Data Collection, Characterization, Monitoring

Charge from Groundwater Management Area Advisory Committee

Working Group Members

Melanie Redding (Chair); Andres Cervantes; Bob Stevens; Charles (Pony) Ellingson; David Bowen; Chelsea Durfey; Dave Cowan; Donald Brown; Doug Simpson; Elizabeth Sanchey; Eric Winiecki; Frank Lyall; Ginny Stern; Jaclyn Hancock; Jan Whitefoot; Jean Mendoza, Jennifer MacDonald; John Van Wingerden, Kevin Lindsey; Laurie Crowe; Lino Guerra; Mike Shuttleworth; Ralph Fisher; René Fuentes; Robert Farrell; Ron Cowin, Scott Stephen; Sheila Fleming; Steve Swope; Stuart Turner; Dr. Troy Peters

Meetings/Calls Dates

Meeting: Wednesday, July 13, 2016, 1:00-3:00 PM
Call Number: 509-574-2353 pin: 2353#

Participants

Present: Melanie Redding (Chair), Jean Mendoza, Steve George, Jim Davenport, David Bowen, Matt Bachmann, Andy Long (USGS), Sandy Braden (FOTC), Cindy Kozma, Vern Redifer, Gary Bahr*, Ginny Stern*, Laurie Crowe*, Pony Ellingson*, Steve Swope*, Chris Saunders (County Support Staff) *via phone

Key Discussion Points

The meeting convened at 1:00pm. Members made the customary introductions.

Particle Tracking Model Overview: Matt Bachmann from the U.S. Geological Survey presented the group with a PowerPoint summary of his report, "Particle Tracking for Selected Groundwater Wells in the Lower Yakima River Basin", [http://pubs.usgs.gov/sir/2015/5149/sir20155149.pdf] published on October 21st, 2015. The report was a follow-up to a 2011 joint effort between USGS, DOE, the Bureau of Reclamation, and the Yakama Nation, "Numerical Simulation of Groundwater Flow for the Yakima River Basin Aquifer System", [http://pubs.usgs.gov/sir/2011/5155/pdf/sir20115155.pdf].
The two reports were an attempt to trace the direction and velocity of groundwater flow in the Yakima River Basin from October 1959 to 2001.

The fourth slide lays out the dimensions of the model. Each cell is 1,000 x 1,000 feet, approximately the same size as some farm fields. Slide 6 shows the grid overlaid on satellite photo of the Yakima Area Arboretum. If two fields share a cell, there are limits on what the model can project for any specific field.

USGS pulled every well log in the Lower Yakima Basin. They looked at where the molecules in the wells came from using the 2011 groundwater flow model, and a reverse particle tracking program called MODPATH-2000, to predict the recharge areas contributing water to the specific well locations with a particular cell or cells. A member of the group asked how far in the future this framework would still be valid. Matt replied that while the Lower Yakima Basin's groundwater system had probably changed a little bit between 2001 and 2015, it likely would not have seen any great changes, since not many new wells have been added in that period of time.

Slide 8 depicts a relief map of the Lower Valley, with 121 green dots representing groundwater samples with nitrate concentrations exceeding 10 mg/liter. The dots were generalized to within 1,000 feet of their true locations in order to protect people's privacy. Most of the dots are located north of Sunnyside and Granger, with another cluster south and east of Mabton.

Slide 9 depicts the same relief map as the previous slide, with fields of red dots portraying the aquifer recharge area for all 121 contaminated wells. What this means according to the model is that if you own property in the red area, you contributed water to the wells. The nitrates could still have been contributed from outside the area.

Slide 10 laid out "What we didn't do" in the USGS report:

- Generate a nitrate budget
    - No nitrate concentrations simulated
    - No nitrate attenuation
    - No physical dispersion or spreading of plumes
    - Determine relative importance of nitrate sources

- Analyze land uses
    - No satellite photos
    - No comparisons of various nitrate sources

- Simulate the vadose zone
    - Assumed instantaneous delivery to water table
    - Assumed only vertical migration in unsaturated sediments

Slide 11 laid out "What we DID do."

- Estimate travel times
    - Median of less than 3 years

- Document groundwater flow directions
    - Towards the river in most cases
    - Highlights the importance of flow barriers

- Relate recharge area to depth of well
    - Shallow wells draw from small nearby areas
    - Deeper wells draw from larger areas, farther away

- Address limitation of EPA analysis
    - Provides an explicit accounting of groundwater motion

- Provide a tool
    - Allows anyone to simulate the recharge area of their well

The projected median travel time of three years could vary by a factor of ten based on the porosity and depth of the soil the water is traveling through. The shortest travel time for a particle to reach a well was 19 days. Some were still traveling after the 42 years of the study.

Slides 12 and 13 depict the erratic courses that particles can travel. In Slide 12, an anticlinal ridge acts as a hydrologic flow barrier that diverts groundwater flow. Slide 13 depicts how areas with high recharge rates influenced by seasonal irrigation can cause particles to follow a crooked, and in some cases, looping path. A group member contended that irrigation would play less of a factor in affecting groundwater flow than the water that goes into canals, especially after technological changes over the last decade. Matt agreed that canals contribute to altering groundwater flow, and that "human impact" was the best way to talk about it. Another member asked if this model could account for variables in this respect. For example, if we assume that all the canals are lined, would the model show the particles traveling a different path? Matt replied that the model would tell you what it thinks would happen. Jim Davenport asked whether the green cell on Slide 13 represented one well, or many. Matt clarified that it represented at least one well, and potentially more. Each cell contains 27 dots, representing particle flow based on depth. If you plug in a specific well, you can get a more exact path.

Slide 14 illustrates two different ways of defining a recharge area. The map on the left highlights in red the cells in which water particles originate before traveling to a well. The map on the right highlights the cells in which the particles originate, plus all the cells they traverse in their journey. It is possible that human activities in the traverse zone contribute towards elevated nitrate levels. Vern stated that there are approximately 6,400 septic tanks in the GWMA, and that the entire GWMA would be colored red using the map on the right.

Slide 15 showed examples of what happens when you have a dense cluster of wells. It becomes visually confusing for a person to track all of the overlapping particle tracks.

Slide 16, "Adding new wells", contains a screen shot of a text file containing starting locations for all particles. The software for running this file can be installed from USGS.

Slide 17 listed the complications of applying the results of the USGS study:

- Technical Limitations
    - Well depth picks are inferred, not measured
    - Screened intervals are unknown (assumed one cell)
    - Model resolution is relatively coarse (1,000 ft)
    - Tracking is only for 42 years, ends in 2001
    - S properties are poorly constrained

- Legal sensitivities
    - Generalized locations of contaminated wells were released
    - Study was classified as "Influential Scientific Information", thus requiring additional levels of review
    - Ongoing litigation may attempt to re-interpret USGS results

Slide 18 was labeled "What's Next"

- Potential Future Work
    - Quantify nitrate budget in GWMA and surrounding areas
    - Measure seasonal nitrate area loading rates and sources
    - Measure natural nitrate breakdown rates during transport
    - Simulate nitrate transport in groundwater including breakdown

- Potential Model Uses
    - Estimate relative contributions from various sources
        - By area or to individual wells
    - Identify areas that have potential to accept more nitrogen loading
    - Assess impacts of current nitrate loading rates
    - Assess impacts of proposed mitigation strategies
    - Safely manage manure and fertilizer application rates

Slide 19 returned to the first relief map, and illustrated what the Lower Valley looked like when the particle flows for all 121 contaminated wells were shown. Jim Davenport remarked that all the overlapping colored lines made it look like a Jackson Pollock painting.

Discussion ensued on how different tracking models could contribute to the GWMA's efforts. Matt had talked with people in the GWMA about combining the MT3D MODFLOW software application to the vadose zone, where most of the nitrates would likely be applied. USGS would like to use each known location of high nitrate contamination in the vadose zone and compare to the model. Matt could differentiate between potential nitrate sources by taking all applications of nitrates, layering them on top of each other, and then subtracting given sources. The model could be applied looking backwards, as well as making predictions going forward. Some members expressed reservations about the usefulness of models, since the potential always exists for people to see generalized estimates, and take them as gospel.

Nitrogen Loading Assessment – Status Update: Gary Bahr informed the group that WSDA had received the RCIM chapter from Vern. The Irrigated Ag chapter had been completed. They were finishing up work on Livestock/CAFO, going over GIS layers as to lagoon locations so as to identify dairy vs. non-dairy sources. It should be available for peer review by late July/early August.

Ambient Groundwater Monitoring Network – Status Update: Pacific Groundwater Group had submitted a draft report, which in Melanie's view, had received a lot of good comments, some of which were outside the scope of the GWMA's mission. PGG is in the process of revising the document.

Other Monitoring Initiatives: Melanie began by stating that there wasn't money in the GWMA budget to pay for long-term sampling and data analysis, and that other funding avenues would have to be pursued if the group felt they were necessary. Melanie asked the group what other initiatives they could pursue, and what people felt were important things to propose to the GWAC. Jim felt that the GWAC was still on Chapter 1 with the ambient monitoring, and needed to take any future work one chapter at a time. Vern noted that the GWAC's mandate expires in December 2017, and that there isn't enough time left to pursue every idea. A member suggested finding a list of what other GWMAs had done, and if replicable, pursue those strategies. Steve Swope stated that PGG has a document from two or three years ago looking at what other GWMAs had done. Matt stated that USGS maintains some monitoring networks and invited Vern to contact him about acquiring the relevant documents.

Members disagreed on the relative importance of monitoring the effectiveness of BMPs. Some felt that since we already have data from existing BMPs, and that any monitoring would be *post hoc*, that it should not be a high priority. Other members saw it as likely that the GWAC would push for new and improved BMPs, and that if the public was going to buy in – whether in the area of RCIM, Irrigated Ag, or Livestock/CAFO – they would need to see how it will affect them personally.

Monitoring nitrate "hotspots" through deep soil sampling emerged as a topic of discussion. Some members felt that keeping track of CAFOs and non-dairy spots to characterize whether they were the worse source areas was where the GWMA's limited dollars should go. Others questioned what the nature of the end goal was supposed to be: identifying high nitrates in all groundwater, identifying high nitrates that pose a high public health risk, promoting more sustainable agricultural practices, or all of the above. Matt stated that USGS has old file logs for existing wells it can consult to see which ones were sampled. His organization could potentially assist in conducting groundwater monitoring with data the GWMA has compiled. Vern and Matt agreed to keep in touch about coming up with something to present to the GWAC at their next meeting.

The meeting adjourned at 3:15pm.

Resources Request

Recommendations for GWAC

Deliverables/Products Status

Proposed Next Steps

Melanie will provide the group with the comments submitted to PGG's draft report on their ambient groundwater monitoring network, as well as PGG's responses.

Steve Swope will provide the group with a document PGG produced two or three years ago, looking at what various GWMAs did regarding monitoring wells.

Vern Redifer and Matt Bachmann will get in touch about procuring documents regarding USGS's groundwater monitoring programs. Matt will also provide the group with a ballpark estimate of how much it would cost for USGS to assist with groundwater monitoring so it can be presented at the August 18th GWAC meeting.