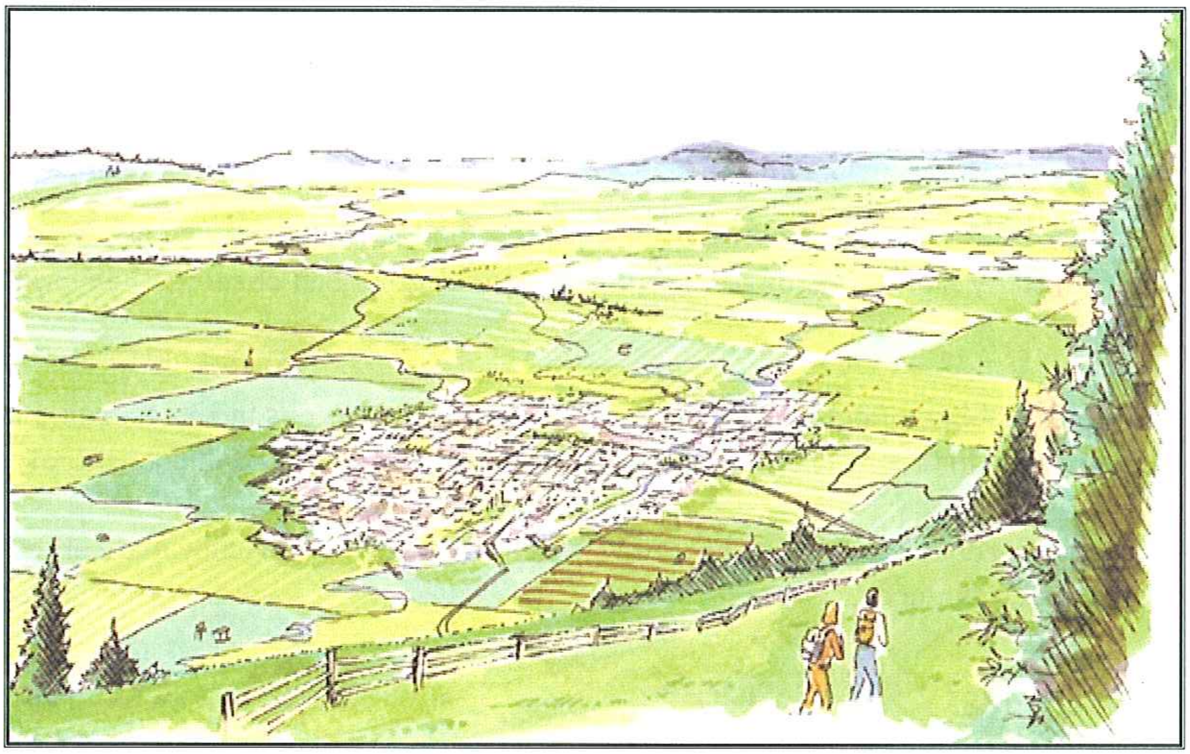
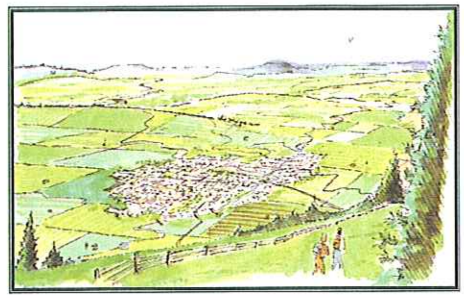
Southern Willamette Valley Groundwater Management Area

Project Tour



July 24, 2008



Itinerary

Thursday, July 24, 2008

8:00 Harrisburg City Hall - Tour Begins.

8:20 Stop 1: Bush Gardens – The mystery of rising nitrate concentrations.

8:45 Stop 2: Funke Road via Coburg Bottom Loop Road – Competing potential contamination sources.

9:10 Stop 3: Egge Sand and Gravel - See a cross-section of the subsurface.

9:50 Rest stop.

10:00 Stop 4: Junction City Wastewater Lagoons – Find out how one city has been affected by high levels of nitrate in the groundwater and observe their own nitrate 'source'.

10:40 Stop 5: Hubbard Road – Take a look at the variety of crops in the area and learn about how different crop types and irrigation practices could impact nitrate levels.

11:00 Stop 6: Goracke Road – See how the Willamette River historically and currently influences the area.

11:30 Harrisburg City Hall – Tour ends.

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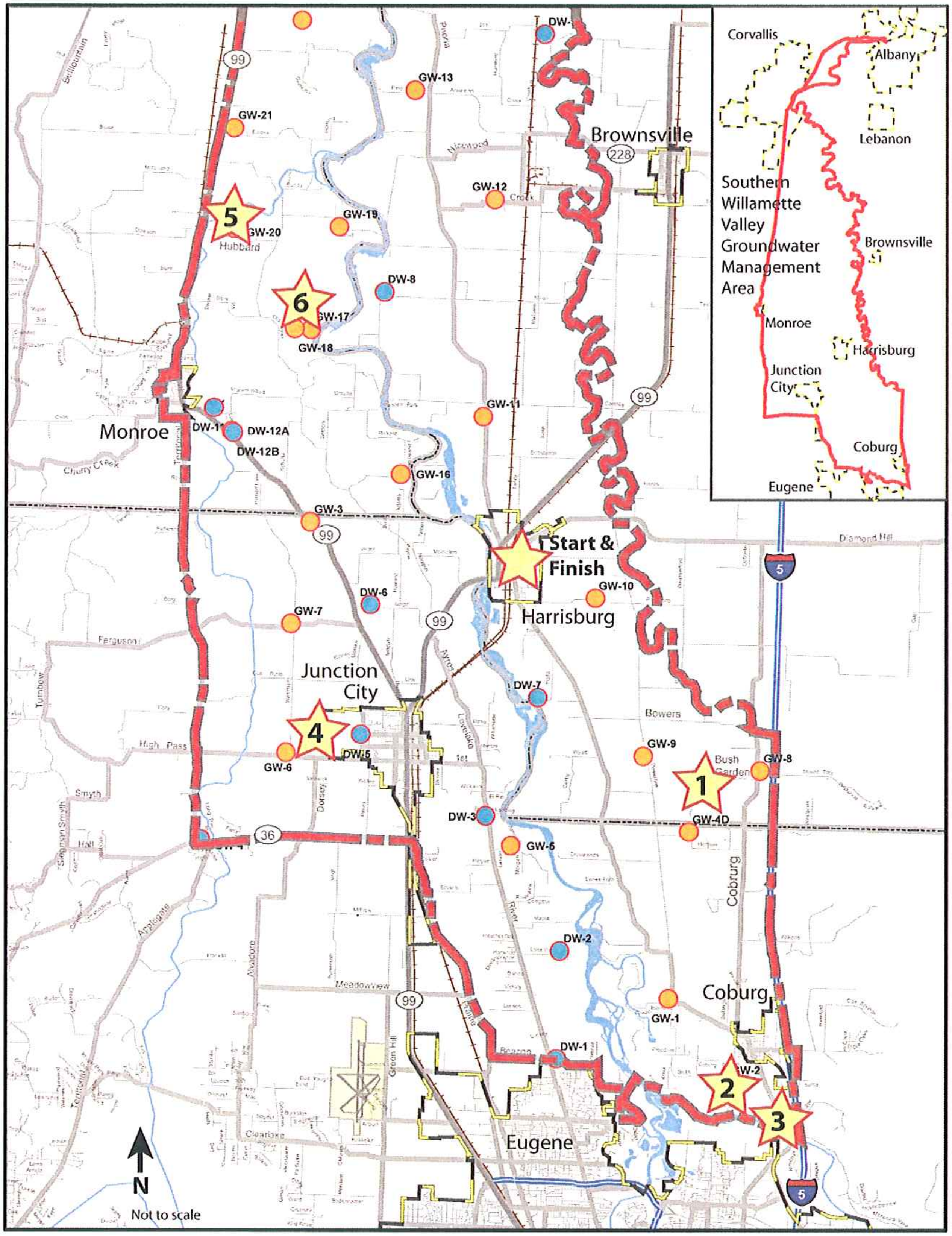
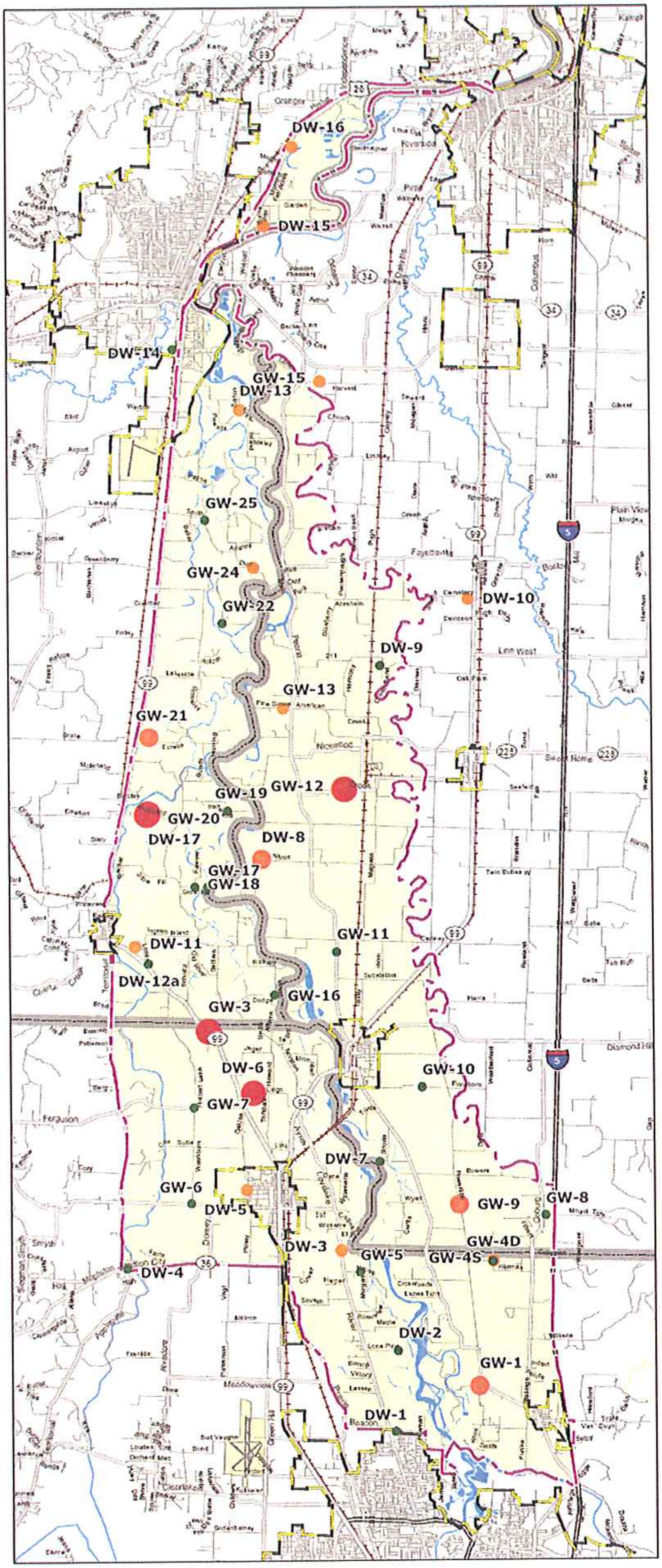


Monitoring Wells (GW) & Domestic Wells (DW) Average Nitrate Concentration

Average of Six Quarterly Samples



Sample Wells

Average nitrate (mg/L)

- 0.0 - 4.0
- 4.1 - 7.0
- 7.1 - 10.0
- 10.1 - 26.4

Groundwater Management Area

Urban Growth Boundaries

County Boundary

City Limits

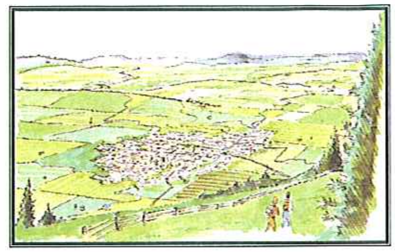
N

0 1 2 3 4 5 6

Miles

LCOG

Tour Starts - Harrisburg City Hall

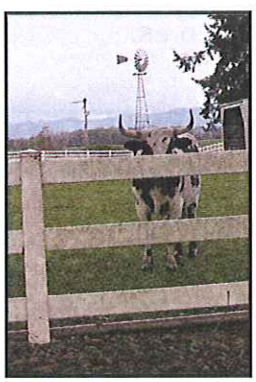


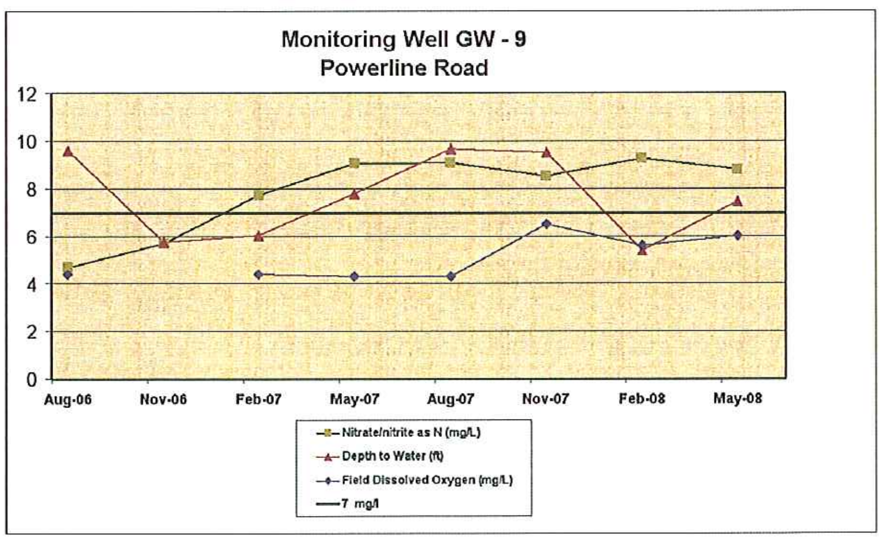
Stop 1: Bush Gardens - The mystery of rising nitrate concentrations

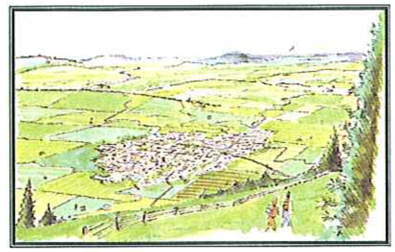
This tour stop lies a little over a mile southeast of monitoring well GW 9. Monitoring well GW 9 is consistently showing increasing nitrate levels. The likely cause of this nitrate is a bit of a mystery. Agricultural lands are the predominant land use immediately surrounding the well with perennial rye grass seed being the predominant crop. Although this crop typically gets a moderate amount of nitrogen fertilizer applied, perennial rye is an excellent "scavenger" of nitrogen with minimal irrigation applied. Other land uses like the ones seen near this stop include rural residential homes and livestock. These are further away but still up-gradient of GW 9.

What do you think is contributing to GW 9 nitrate concentration increases:

- Surrounding crop lands;
- House and septic system next to the monitoring well;
- Rural sub-division;
- Scattering of rural homes in the area;
- People throwing salads from their cars on I-5;
- Small scale livestock seen near rural homes; or
- Larger scale livestock operation on Coburg road?

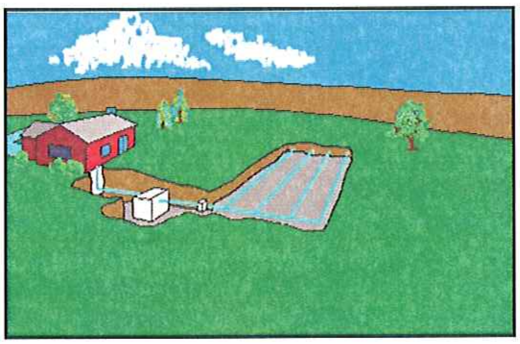






Stop 2: Funke Road via Coburg Bottom Loop Road - Competing potential contamination sources

This site lies near the City of Coburg's two municipal water system wells. Both of Coburg's wells are over 100 feet deep yet still show occasional high nitrate levels. All of Coburg's 10 year time of travel Drinking Water Source Area is outside of the city's jurisdiction making protecting that source more challenging.



There is a mixture of rural and city homes in the area all relying on private wells and septic systems. The nitrogen budget estimates that for the entire GWMA, septic systems contribute about 80 tons of nitrogen annually. There is also a mixture of crops nearby. The nitrogen budget estimated that about 1,700 tons of nitrogen is contributed annually within the GWMA as a whole. Historically the area near Bottom Loop Road was predominately mint and vegetable crops but has transitioned to more grass seed crops. Recently sod farms can be seen in the nearby area.

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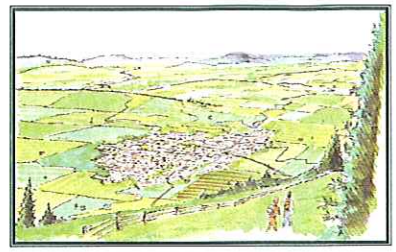
Many of the rural domestic wells sampled in this area have elevated nitrate levels (above 7 mg/L). There used to be a mint distillery in the area and when it was in operation, people described their well water as tasting like mint.

This site has a mixture of land uses that may be impacting groundwater quality, such as:

- Rural residential homes and about 400 City of Coburg homes and businesses relying on septic systems;
- A swale constructed for stormwater runoff;
- Rural and urban homes with fertilized lawns;
- A mixture of agricultural crops; and
- Sand and gravel operations



Stop 3: Stop 3: Egge Sand and Gravel - See a cross-section of the subsurface

At this stop, we'll be looking at landforms and discussing geologic conditions that helped to form the Valleys' shallow groundwater aquifers. In general, the Willamette Valley has five sedimentary 'deposits' that record four distinct episodes in the geologically-recent, development of the Willamette Valley. The existing topography is mostly determined by the deposits character, distribution, and thickness. and by groundwater properties. .

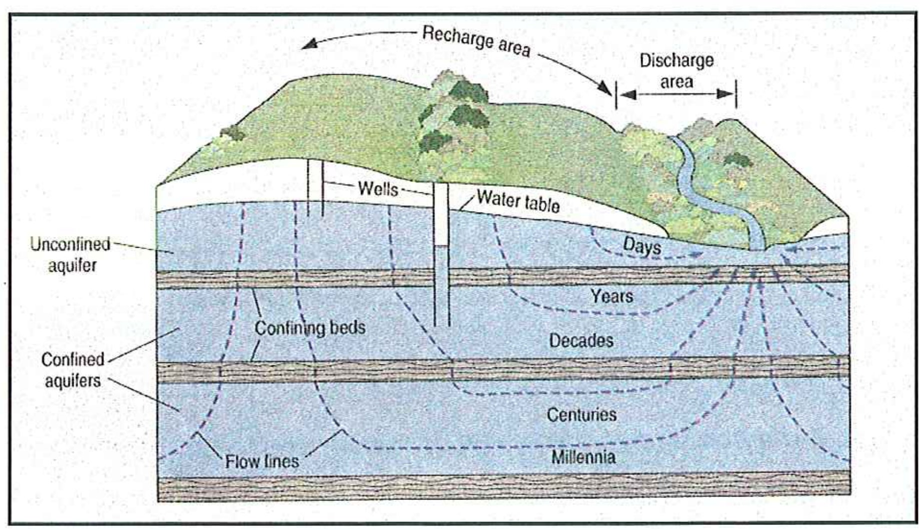
The oldest widespread unconsolidated deposits are sands and gravels laid down by streams and rivers between 2.5 million and 500 thousand years ago. These older deposits are underneath the terraces seen flanking the margins of valleys and lowlands and were deposited.

Excavation or tectonic lowering of the valley allowed as much as 500 meters of sediment deposition to occur. These sand and gravel deposits range in age between 420 and 12 thousand years.

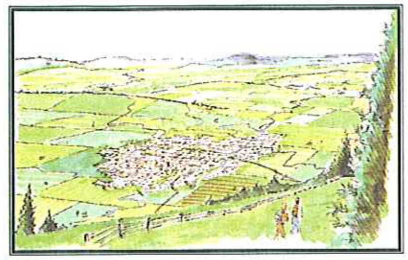
Towards the end of this depositional event, between 15,000 and 12,700 ago, dozens of floods from Glacial Lake Missoula flowed down the Willamette Valley from the Columbia River, depositing up to 35 meters of gravel, sand, silt and clay.

Since the last of these great floods (12,000 years to the present), the Willamette River flow system has changed significantly. The braided river system that formed vast plains of sand and gravel deposits have changed into to incised and meandering rivers that are constructing today's fine grained floodplains and gravely channel deposits. In the subsurface, these channel deposits are loose, unconsolidated, and highly permeable. As such, substantial groundwater flows through these channels are well connected to the Willamette River and its major tributaries.

Depending on our location, we may be able to see this geology displayed in the gravel mine or nearby road-cut. Our discussion will focus on groundwater flow directions and their association with the McKenzie and Willamette river channels.



Stop 4: Junction City Wastewater Lagoons - Find out how one city has been affected by high levels of nitrate in the groundwater and observe their own nitrate 'source'



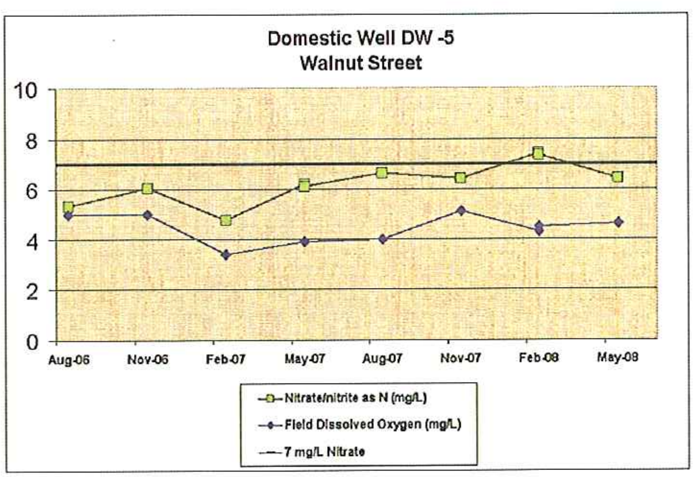
Junction City's wastewater lagoons are approximately 1 mile due west of the town center. Groundwater in this vicinity is flowing in a northerly direction. The site is approximately ½ mile west of DW-5 and approximately ¾ mile northeast of GW-6.

This location rests on a thick section of layered sediments that are composed of silt, clay, sand, and gravel. These sediments rest on top of older sedimentary and volcanic rocks. Junction City's public drinking water wells draw water from the more permeable portions of the sediments. The sediments are broken into a 50-foot thick sand and gravel aquifer that is underlain by a 50- to 75-foot thick silt/clay dominated layer which, in turn, is underlain by a thick (~ 150-foot) sand dominated layer. The shallow sand and gravel aquifer supplies many domestic wells and the Elm Street well (see map). This water source is considered highly sensitive to contamination from land use activities. The silt/clay dominated layer has a low permeability and adds a measure of natural protection to the deeper sand aquifer. Most of Junction City's wells draw water from the deeper sand aquifer.

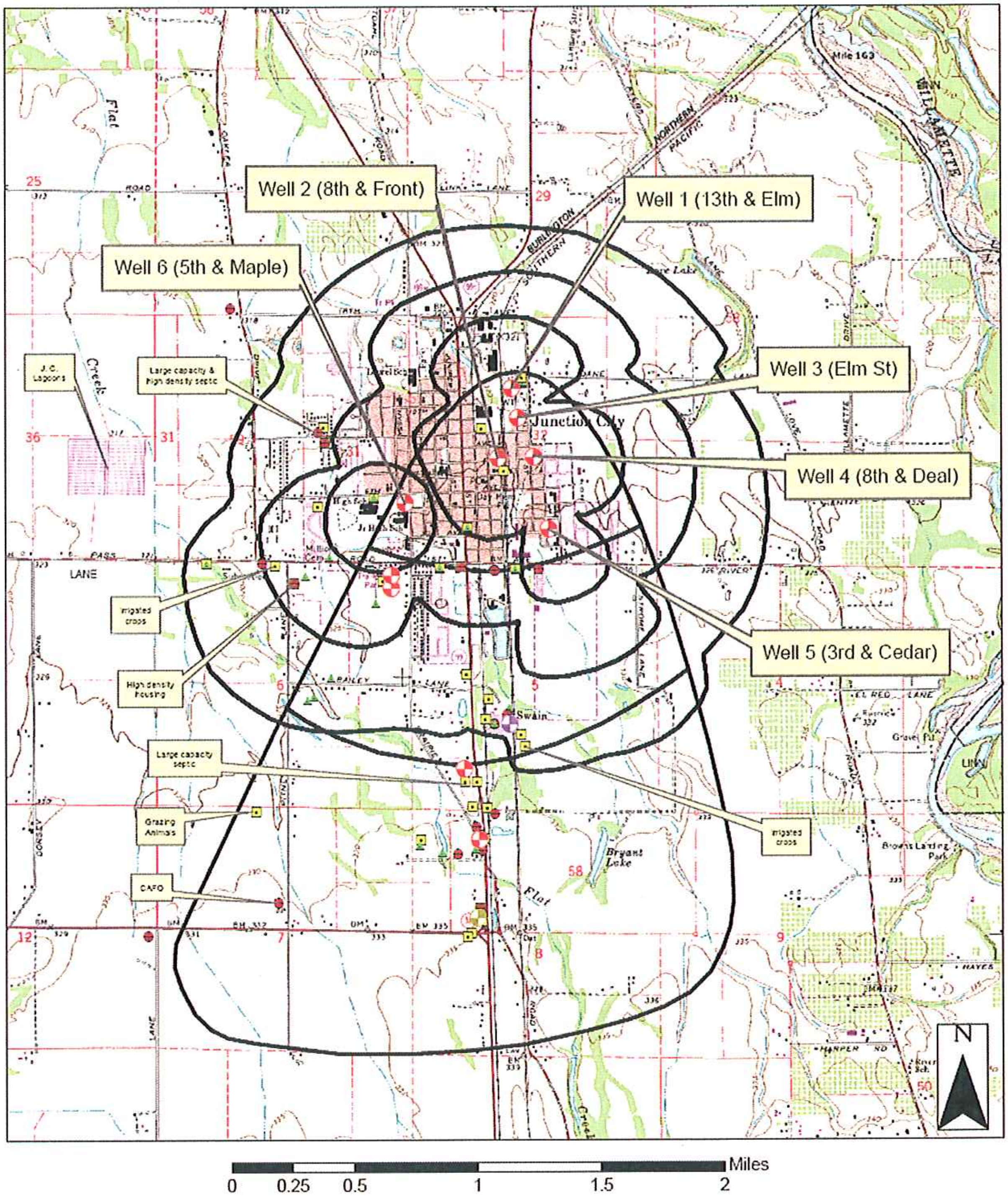
The Drinking Water Source Area for Junction City includes the core of the community and extends into lands outside the City's control. Two of the city's wells are now offline due to nitrate issues. Currently the lagoons are outside of the Drinking Water Source Area but if additional wells are added, this area could become part of the Source Area. The lagoons are lined with two to three feet of bentonite clay. From July through September, effluent is field-applied on adjacent farmland at agronomic rates. The lagoons discharge to Crow Creek.

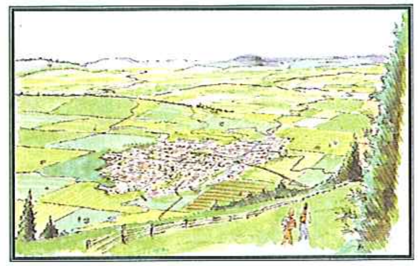
Factors that could potentially affect groundwater quality in this vicinity:

- Nearby farming activities and use of fertilizers;
- Spray-application of effluent from sewage lagoons;
- Septic system impacts from rural residential homes outside city limits; and
- Fertilizer impacts from residential lawn and garden management



Junction City Drinking Water Source Area



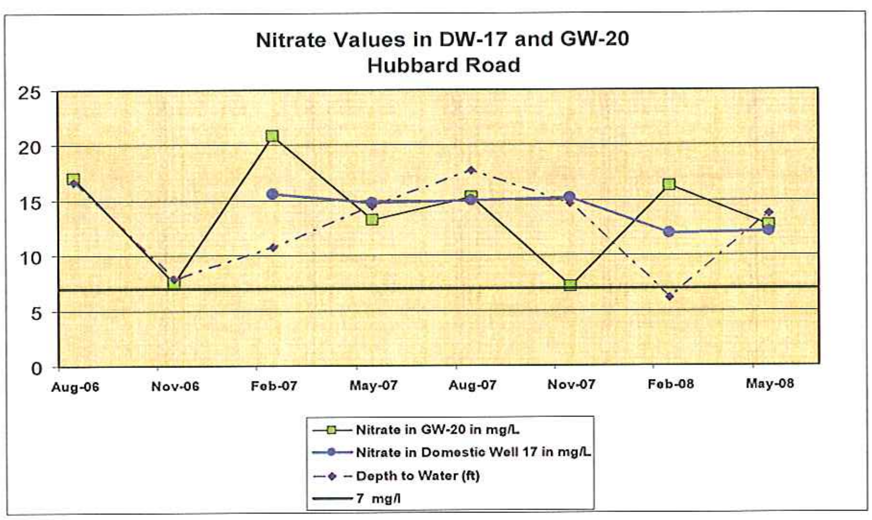


Stop 5: Hubbard Road - Domestic and Monitoring Wells

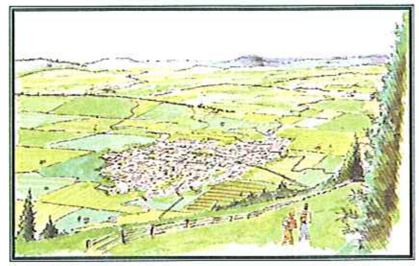
This site provides a look into the question – what nitrate contribution is from agriculture and what could be from the residents. The domestic well (DW-17) is relatively shallow (~37 feet deep) and water was first found at a depth of 20 feet. When this domestic well was first monitored between 2000 and 2002, it consistently had values around 9.5 mg/L. Now we are seeing levels between 12 and 16. In 2002, this domestic well also reported a high number of pesticides present – although each pesticide was measured at very low concentrations.

The monitoring well GW-20 indicates that the level of nitrate in the shallow aquifer can vary significantly over a short period of time. This is a slightly shallower well (~23 feet deep) and water was first present at 14 feet. We also know that this well is located in an area where crop types and irrigation patterns change several times a year.

The question is: what are the nitrate levels in these two wells telling us?



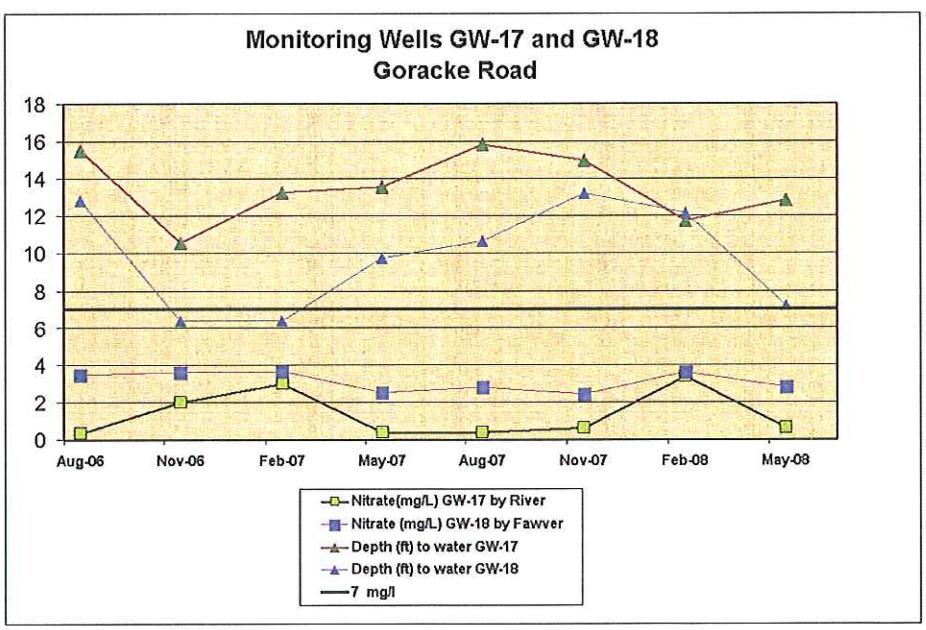
- Are the high values of nitrate in the domestic well from the septic system?
- Are rapid nitrate changes in GW-20 due to crop-specific fertilizer use at this location?
- Could the slight difference in the wells depth be a factor in the nitrate values?



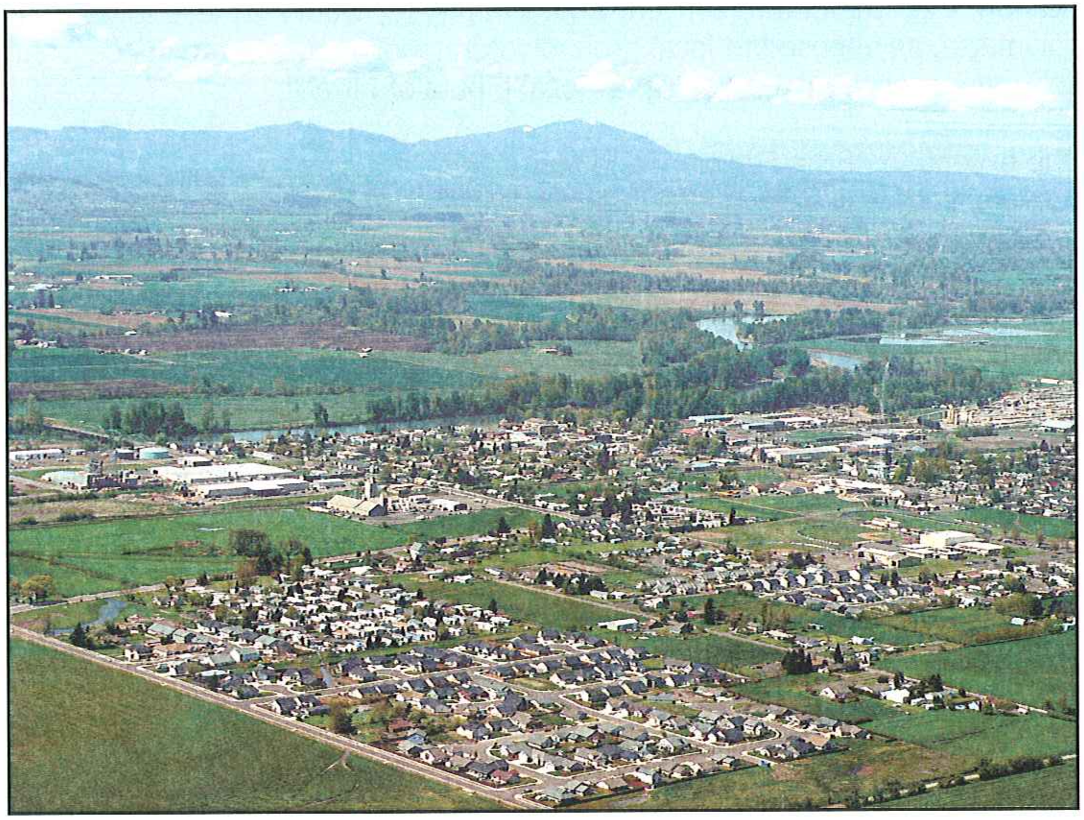
Stop 6: Goracke Road: See how the Willamette River historically and currently influences the area

Monitoring wells 17 and 18 are both drilled into a gravel aquifer that is probably in communication with flows in the Willamette. Well logs for GW-17 and 18 match closely with well logs on the other side of the river; all of them show gravels and sandy gravels from 12 to greater than 20 feet below ground surface. Groundwater movement from the aquifer into the river and back is called hyporheic flow. If hyporheic flow is occurring at this location, then the nitrate concentrations in MW-17 would represent nitrate concentrations in the Willamette, as opposed to local groundwater conditions. Nitrate concentrations in MW-18 probably represent the river water plus local inputs of nitrate.

With the exception of the February and May 2008 water levels, both well's elevations in groundwater mirror each other. Nitrate concentrations in both are similar, except that GW-17 has slightly lower concentrations. The differing nitrate concentrations may reflect nitrate inputs from the land surface in the vicinity of the two wells, as compared to nitrate concentrations in the river. Both wells have low dissolved oxygen concentrations. This is probably due to a silty clay layer overlying the gravel aquifer, reducing oxygen inputs from the surface. Water entering the aquifer from the Willamette may have low dissolved oxygen, if flow in the river is not well mixed vertically



Tour Beginning and End - Harrisburg City Hall



Thank You