources planning and management for Texas. To develop a groundwater model simulating the flow of water within the subsurface, one has to first understand the hydrogeology of the system and estimate the physical properties of underlying aquifer layers and confining units. Thus, a detailed and accurate description of the subsurface is essential for developing accurate models.

By its nature, creation of a 3D realistic subsurface model is complex and requires integration of many datasets (usually from different sources) such as digital elevation models, borehole records, geologic maps, hydrography, and more. Common data products in the process of creating a 3D subsurface model include borehole logs, 2D cross sections, 3D fence diagrams, surfaces representing terrain or top/bottom elevations of units, and 3D volume elements. The use of GIS datasets in their native format and integration of all the information into a single geodatabase streamlined the process of building the 3D subsurface model, and later updating and maintaining the model as new information is obtained. We used the Subsurface Analyst toolset, available as part of the Arc Hydro Groundwater tools to integrate the necessary information, create cross sections in ArcMap, transform the cross sections into 3D features, and build a 3D subsurface model.

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Creating a 3D Hydrostratigraphy model of the Gulf Coast Aquifer in Texas (continued)

(Continued from page 5)

For this study, the Gulf Coast Aquifer has been subdivided on the basis of chronostratigraphic correlation to yield sub-aquifer layers. The aquifer system is comprised of four units, from shallowest to deepest, the Chicot Aquifer, the Evangeline Aquifer, the Burkeville Confining System, and the Jasper Aquifer. Each of the units was further subdivided into sub-units resulting in a set of ten hydrogeologic units. The basic workflow started with identification of aquifer layer boundaries along boreholes, based on drilling and geophysical logs, and then systematic correlation of layers throughout the study area.

To support the correlation a grid of cross sections was created covering the model domain. For each cross section, a set of panels were sketched based on borehole logs, the digital elevation model, and geologic maps, together with best geologic knowledge of the area. The creation of the cross sections and the sketching process was all done within ArcMap using the Subsurface Analyst cross section tools. Each cross section is created in a separate Data Frame setup using the Cross Section Wizard, and different types of information are projected onto the cross section using custom Geoprocessing tools.

The sketched 2D cross sections are the base for developing a 3D subsurface model. Although not part of the original project, we developed a workflow to support the creation of a 3D subsurface model from the sketched cross sections. The workflow includes the following steps:

- The sketched 2D cross section panels were converted into GeoSections (3D multipatch features) that enable viewing hydrogeologic layers as a 3D fence diagram.
- 3D GeoSections were sampled to create a set of new 3D points, where each point represents the top or base of a hydrogeologic unit.
- Raster surfaces were interpolated from the points using Spatial Analyst interpolation tools. Each raster represents the top or bottom of a hydrogeologic unit.
- GeoVolume (3D multipatch features) features were created, by "filling" between the raster surfaces, to display hydrogeologic units as 3D volume elements.

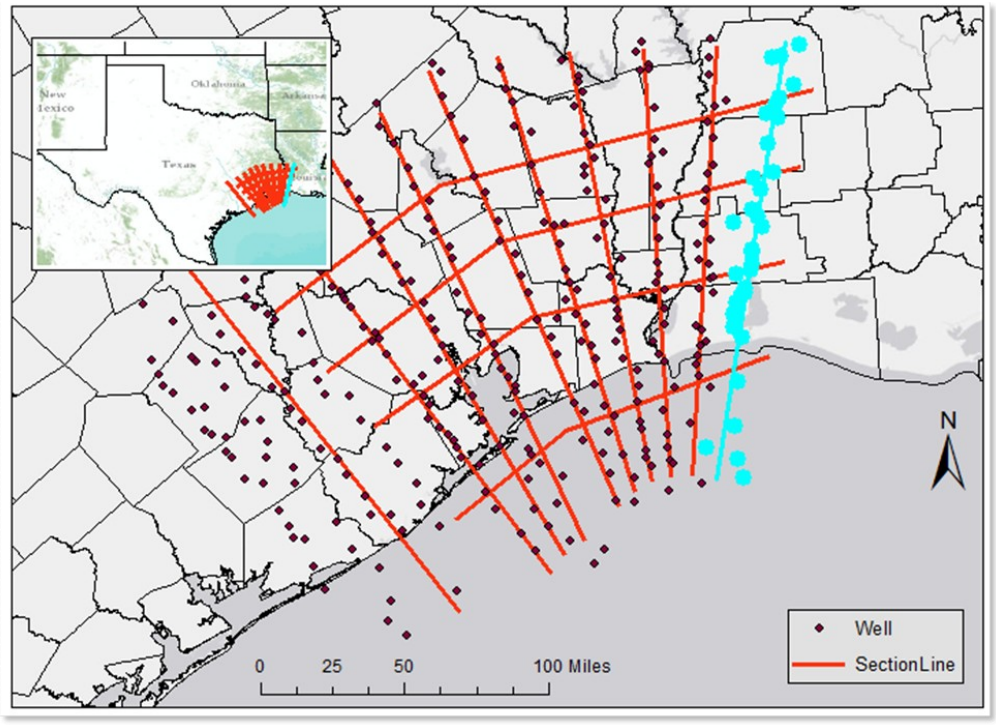

Figure 1 – Location of boreholes used to characterize the stratigraphy of the northern part of the Gulf Coast Aquifer. Red lines show section lines used to create 2D cross sections, and the highlighted points are the selected wells that will be plotted on the highlighted cross section. 8)

Creating a 3D Hydrostratigraphy model of the Gulf Coast Aquifer in Texas (continued)

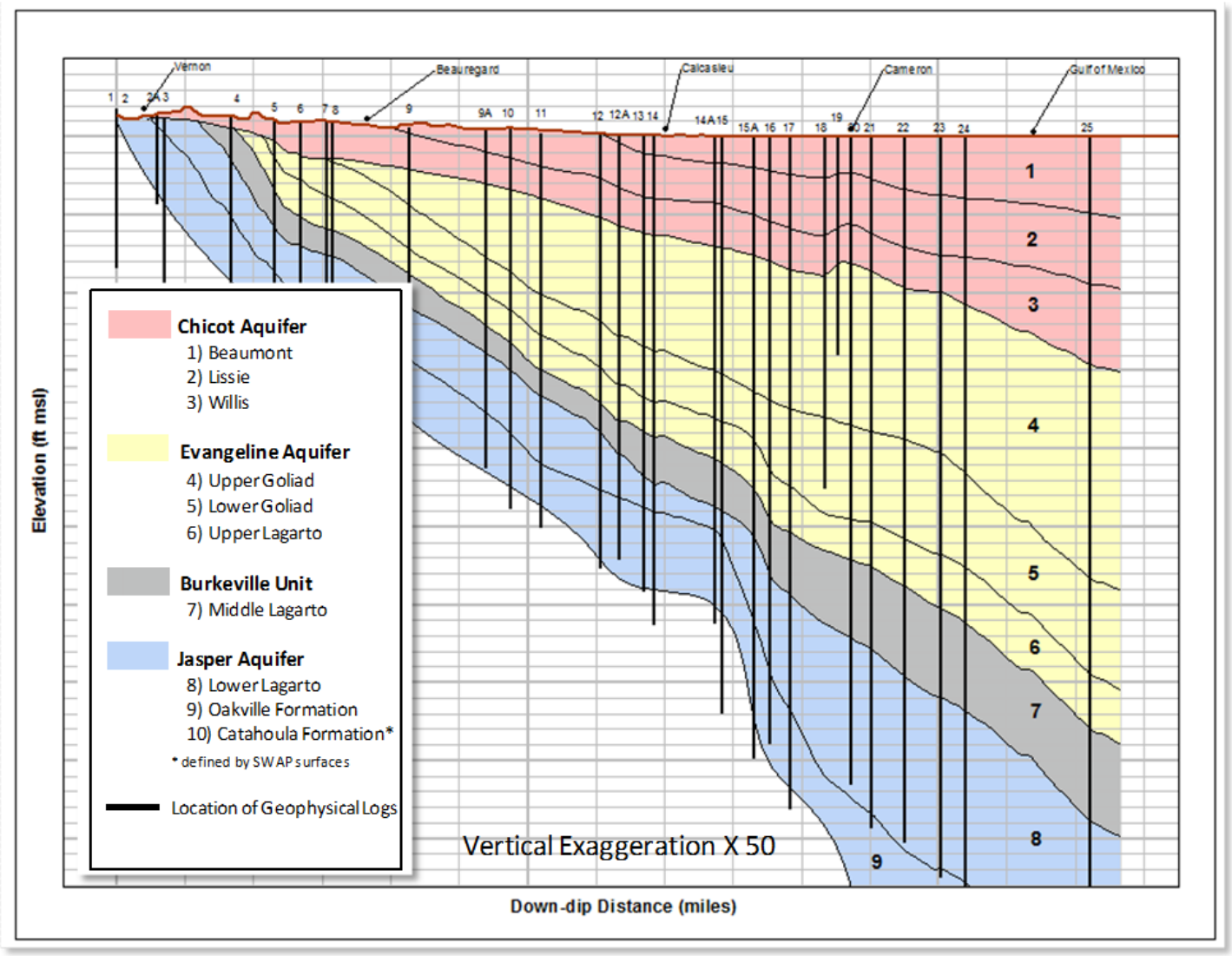

Figure 2 – Example cross section created in ArcMap using Subsurface Analyst tools. An ArcGIS-based workflow was developed to support creating and updating of cross sections as more information becomes available.

Creating a 3D Hydrostratigraphy model of the Gulf Coast Aquifer in Texas (continued)

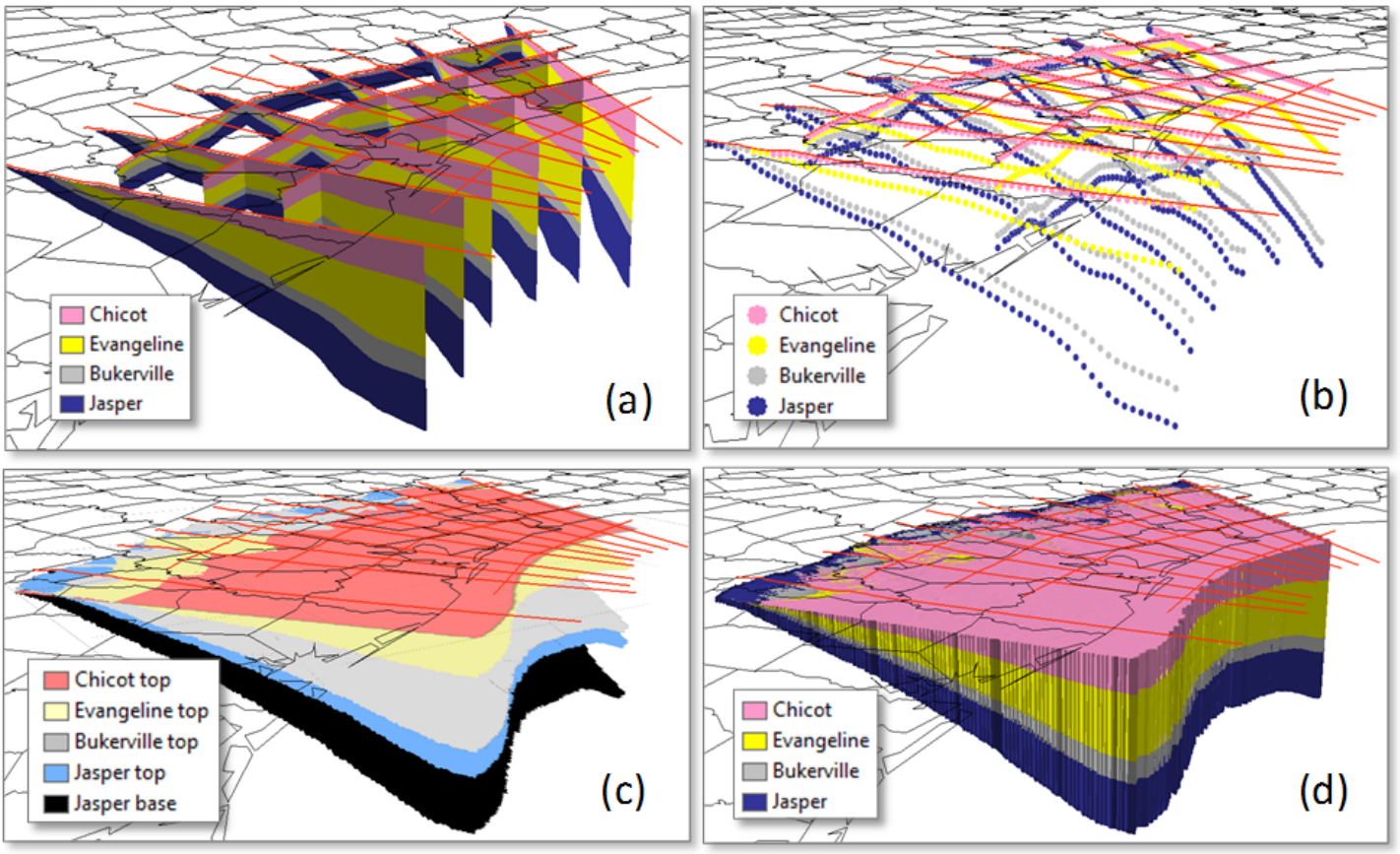

Figure 3 - Workflow for creating a 3D subsurface model from 2D cross sections: (a) cross section panels are converted to GeoSections forming a 3D fence diagram, (b) GeoSections are sampled and 3D points are created representing top/bottom of units, (c) raster surfaces are interpolated from the 3D points, and (d) 3D GeoVolume features are created by "filling" between the surfaces.

This project is an excellent example of how GIS-based workflows can support the development of subsurface models. The ability to integrate a wide array of spatial datasets into a single geodatabase, automate parts of the data processing, and visualize the results in real spatial context proved invaluable for the project. The development of workflows enable quick updates of the end products such as maps, cross sections, and 3D features. For example, cross sections can easily be re-sketched and updated in ArcMap as new drilling records and geophysical logs become available, and the 3D model can then be quickly updated accordingly.

For more information about the project please contact Daniel Lupton, Intera Inc, dlupton@intera.com. For more information on the Arc Hydro Groundwater data model and tools please visit www.aquaveo.com/archydro or contact Gil Strassberg, gstrassberg@aquaveo.com, Aquaveo, LLC.

A Piece of Water History from Eau Claire

By Ed Morse, September 2010
Reprinted from the WRWA Journal, Fall 2010

We have an exciting new addition to our water museum. John Doyle, the Director of Public Works for Deerfield came across a section of a 120-year old wooden water main and he recently persuaded its owner, Dale Miller, to generously donate it to us. Dale is a retired operator and former business agent for the operators union who obtained it from a construction site in Eau Claire back in 2002. This is a large diameter pipe, 26 inches inside diameter and it is made of white pine wood staves held together by iron hoops, very similar to the way that barrels were made. In the days of wooden water mains, smaller diameter pipes were generally made by boring out the centers of logs but larger mains were of stave construction and instead of joining individual sections of pipe, the staves were staggered so that the pipe could be constructed continuously in place at the site. This one comes with an interesting history that illustrates the frustrations, the public involvement and the persistence that our ancestors showed in attempts to obtain a reliable and drinkable source of water. Of course, what passed for "drinkable" back then might fall a little short today.

Many Wisconsin communities went through a succession of different water sources as rivers became polluted or demand increased beyond the capacity of a spring or aquifer and the City of Eau Claire had its share of fits and starts. Eau Claire, at the confluence of the Chippewa and Eau Claire Rivers was the site of sawmills that processed timber from the extensive logging operations upstream. The city ran the gamut of water sources, the earliest being small springs in the valley. These were soon inadequate in volume for the rapidly growing city and beginning in 1885 water was then taken from the Chippewa River. The Dells Dam had been built in 1878 to power saw mills but also to create an intake reservoir and provide hydroelectric power to operate pumps for a future water works. The river water was often turbid, especially during log drives, and required purification by a filtration plant preceded by a settling tank. The settling process was enhanced by the addition of a coagulating agent which causes small particles to clump together to form larger particles that settle faster. The coagulant used was alum (aluminum sulfate) and the required dosage was so high that it imparted an unacceptable taste to the water. Actually, the Chippewa River originates up north in tamarack swamps and peat bogs and contains a great deal of tannin and humic acids which complicates the coagulation process, requiring unusually heavy doses of alum.

Because of the public's objection to the water's taste the city decided to search for a new source, which led to Wheaton Springs on the west bank of the Chippewa River north of town. In 1889 an earthen dike was constructed to impound the spring's discharge which was then piped more than a mile and a half to town. Dale's pipe was part of this pipeline. Water from the pond was fed into it through a flume and it flowed by gravity to the dam where a pumping station was built.

The spring water was clear and soft and a big improvement over the treated river water. However, after a few years, another taste problem arose, this time from algae in the reservoir. It was sometimes also turbid from cows and horses that were somehow allowed to wade into the reservoir and there were complaints of small fish, snakes and other life forms coming out of water taps. Furthermore in 1893 the spring failed to meet the rising demand of the city. To supplement the spring, three large brick-lined open wells, twenty feet in diameter, were dug in the alluvial sand and gravel along the river. In the spring floods of 1896, the Wheaton Springs reservoir dikes were damaged by ice, and river water flooded and contaminated the reservoir. The dikes were repaired

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A Piece of Water History from Eau Claire (continued)

(Continued from page 9)

but after that the wells became the principal source and the use of Wheaton Springs was phased out after 1902. Additional large open wells were sunk in 1903 but in the bottoms of these wells numerous well points were driven, as many as forty per well, in an attempt to increase the yield. Between 1911 and 1918 the city experimented with drilled wells in the alluvium but they were soon abandoned because of high levels of iron and manganese and what was reported as algae in the wells. The iron and manganese were very unpopular with customers and everyone was walking around town with iron-stained clothing, but when the city proposed adding treatment to remove the iron, a citizens group organized to oppose it, perhaps recalling the bad experience with the alum treatment. They contended that another source of iron-free water could be found. The city's consultant countered that even if low-iron water could be found, prolonged pumping might increase the levels of iron and manganese as had happened in the first city wells. In the 1930s a great debate raged in the local press between the citizens group and city officials and the mayor was the object of a recall petition. Meanwhile, other sites were investigated and eventually it was agreed to develop wells on the east side of the river upstream from town.

All the while, the city had maintained the structures for the use of river water though the intake above the dam, mainly for emergency use. There was still no elevated storage so pressure had to be maintained by continuous operation of the pumps with relief valves discharging to the river upon reaching a set pressure. In 1924, at the urging of fire insurance underwriters, the city voted to build a three million gallon reservoir on Mt. Tom. The Iron was apparently a legitimate complaint. In 1934 a transmission main was cleaned of three inches of iron encrustation that accumulated after only four years of use. During this cleaning, river water had to be used and, because none of the upstream towns had sewage treatment it was necessary to chlorinate heavily and a boil order was in effect.

We can only imagine the relief when the new well field was completed later in 1934. Hydrants were opened and river water was flushed from mains and the Mt. Tom reservoir and the new well water began flowing amid great fanfare. Headlines proclaimed, "Softness of new water is revelation to housewives; to cut soap bill in half," reminiscent of the day 55 years earlier when Wheaton Springs was initiated. As a postscript, by the 1950s iron and manganese levels had increased, as predicted, to the point that in 1955, an iron/manganese filtration plant was built.

Over the following years additional wells have been drilled and Eau Claire still relies on drilled wells in the alluvial aquifer, although the journey to that point took a number of interesting turns. Wisconsin's first municipal water systems were being built in the late 1800s and the technologies that seem so well established today were just being developed. There was a lot of trial and error that make for some fascinating reading. Thanks to Steve Hayden of the Eau Claire Water Works and Frank Smoot of the Chippewa Valley Museum for help with this story.

2013 Annual Meeting—Photographic Recap

Photos Courtesy of Troy Thompson

We had a full house—over 60 attendees—for the 2013 annual meeting.

Jim Bannantine, our meeting MC and 2013 WGWA President.

Steve Sellwood presenting an update on new techniques for measuring groundwater flow.

2013 Annual Meeting—Photographic Recap

Photos Courtesy of Troy Thompson

President-Elect Ralph Smith's presentation focused on use of Na-4 Mica as a ceramic water filter.

Our keynote speaker, John Jansen, delivered his McEllhiney lecture on aquifer sustainability.

Robert Smail summarized the DNR's water withdrawal inventory and reporting program.

Terry Evenson reported on new groundwater screening levels used to assess the risk for vapor intrusion.

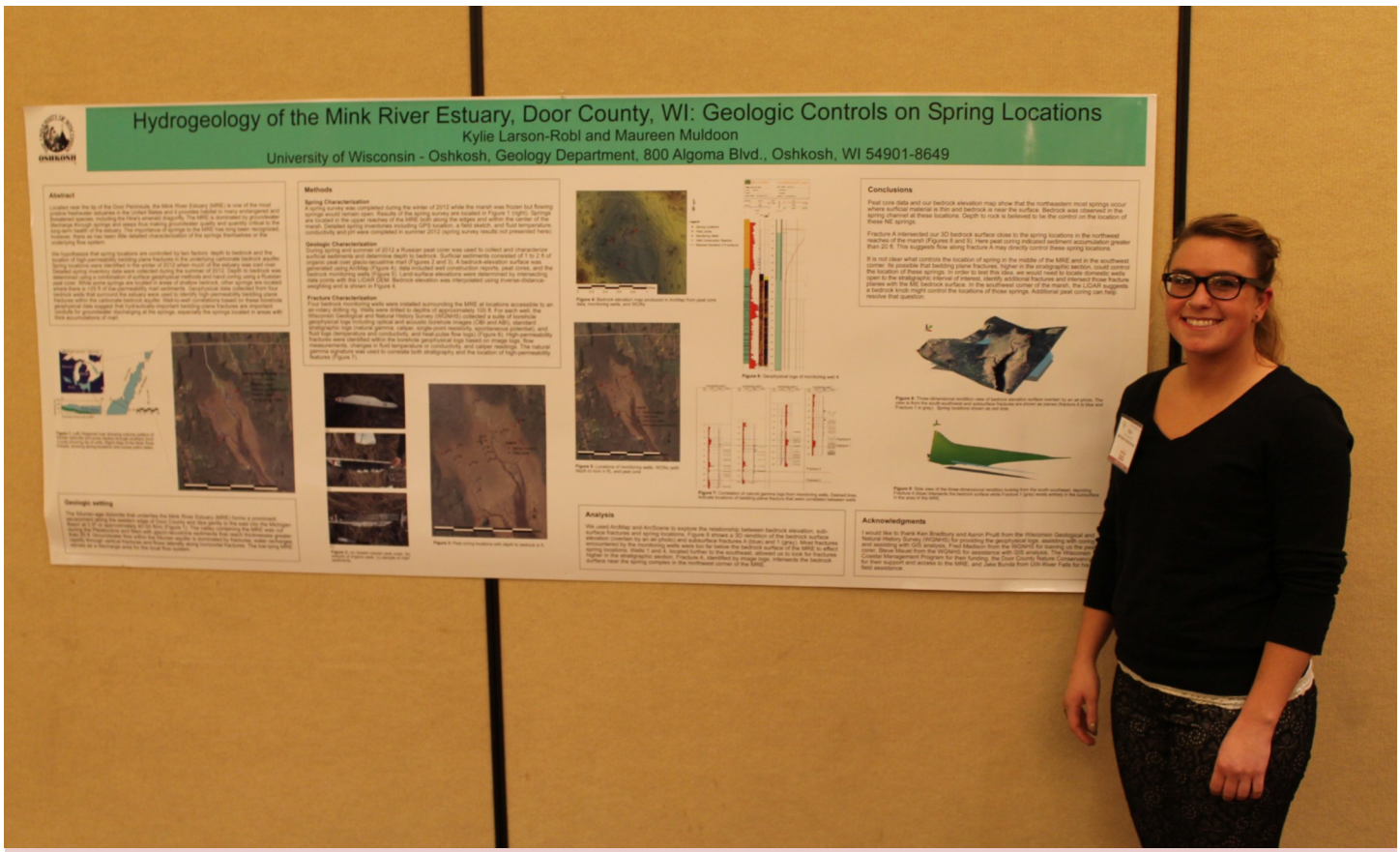
Christine Lilek explained the Green Tier program and how it has improved groundwater quality in Wisconsin.

Eric Oelkers gave details on his experience with a recent well siting process in the City of Madison.

2013 Annual Meeting—Photographic Recap (continued)

Kathy Reid demonstrating the sand model

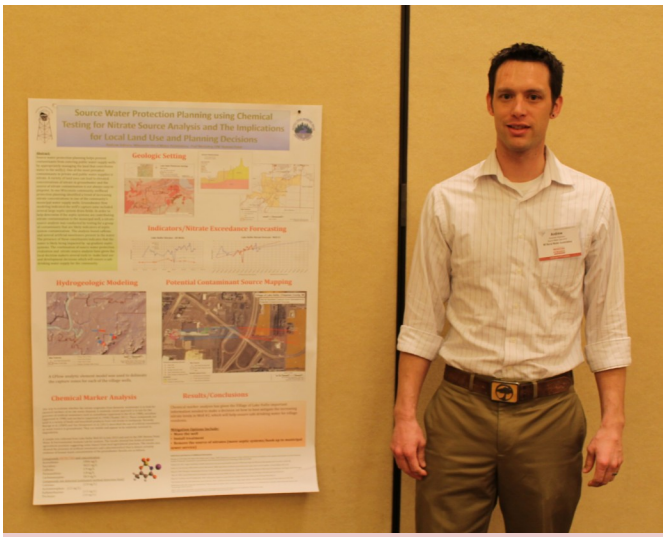
Poster presenters, Mike Baierlipp, Kylie Larson-Robld, Heather Davis, and Andrew Aslesen



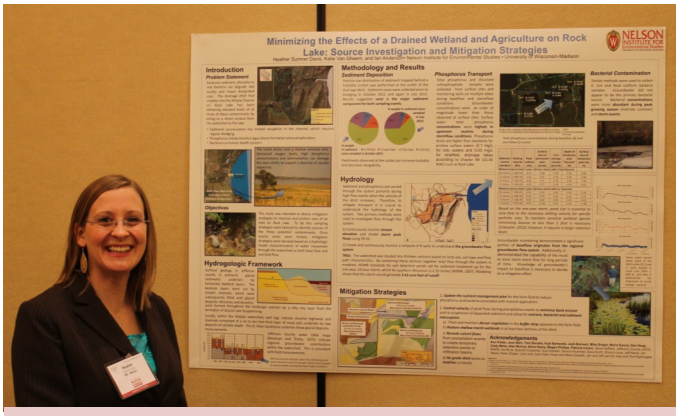
Poster presenter and winner Kylie Larson-Robld

2013 Annual Meeting—Photographic Recap (continued)

Poster presenter Mike Baierlipp explaining his research on Cedarburg Bog.



Poster presenter Andrew Aslesen



Poster presenter Heather Davis

Treasurer Becky Caudill, Board Member Anna Fehling, and Past President (2012) Paula Richardson

Jeremiah Jonson, Board Member Jodie Peotter, Eric Oelkers, Secretary Jeff Ramey, and Steve Sletten

Thank you to all who attended, presented and helped plan and coordinate the 2013 annual meeting. We are looking forward to seeing members again at the June 13 luncheon.