PACIFIC groundwater GROUP

Request For Identification
Lower Yakima Valley
Groundwater Management Area

June 2011

REQUEST FOR IDENTIFICATION
LOWER YAKIMA VALLEY GROUNDWATER MANAGEMENT AREA

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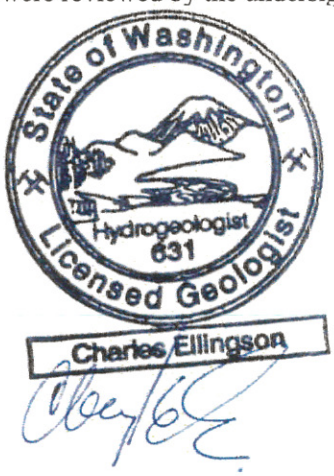
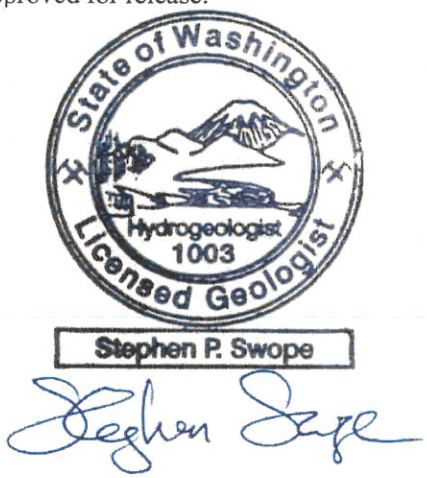
SIGNATURE

This report, and Pacific Groundwater Group's work contributing to this report, were reviewed by the undersigned and approved for release.





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1.0 INTRODUCTION

This report serves as a request to the Department of Ecology from Yakima County to form the Lower Yakima Valley Groundwater Management Area (GWMA). This report contains all elements required under WAC 173-100 (Groundwater Management Areas and Programs) including supporting data, the proposed GWMA boundary and rationale, goals and objectives of the GWMA, estimated costs, potential funding sources, recommended members of the Groundwater Advisory Committee (GWAC), and the recommended lead agency.

The proposed GWMA is a response to elevated nitrate concentrations in groundwater in Lower Yakima Valley (LYV). The concentrations detected in groundwater indicate impact by human activity and are significant to human health. This issue was first identified by grass roots organizations such as Community Association for Restoration of the Environment (CARE) and Concerned Citizens for the Yakima Reservation (CCYR) as early as 1997. The issue was more recently publicized in a series of articles entitled "Hidden Wells, Dirty Water" which ran in the Yakima Herald Republic in 2008. These articles detailed the Valley's nitrate issues affecting public and private wells. The reporter suggested that the issue should be addressed by United States Environmental Protection Agency (EPA) via Section 1431 of the Safe Drinking Water Act (SDWA). Section 1431 is an emergency order to address water supply hazards[1]. The articles cited a lack of coordination between local, state and federal agencies which aggravated the problem. The county permits land use, Department of Agriculture permits most dairies and agricultural activities, and under authority delegated by EPA, the Department of Ecology oversees water quality programs and the permitting of some dairies.

EPA responded by facilitating public meetings along with other state and local agencies in December 2008, February and October 2009, and June 2010. In November 2009, the Yakima Valley was designated as an EPA Environmental Justice Community. Also, on January 25, 2010, EPA issued a finding in support of the use of SDWA Section 1431 to address the contamination. EPA found that groundwater in the Yakima Valley is an underground source of drinking water which is contaminated, and that this contamination may present an imminent and substantial endangerment to human health. Sampling was conducted by EPA in February and April, 2010, under the authority of SDWA Section 1431.

The Washington State Department of Ecology along with four other county, state, and federal agencies published a report (Ecology, February 2010) titled Lower Yakima Valley Groundwater Quality Preliminary Assessment and Recommendations Document. The report summarized the nitrate and coliform issue in the LYV and was based on earlier technical reports and technical data obtained by:

- The Washington Department of Ecology
- The Washington State Department of Agriculture
- The Washington State Department of Health

[1] The EPA's enforcement authority to protect and clean up contaminated drinking water is codified in Section 301i of the Safe Drinking Water Act (SWDA) but is generally referred to as Section 1431.

- The Yakima County Public Works Department
- The United States Environmental Protection Agency

Much of the information provided in this report is derived from the February 2010 Preliminary Assessment report.

The report identified a number of regulatory options for addressing the elevated nitrate concentrations including establishment of a Groundwater Management Area (GWMA), Special Protection Area, Aquifer Protection Area, Sole Source Aquifer, Watershed Management Plan, and Total Daily Maximum Load (TMDL). Of these options, the Yakima County Commissioners selected to establish a GWMA and signed an interagency agreement with Ecology in September of 2010.

GWMA is focused on groundwater quality with the primary focus as nitrate contamination. However, the GWAC may elect to add other groundwater constituents such as bacterial contamination at a later date.

2.0 POTENTIAL HEALTH EFFECTS OF NITRATE

The Preliminary Assessment report estimated that over 2,000 people in the LYV are exposed to nitrate over the maximum contaminant level (MCL) through their drinking water. (Population of area is 71,400, 34% of these residents are on private wells, and about 12% of private wells exceed the nitrate MCL).

Nitrate is an acute contaminant, which means a single exposure can affect a person's health. It reduces the ability of red blood cells to carry oxygen. In most adults and children these red blood cells rapidly return to normal. However, in infants it can take much longer for the blood cells to return to normal. Infants who drink water with high levels of nitrate (or eat foods made with nitrate-contaminated water) may develop a serious health condition due to the lack of oxygen and, if untreated, may die. This condition is called methemoglobinemia or "blue baby syndrome."

Studies have found an increased risk of spontaneous abortion or certain birth defects if the mother drank water high in nitrate. Women who are pregnant or trying to become pregnant should not consume water with more than 10 mg/L of nitrate. Low levels of nitrate have been found in breast milk, but the levels are not high enough to cause "blue baby syndrome." Adults with reduced stomach acidity, and individuals deficient in the enzyme that changes methemoglobin back to normal hemoglobin are susceptible to methemoglobinemia.

For more information about the health effects of nitrate in drinking water, see Appendix B, Nitrates and Drinking Water of the Lower Yakima Valley Groundwater Quality Preliminary Assessment and Recommendations Document (Ecology 2010).

3.0 LOCAL HYDROGEOLOGY

Lower Yakima Valley is the valley surrounding the Yakima River between Union Gap and Benton City (Figure 1). On the north it is bounded by the Rattlesnake Hills, and on the south it is bounded by the Horse Heaven Hills and Toppenish Ridge. Politically it is composed of unincorporated Yakima County, the Yakama Nation reservation, and the Cities of Benton City, Prosser, Grandview, Mabton, Sunnyside, Granger, Zillah, Toppenish and Wapato. Land and water use is dominated by agriculture on and off the reservation.

Groundwater in the LYV originates as precipitation, infiltration from streams, and from irrigation and stock water that infiltrates into the ground from canals, fields and spray-fields. Infiltration of septic tank effluent and stock water overflow also recycles water locally and results in groundwater recharge. Annual precipitation ranges from about 6 to 9 inches, while groundwater recharge is estimated to range from 7 to over 25 inches per year in irrigated areas and an inch or less in unirrigated areas (Vaccaro and Olsen, 2007,). With much of the land in the LYV used for irrigated agriculture, local recharge rates are significantly higher than precipitation due to the application and leakage of irrigation water.

Recharge water may be contaminated by human activities. After recharge, the groundwater and possible contaminants move laterally and vertically toward wells, drainage ditches, and the Yakima River and its tributaries. The US Geological Survey has mapped shallow groundwater flow paths (Figure 1).

If not intercepted by wells, shallow groundwater generally moves toward the Yakima River and its tributaries from the uplands on both sides of the valley (Figure 1). Where the river water level is lower than the adjacent groundwater elevation, groundwater will flow into the river from both sides. In these cases the river is a hydrologic boundary for shallow groundwater and shallow groundwater does not pass to the other side of the river. However, the boundary effect depends on the relative elevations of the river and groundwater; therefore, changes in recharge, pumping, river level changes, and the basin-and-ridge geology of the valley affect the boundary relationship. USGS research suggests that in some river reaches in some seasons, the groundwater level is lower than the river and the river therefore loses flow to the ground. In those cases the river may not be a regional hydrologic boundary (groundwater may move laterally below the river). Finally, deeper aquifers are less influenced by the river than are shallow aquifers.

Drinking water supplies in LYV are met primarily by wells that pump groundwater. Individual domestic wells tap permeable portions of a surficial sedimentary aquifer, while most municipal wells tap deeper aquifers in basalt (lava bedrock) and sedimentary interbed layers that underlay the sediments.

Shallow layers of the sedimentary aquifer (less than ~100 ft below ground) may not be overlain by protective (low permeability) layers (ie: they may be "unconfined") whereas deeper layers of the sedimentary aquifer and the basalt aquifers are usually overlain by protective layers (ie: they are "confined"). Confined aquifers are usually deeper and are more protected by low permeable layers than are unconfined aquifers; however, they may nonetheless be subject to contamination by human activities. In the case of LYV, the Preliminary Assessment Report of 2010 identified that wells up to 300 feet deep were much

more likely to contain groundwater with nitrate concentration above the MCL of 10 mg/L than were deeper wells. Because of the slow movement of groundwater, deeper aquifers may become contaminated in the future, and take more time to recover after reductions in nitrogen loads.

Deeper wells in the area are generally completed in lower portions of the sediments and in the Columbia River Basalts (bedrock aquifer) and interbed layers. Some wells completed in basalt are shallower than wells completed in sediments due to differences in sediment thickness. The basalt aquifer is generally semi-confined and is composed of numerous distinct aquifers present in zones between the basalt flows. The extent of connection between the basalt aquifers at different interflow zones is documented in recent and pending published reports (Vaccaro et al, 2009) by the USGS. Most municipal and irrigation wells are completed in the deeper sedimentary and bedrock aquifers.

4.0 NITROGEN LOADING AND GROUNDWATER CONTAMINATION

Agriculture is the primary economic and land use activity in the LYV. Approximately 70 to 80 % of the LYV (including Yakama Nation lands) is used for agriculture. Most cropland in the area is irrigated. Major irrigation districts include the Roza, Sunnyside Valley, Grandview, Zillah, and the Wapato Irrigation Project. Major agricultural commodities produced in the valley include fruit (apples, pears, cherries, peaches, grapes), vegetables, hay, mint, corn, milk, and hops. Nitrogen is an essential nutrient for growing crops. It is taken up by roots along with water. It occurs naturally in soil, but to increase plant growth it is added to soil by farmers in the form of chemical fertilizer, manure, and compost.

As noted above, manure contains abundant nitrogen. In LYV, manure is produced primarily by cattle, many of which are concentrated in dairies and feedlots. Dairy operations were greatly expanded starting in the late 1980's. Also, animal feeding operations operate at various sizes from small home lots to large commercial feedlots. The dairies and animal feeding operations are concentrated in the lower parts of the valley in and around the cities of Zillah, Sunnyside, Grandview, Mabton and Granger, although some occur in more dispersed parts of the valley on the Yakama Reservation.

Agricultural practices, the use of fertilizer, and the management of manure are linked to nitrogen loading and incidents of nitrate contamination in groundwater. They can be significant inputs of nitrogen into the environment, but they may not be the only source. Other sources include on-site waste disposal systems, and residential and urban use of fertilizers.

The natural level of nitrate in groundwater is generally less than 0.3 mg/L. Many samples from pristine areas of the Yakima Valley have results in this range or below. Concentrations above 0.3 mg/L indicate additional nitrate has been introduced from some land use that involves organic waste or fertilizer or, less commonly, natural processes. With the introduction of agriculture over the last 100 years nitrate levels have risen above the natural level in a wide area of LYV (Figure 1). Based on the 2010 Preliminary Assessment report, approximately 12% of wells sampled in the LYV exceeded the maximum contaminant level (MCL) for nitrate of 10 mg/L. Approximately 21% of wells

sampled showed elevated nitrate levels in the range of 3-9.9 mg/L, and 67% of wells were less than 3 mg/l.

Subsequent to publication of the Preliminary Assessment, EPA reported sampling 337 private wells (approximately 1% of ground-water users in the Valley) for nitrate and bacteria between February 22nd and March 6th 2010 (USEPA, 2010). EPA reports that 21 percent of the wells sampled (70 wells) had nitrate levels greater than the EPA drinking water standard of 10 mg/L and that concentrations up to four times the drinking water standard were documented.

The population in the LYV is served by a mix of public and private water supplies. The public systems primarily serve the communities and the private wells are used in the more rural areas. It is estimated that approximately one third of valley residents rely on private wells for drinking water (Ecology, February 2010).

Many private wells in the area draw from the shallow portion of the sedimentary aquifer, while public systems tend to rely on deeper wells or a mix of sources. The historical water quality data reviewed as part of the 2010 study (Figure 1) suggests that 12 percent of residents who rely on individual private wells in the LYV may drink water which exceeds the nitrate-nitrogen drinking water MCL of 10 mg/l. It is not lawful for public water utilities to serve water with a nitrate concentration above the MCL; however, private water supplies are unregulated, and often not measured. There is some data to suggest that in addition to nitrate contamination, the most vulnerable wells are also at risk of bacterial contamination (Total coliform and fecal coliform bacteria).

5.0 DESCRIPTION OF PROPOSED BOUNDARY

Yakima County proposes the area of Lower Yakima Valley from Union Gap to Benton City, minus the Yakama Reservation, be designated as the Ground Water Management Area (GWMA). Areas outside LYV were not included regardless of environmental and hydrogeologic characteristics. The GWMA boundary is presented in Figure 2. This region of Yakima County has an area of approximately 512 square miles.

Yakima County proposes to facilitate the formation of a GWMA on non-reservation land. It is expected and important that the Yakama Nation be an active participant in Yakima County's GWMA process. The Yakama Nation plans to develop a program similar to the GWMA to reduce nitrate groundwater contamination on the reservation, and Yakima County expects to participate in that process. Coordination of the efforts will make the efforts more effective, and recognizes that political boundaries are typically not hydrologic boundaries.

5.1 BOUNDARY DEFINITION PROCESS

Most of the southwestern boundary of the proposed GWMA is defined by the Yakama Nation reservation (Figure 2), which is coincident with the Yakima River in this part. At the southeastern end of the reservation near Mabton, the proposed GWMA boundary extends south of the river to the Horse Heaven Hills using the geologic, water quality, and land use process described below.

The northern and southeastern boundaries were established to surround the portion of LYV that has a potential for elevated groundwater nitrate. That potential was evaluated using a number of data sources including:

- US Geological Survey nitrate vulnerability map (USGS, 2008)
- Surficial Geology (Department of Natural Resources, 100K map)
- Extent of irrigated agriculture
- Nitrate concentrations in groundwater from Washington State Department of Health, Valley Institute for Research and Education (Sell and Knutson, 2002), Yakima County, and the US Geological Survey NWIS database.

Most wells with elevated nitrate concentrations in the three water quality studies referenced above are completed in shallow portions of the sedimentary aquifer. The extent of elevated groundwater nitrate concentrations roughly coincides with the extent of the sedimentary aquifer and the agricultural land uses above it. This extent also coincides with the 40 percent probability that the nitrate concentration will be greater than 2 mg/l as defined by the US Geological Survey (2008). Where the boundary suggested by one data source extended further than others in a particular area, the boundary was defined conservatively in that the greatest extent was used as the boundary (within the confines of the LYV). The process was conducted at a precision of one mile and thus used the closest section line that encompassed the extent of nitrate concentrations greater that 1 mg/l, the 40 percent probability line, the area of irrigated agriculture as determined by topography and aerial photography, and as much of the sedimentary aquifer in the LYV as possible as determined by geologic mapping.

6.0 GOALS AND OBJECTIVES

The GWMA will be a multi-agency, citizen-based, coordinated effort to reduce groundwater nitrate contamination in the lower Yakima Valley. It will receive input from people affected or interested in the problems and solutions and will coordinate their energies toward action. It will work to achieve credibility with the general public and the farming community.

6.1 GWMA GOAL

The primary long-term goal of the GWMA is to reduce concentrations of nitrate in groundwater to below Washington State drinking water standards. Reductions in nitrogen loading will be demonstrated within 5 years. Progress towards identifying and reducing the sources of groundwater contamination will be evaluated by 2013 and shared with the public. Specific objectives are listed below.

6.2 PROPOSED OBJECTIVES

Objectives have been divided into six categories: Data and Monitoring, Problem Identification, Measures to Reduce Groundwater Contamination, Education, Drinking Water Systems, and General objectives. Input from the GWAC and citizen input will be used to

refine and prioritize objectives. In general, refinement of objectives in each category will begin with an updated assessment of the current status of work. For instance, pending work includes publication of EPA sampling data and evaluations.

DATA AND MONITORING

- Collect and incorporate existing nitrate and nitrogen data into a shared data management system or data sharing site to improve understanding of the sources and extent of contamination.
- Establish a monitoring program to identify sources of nitrate contamination and their relative importance.
- Establish and conduct long-term groundwater quality monitoring program and evaluate progress.

PROBLEM IDENTIFICATION

- Characterize the nature and extent of nitrate concentrations in Lower Yakima Valley groundwater.
- Identify and rank the sources of elevated nitrate in groundwater, with site-specific characteristics developed for "hot spots" as appropriate.
- Identify and describe activities contributing to groundwater contamination based on scientific data and evaluation. Scientific and other data will be shared among the partners to facilitate development of effective programs and strategies.

MEASURES TO REDUCE GROUNDWATER CONTAMINATION

- Develop effective and coordinated best management practices (BMPs) to address specific nitrate sources.
- Develop strategies for implementing best management practices such as technical assistance, education, ordinances and coordination with other regulatory and non-regulatory programs.
- Support enforcement of new and existing laws and ordinances.

EDUCATION

- Establish educational programs to promote the protection of groundwater quality and provide a forum for stakeholders to discuss nitrate reduction methods and improvement of groundwater quality. This will include culturally-appropriate education and outreach.
- Establish a clearinghouse for pertinent public health, environmental, and business information.
- Educate private well owners on water quality testing methods, frequencies, interpretation of results, and funding sources.

Drinking Water Systems

- Provide water quality and hydrogeologic data to assess needs and methods of expanding public water supplies, and provide a forum for initiation of these plans.
- Consider options to encourage appropriate expansion of public water supplies to areas that are currently dealing with contaminated private supplies.
- Assist residents whose supplies have been contaminated to access safe and reliable water supplies, using culturally-appropriate communications.

General

- Pollution prevention will be a guiding principle for all work done by the GWMA.
- Participation by the Yakama Nation will be requested and encouraged in a way that is consistent with their sovereignty.
- Participating agencies will maintain their regulatory authority using their own discretion as appropriate. They will also seek opportunities to coordinate actions and address regulatory gaps.
- The GWMA will seek sustainable funding sources to carry out its mission.

7.0 RECOMMENDED ADVISORY COMMITTEE MEMBERS

The following list presents the recommended GWAC members. The final list will be determined by the Department of Ecology.

Citizens

- Environmentalist
- Environmental Justice representative
- Hispanic Community Leader
- Group B groundwater user groups or systems

Governmental

- Yakima/Benton County Commissioners
- Yakama Nation
- Representative for cities – Sunnyside, Granger, Zillah, Mabton, Grandview, Prosser, Benton City

Agencies

- Farm Bureaus of Yakima/Benton County
- Department of Ecology

- Department of Agriculture
- South Yakima/Benton Conservation Districts
- Department of Health
- Yakima/Benton County Planning Agencies
- County Health Districts (Yakima/Benton)
- Environmental Protection Agency
- USGS
- USDA Natural Resource Conservation Service

BUSINESS

- Washington Dairy Federation and/or Cattlemen's Assn
- Crop or Fertilizer Group
- Representative for Port Districts
- Sunnyside-Roza Joint Board of Control representative

8.0 ESTIMATED TWO YEAR COSTS AND FUNDING SOURCES

This section provides an estimated cost for the first two years of development and administration of the Ground Water Management Program for the Lower Yakima Valley GWMA. The estimate includes many assumptions, including that GWAC members volunteer their time or are paid for their participation through other budgets. The subsequent section presents potential funding sources. Note: Coordination with the parallel Yakama Nation process is important and expected.

Task 1. Plan Development and Administration **$300,000**

Establish GWAC - Interview Members (21)

Produce quarterly status reports (8)

SEPA checklist (existing info only)

Develop GWMA plan elements

Develop draft and final plan

Seek adoption by County Commissioners

Grant funding application and administration

Coordinate with Yakama Nation nitrate pollution reduction process

GWAC meeting facilitation by neutral third party (8)

Project Communication

Invoicing and accounting

Task 2. Monitoring and Characterization **$150,000**

Collect and organize existing data

Design and implement area-wide database

Identify needs for additional data (SAP/QAPP)

Design, establish, and commence long term monitoring program

Conduct groundwater sampling

Analyze data and evaluate progress

Produce draft and final report on nitrate

Assess needs for expanding public water systems

Task 3. Public Information and Outreach **$100,000**

Conduct periodic public meetings (four semiannual) including interpretation

Develop and distribute informational materials

Coordinate outreach with community and stakeholder groups

Coordinate with potential sources not represented on GWAC

Develop/support educational programs

Maintain stakeholder and community contact list

Conduct media relations including 4 news releases

Attend fairs and festivals (4)

Task 4. BMP Implementation and Field Research **$200,000**

Evaluate/ Facilitate implementation of BMP's

Characterize priority locations for BMP applications

Evaluate existing permits and mandatory protection measures

Evaluate available BMPs (includes field evaluation)

Identify research needs & begin projects

Recommend mandatory BMPs if necessary

Develop comprehensive BMP guidance for GWMA

Recommend rulemaking activities, enforcement strategies, and/or legislation

Total Cost (2-year budget) **$750,000**

The budget above is an estimate based on experience with other GWMAs, the actual scope and budget will likely be modified by the GWAC once it is convened.

8.1 POTENTIAL SOURCES OF FUNDING

The cost of developing the program over a two-year period is estimated at $750,000. Funds may be made available through special allocations or competitive grants such as Centennial Clean Water grant program, the Clean Water Act Section 319 grant program, and the Revolving Fund loan program. Additionally, the Washington State Departments of Agriculture, Ecology, and Health; the Conservation Commission; Washington State University; and the U.S. EPA will be encouraged to actively seek additional funding as may be needed during pursuit of GWMA goals. Some percentage will likely be funded by the local participating agencies either in the form of money or in-kind services. The budget shown only covers plan development and early action implementation during the first two years. Full scale implementation costs will be based on the plan developed and funds available.

During the course of the Ground Water Management Area process, Yakima County will serve as the lead fiscal agent through which state and federal money will pass.

9.0 REFERENCES

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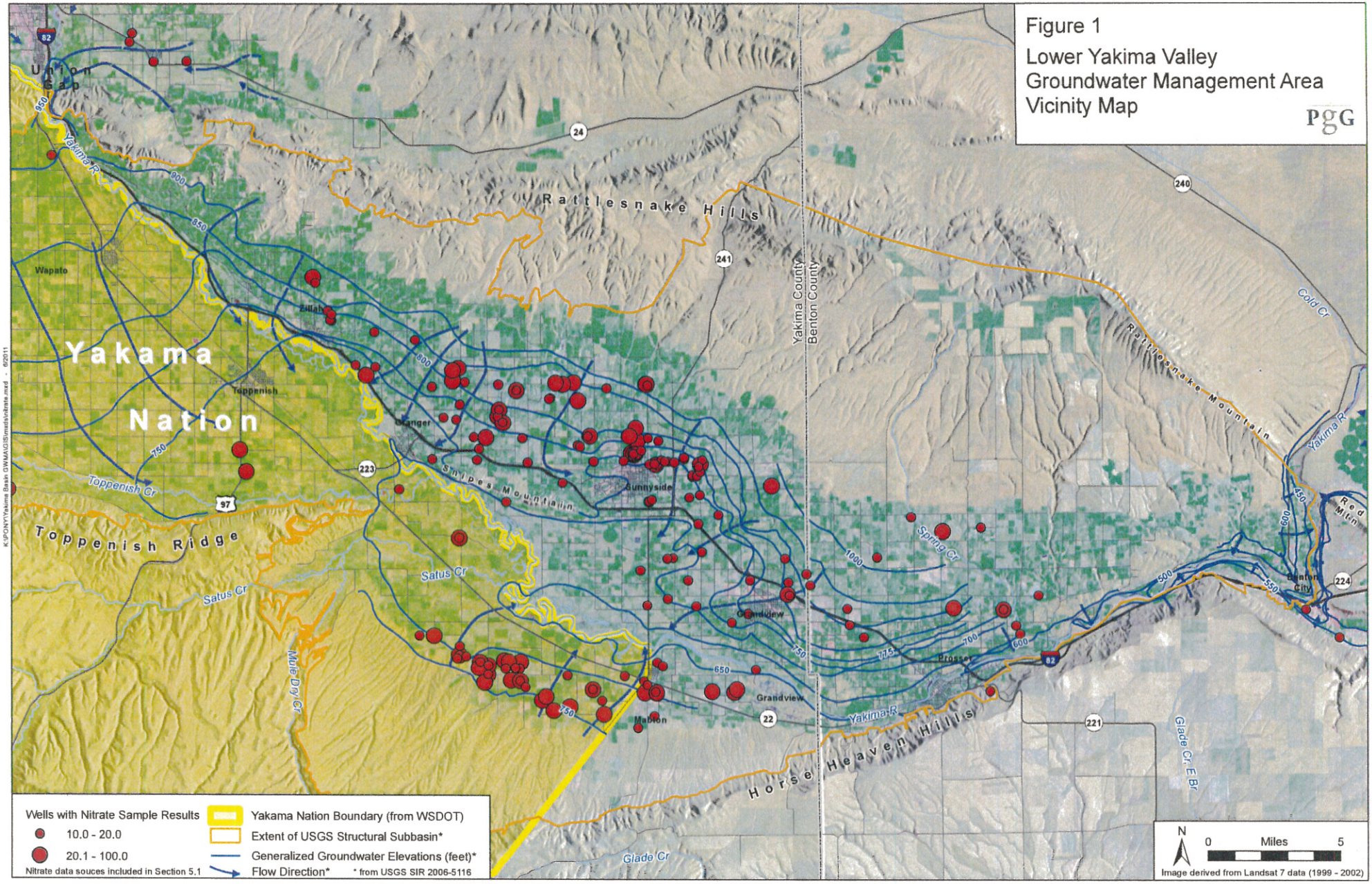
Figure 1
Lower Yakima Valley
Groundwater Management Area
Vicinity Map
PgG
Yakama Nation
Toppenish Ridge
Rattlesnake Hills
Snipes Mountain
Horse Heaven Hills
Rattlesnake Mountain
Red Mtn
Union Gap
Wapato
Zillah
Toppenish
Granger
Sunnyside
Grandview
Mabton
Prosser
Benton City
Yakima County
Benton County
Yakima R
Toppenish Cr
Satus Cr
Mule Dry Cr
Spring Cr
Cold Cr
Glade Cr
Glade Cr E Br
Wells with Nitrate Sample Results
10.0 - 20.0
20.1 - 100.0
Nitrate data souces included in Section 5.1
Yakama Nation Boundary (from WSDOT)
Extent of USGS Structural Subbasin*
Generalized Groundwater Elevations (feet)*
Flow Direction*
* from USGS SIR 2006-5116
N
0
Miles
5
Image derived from Landsat 7 data (1999 - 2002)

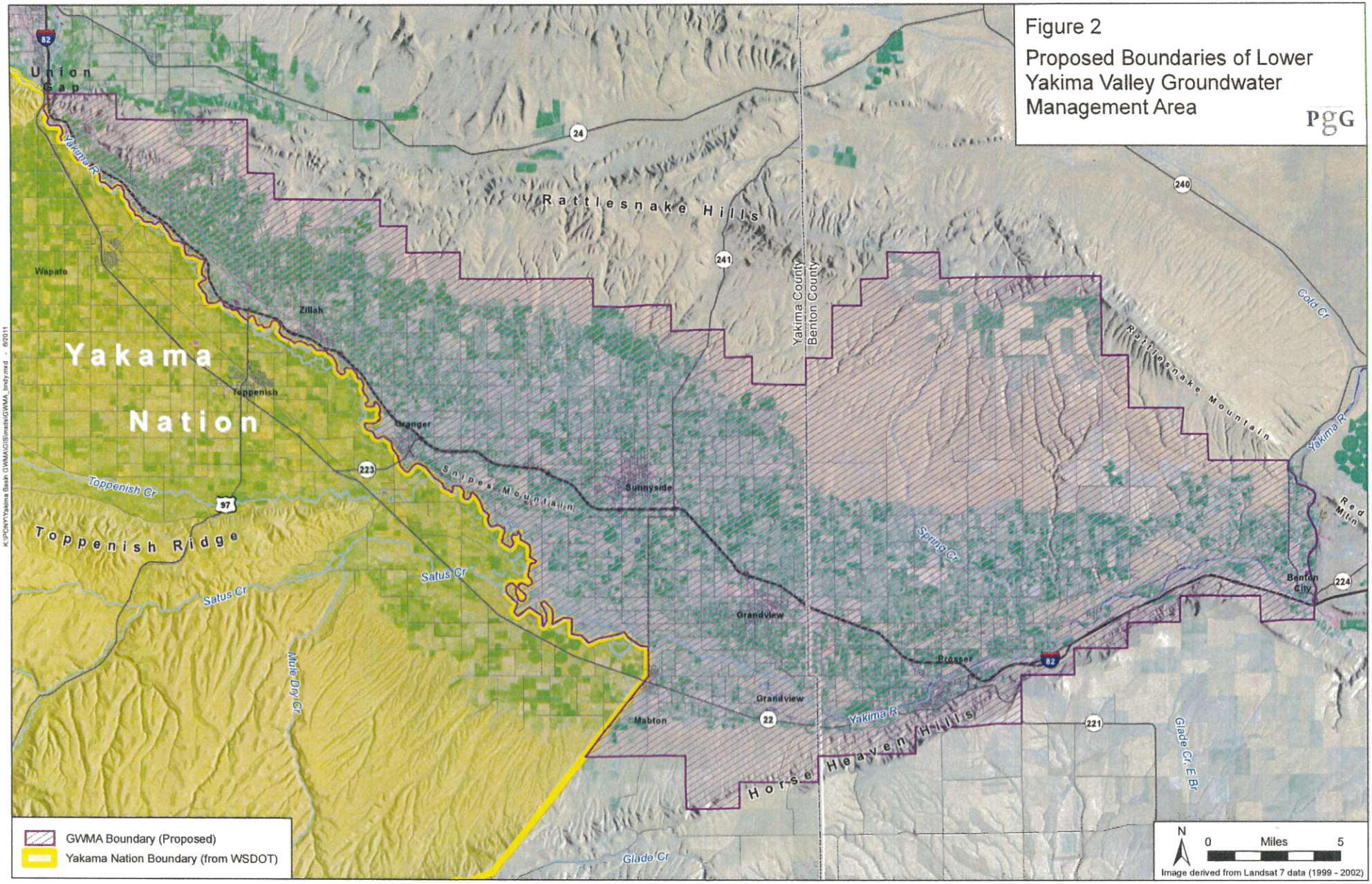
Figure 2
Proposed Boundaries of Lower Yakima Valley Groundwater Management Area
PgG
Union Gap
Wapato
Zillah
Toppenish
Granger
Sunnyside
Grandview
Prosser
Mabton
Benton City
Yakama Nation
Toppenish Ridge
Rattlesnake Hills
Snipes Mountain
Horse Heaven Hills
Rattlesnake Mountain
Red Mtn
Yakima County
Benton County
Yakima R
Toppenish Cr
Satus Cr
Mule Dry Cr
Spring Cr
Cold Cr
Glade Cr
Glade Cr E Br
82
24
241
240
223
97
22
221
224
GWMA Boundary (Proposed)
Yakama Nation Boundary (from WSDOT)
N
0
Miles
5
Image derived from Landsat 7 data (1999 - 2002)