# SOUTHERN WILLAMETTE VALLEY GROUNDWATER

# SUMMARY REPORT

**FINAL**
**JANUARY 30, 2004**

DEQ

State of Oregon
**Department of Environmental Quality**

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# SUMMARY AND PURPOSE

Over the last 20 years, many studies and sampling programs have focused on water quality in the Southern Willamette Valley (see Figure 1). The results have identified nitrate contamination of shallow groundwater in some parts of the Valley. Although nitrate sometimes comes from natural sources, the probable causes of nitrate contamination in the groundwater Southern Willamette Valley are human activities. In this study area, potential nitrate sources include septic systems, agricultural amendments, confined animal feeding operations, fertilizers for lawns and golf courses, and bulk fertilizer facilities.

Precipitation creates much of the groundwater. Rain sinks through the soils and eventually saturates the subsurface or is utilized by plants. The primary groundwater resource in the Valley is located not far below the surface, often less than 20 feet deep. The shallow depth of the groundwater increases the chances that over-application of fertilizers, high density or improper maintenance or design of septic systems, and improper management of animal wastes or other materials will cause contamination.

The Valley is one of Oregon's fastest growing regions and depends heavily on groundwater for both private and public drinking water, irrigation water, and other beneficial uses. In fact, groundwater provides almost all of the drinking water in the study area. Nitrate contamination therefore poses a health risk. Additionally, contaminated groundwater may also affect the water quality of the Willamette River and its tributaries as the groundwater discharges to surface water.

A useable groundwater resource needs to be available now and in the future for area residents, farmers, and businesses. As the origin of nitrate in the groundwater appears to be at least in part from non-point sources, the Department of Environmental Quality (DEQ) is considering recommending that a portion of the Valley be declared a Groundwater Management Area. The available information on nitrate contamination of groundwater lends support for such a recommendation. A Groundwater Management Area (GWMA) unites local residents and environmental planners in the process of restoring and protecting groundwater quality, ensuring that people who live and work in the area regain a groundwater resource they can safely utilize.

This report summarizes the groundwater information for the Southern Willamette Valley (SWV) and explains DEQ's recommendation to declare part of the Valley as a Groundwater Management Area. The following elements are included in this report:

- Site information;
- Summaries of the results of various nitrate studies and sampling efforts completed in the SWV;
- Recommendation to declare a GWMA for selected areas of the Southern Willamette Basin; and
- Analysis of the data gaps and resource needs for future actions.

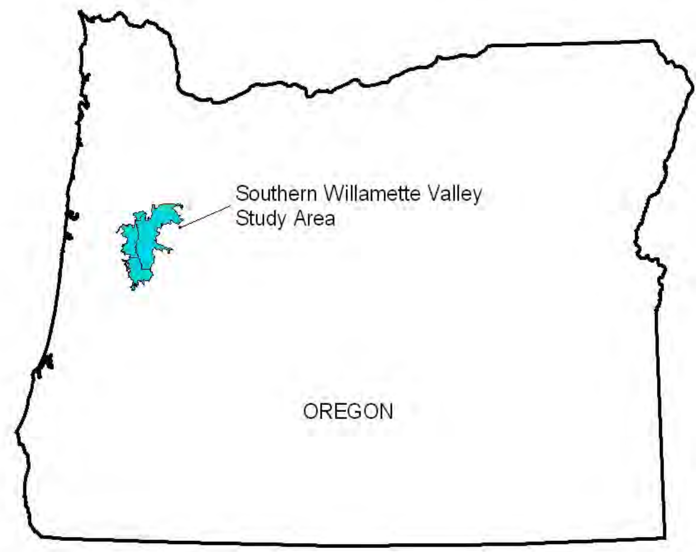


**Figure 1:**
**Location of the Southern Willamette Valley**

# SITE INFORMATION

## Location of the Southern Willamette Valley Study Area

The Southern Willamette Valley (SWV) study area includes the lowlands of the southern portion of the Valley, extending from Eugene to Albany in Lane, Linn, and Benton Counties (see Figure 2). Areas inside the city limits of Eugene, Corvallis, Albany, and Lebanon were originally excluded from earlier studies because of the previous studies emphasis on groundwater quality issues affecting non-regulated rural water supplies. Private water wells, such as those used by many residents in the rural areas of the Southern Willamette Valley, are exempt from the water quality regulations that apply to public drinking water supplies.


**Figure 2: Southern Willamette Valley Study Area**

It was believed that, in general, homeowners inside the city limits are provided with public drinking water supplies. Recently, DEQ discovered that this does not hold true for all of the 'cities' in the SWV study area.

The east and west boundaries of the study area approximately coincide with the limits of unconfined aquifers within the Southern Willamette Valley, known to include a shallow sensitive aquifer. The Southern Willamette Valley study area is bounded on the east by the Cascade Range, to the west by the Oregon Coast Range, to the north by the Salem Hills, and to the south by the city of Eugene's urban growth boundary. The study area encompasses approximately 780 square miles.

## Land Uses

Land uses in the study area are predominantly agricultural, including a diversity of field crops, such as grains, hay, mint and hops; seed crops such as grass and vegetable seeds;

vegetable, fruit, nut, and nursery crops and pastureland (Figure 3). Many of these crops are irrigated.

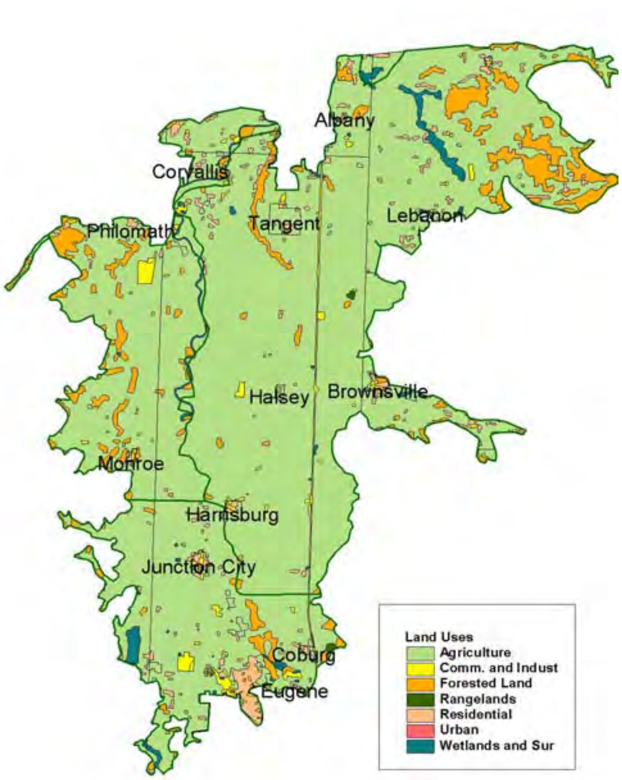


**Figure 3: Land Uses**

Commercial livestock production in the study area includes a number of confined animal feeding operations (CAFOs) permitted by the Oregon Department of Agriculture (ODA). Non-agricultural uses include, industrial, commercial, rural residential, golf courses and natural habitat enhancement. The 2000-2001 Southern Willamette Valley Groundwater Assessment, Final Report (DEQ, 2003a) contains a more complete description of the land uses in this area.

## Groundwater

The study of groundwater and the way it moves in the subsurface is called 'hydrogeology'. Previous studies in the Willamette Valley conducted by the U.S. Geological Survey (USGS) and Oregon's Water Resources Department (WRD) has defined five regional hydrogeologic units (O'Connor et. al., 2001). These regional units are (1) the Basement Confining unit, (2) the Columbia River Basalt unit, (3) the Willamette Confining unit [not shown as it underlies various units and does not surface in the study area], (4) the Willamette Aquifer [depicted as the Older and Younger Upper Sedimentary Unit], and (5) the Willamette Silt unit (see Figure 4).

The Willamette Aquifer is the combination of the Younger and Older members of the Upper Sedimentary Unit. The Upper Sedimentary Units, and especially the Younger member, contain the most important and productive aquifer in this study area. The Willamette Aquifer is a major source of groundwater, and wells in this aquifer produce as much as 300 gallons of water per minute. This aquifer is more permeable and more susceptible to contamination than are aquifers in other basin deposits, such as the Willamette Silt.

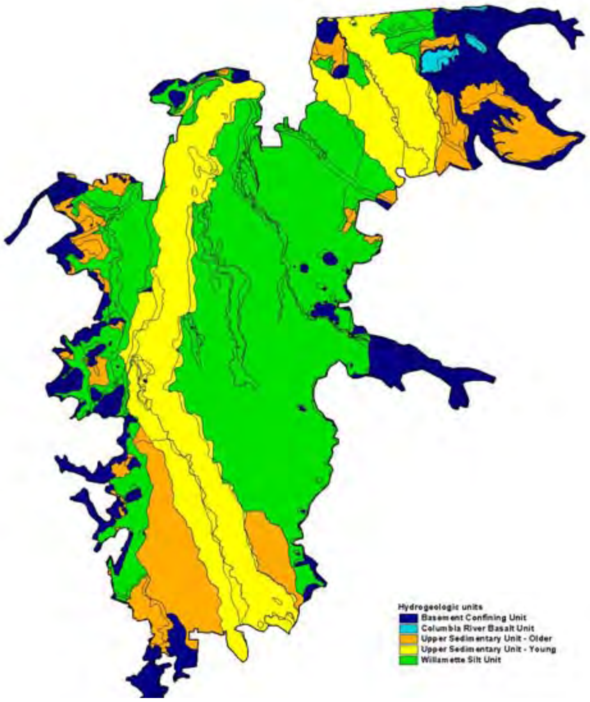


**Figure 4: Hydrogeologic Units**

In the study area, groundwater in the Younger unit of the Willamette Aquifer generally occurs under unconfined conditions. An unconfined groundwater aquifer is one that can easily receive water from the surface, since there are no overlying "confining beds" of low permeability to isolate the aquifer.

The overall groundwater flow direction of the shallow alluvial aquifers is toward the Willamette River. However, groundwater in close proximity of the Willamette River will tend to flow in the direction of the river drainage.

## Surface Water

The study of the properties, distribution, and effect of water in the atmosphere and on the earth's surface is part of the science called 'hydrology'. There are many surface water features in the Valley. The main feature, the Willamette River, flows north and discharges to the Columbia River, draining the entire SWV. To the east of the Willamette River, the major tributaries in the study area are the Calapooia River, Muddy Creek, McKenzie River and the Santiam River. To the west of the Willamette River, the major tributaries in the study area are Muddy Creek, Long Tom River, Row River and Mary's River (see Figure 5).

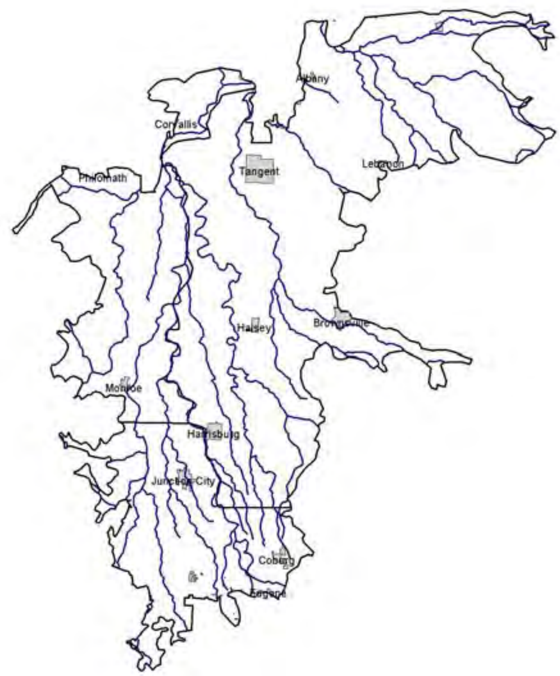


**Figure 5: Rivers of the Willamette Valley**

According to USGS (Woodward, et al., 1998) most surface water summer flow out of the High

Cascades is not due to snowmelt. The USGS likens the High Cascades to “a vast hydrologic sponge,” one that is capable of storing decades worth of water in the deep groundwater regime. Over time, this groundwater is released to springs along the flanks of the Cascades.  Even during very dry years, groundwater flows feed the creeks and rivers at virtually constant discharges, although the operation of flood control dams modifies the natural flow patterns.

# GROUNDWATER QUALITY AND SOURCE INFORMATION

## Groundwater Quality Studies

Many studies and sampling programs conducted in the Southern Willamette Valley study area have targeted the shallow groundwater of the Willamette Aquifer, which is generally less than 75 feet below ground surface. According to the USGS water supply data (Hinkle, 1997), "more than 80% of the groundwater used in the Willamette Basin is pumped from the alluvium" (shallow portion of the Willamette Aquifer). Due to the geology of the area, shallow groundwater in the uppermost aquifer is the groundwater resource most likely affected by human activities.

### Table 1: Southern Willamette Valley Groundwater Assessments

| Organization | Sampling Program | Geographic Focus | # of Sample Points in Southern Willamette | Sampling Period | Quality Cont Level[1] |
|---|---|---|---|---|---|
| Oregon DEQ | Groundwater Assessments | Statewide | 15 | 1985-1987 | High |
| Oregon DEQ | Groundwater Assessments | Coburg, Junction City, Albany-Lebanon | 61 | 1993-1994 | High |
| Oregon DEQ | Voluntary Nitrate Testing | Statewide | 34 | 1992-1993 | Low |
| Oregon DEQ | Groundwater Survey | Southern Willamette Valley | 476 | 2000-2001 | High |
| Oregon DEQ | Groundwater Assessment | Southern Willamette Valley | 100 | 2002 | High |
| Oregon State University Agricultural Extension | Volunteer Nitrate Testing | Junction City and Coburg | 271 | 1997 | Low |
| Oregon Health Division | Real Estate Transaction Testing | Statewide | 963 | 1989-1996[2] | Low |
| Oregon Health Division | Public Water Supply System Testing | Statewide | 144 | 1979 through present[3] | Low/High |
| United States Geological Survey | NAWQA | Nationwide | 30 | 1991-1993 | High |

Table 1 reviews the types of studies and sampling events conducted in the Valley and indicates the quality of the analytical data. Appendix 1 provides a summary of these

1 High quality Control attributed to adherence to strict protocols for field sampling and laboratory analysis by trained regulatory agency personnel; low quality control designated when protocols for sampling and analysis are not documented, or when colorimetric analytical methods are used.

2 Electronic summaries of OHD's real estate transaction groundwater testing data are not available after 1996.

3 Data reviewed by DEQ do not include sampling events for the years 2000-2003. "Low/High" rating due to the that sampling may not have been done by trained personnel, but the analysis does follow EPA protocols.

studies. In general, all of these studies provide documentation of nitrate present in the shallow groundwater of the Southern Willamette Valley at levels greater than 7.0 mg/L.[4]

## Sources of Nitrate Groundwater Contamination

### Non-Point Sources

Non-point sources of pollution come from many diffuse sources. Non-point sources of pollution are caused by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters, and even into underground sources of drinking water (EPA 2003). Non-point sources of pollution can originate from relatively large areas, can be associated with particular land uses, and may combine several pollutants. These features make it extremely difficult to trace all individual sources and identify which pollutant came from which source. In general, these pollutants can arise from activities that the everyday person has control over.

Potential non-point sources of nitrate pollution in the Southern Willamette Valley study area include: septic tank failures; seepage from dense clusters of functioning septic systems; agricultural soil fertilizers; commercial application of fertilizers (i.e., golf courses); nurseries; residential lawn and garden fertilizers; animal waste management (other than concentrated animal feeding operations permitted by Oregon Dept. of Agriculture).

### Point Sources

The Clean Water Act defines the term ‘point source’ very broadly. A point source is any discernible, confined, and discrete conveyance of pollution, such as a pipe, ditch, channel, tunnel, or conduit from which pollutants are or may be discharged. By law, the term "point source" also includes concentrated animal feeding operations (CAFOs).

There are 114 DEQ Water Quality permitted point sources in the Southern Willamette Valley. A point source may be discharging to either surface water or land. Two of these point sources are considered “Major” permits by DEQ, and both of these permits regulate the pulp, paper and other fiber pulping industry. There are 10 sewage permits, all are less than 1 million gallons per day and 9 of these facilities have lagoons. Table 2 presents a summary of the types of permits, and Figure 6 depicts the locations of these permitted facilities. Not all permitted facilities have the potential to discharge nitrate to the groundwater. National Pollutant Discharge Elimination System (NPDES) permits discharge to surface water, while WPCF permits may discharge to land.

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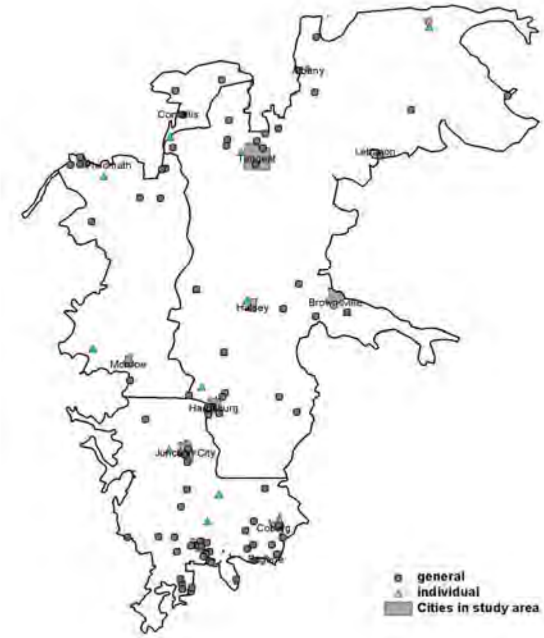
4 For the purposes of this report, nitrate is reported as nitrate-nitrogen ($NO_3$-N), and the Public Drinking Water Standard and the MML for $NO_3$-N is 10 mg/L.



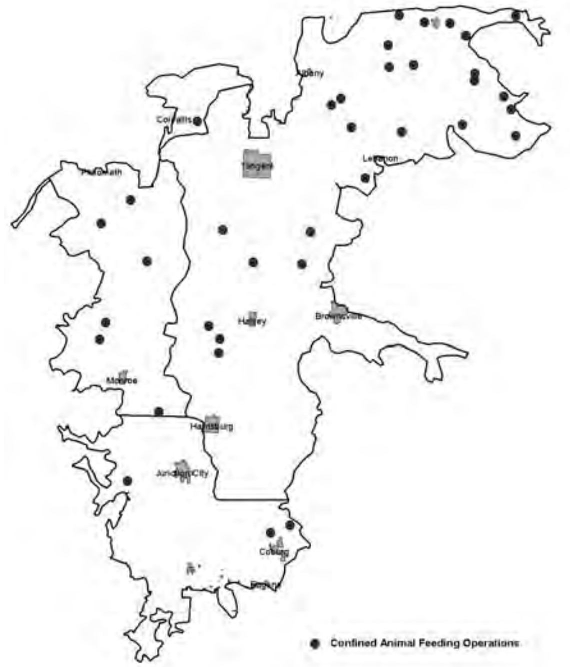




**Figure 6: Locations of Point Source Pemits**

**Figure 7: Locations of Confined Animal Feeding Operations**

Currently, the ODA permits the CAFOs. In 2001, the Oregon legislature authorized and directed the transfer of the NPDES permit program for CAFOs from DEQ to ODA, pending EPA approval. Figure 7 shows the locations of the 35 CAFOs in the Southern Willamette Valley.

**Table 2: Class, Type and Number of Point Source permits in the SWV**

| Class | Type | No. | Class | Type | No. |
|---|---|---|---|---|---|
| 100-J<br>NPDES | Cooling Water/heat pumps | 2 | 1500-A<br>NPDES | Tanks cleanup | 1 |
| 200-J<br>NPDES | Filter backwash | 6 | 1500-B<br>WPCF | Tanks cleanup | 2 |
| 300-J<br>NPDES | Fish hatcheries | 1 | 1700-A<br>NPDES | Washwater | 7 |
| 400-J<br>NPDES | Log ponds | 1 | 1700-B<br>WPCF | Washwater | 3 |
| 500-J<br>NPDES | Boiler blowdowns | 1 | 5102<br>WPCF | Sand filter<br><2500 gpd | 3 |
| 1000-J<br>WPCF | Gravel mining | 7 | 5400<br>WPCF | Holding tank | 3 |
| 1200-A<br>NPDES | Stormwater – gravel mining | 4 | 5601<br>WPCF | Standard/Alternate system < 5000 gpd | 1 |
| 1200 -C<br>NPDES | Construction > 1 acre | 12 | Pulp<br>NPDES | n/a | 2 |
| 1200-CA<br>NPDES | Construction > 1 acre (government) | 1 | Sugar beet<br>NPDES | n/a | 1 |
| 1200-Z<br>NPDES | Industrial stormwater | 40 | Non-Classified<br>NPDES | n/a | 4 |
| 1300-J<br>NPDES | Oily stormwater | 2 | Sewerage<br>NPDES | n/a | 10 |

# BASIS FOR DECLARATION OF A GROUNDWATER MANAGEMENT AREA

## Background

In 1989 the Groundwater Protection Act (the "Act") established state goals to protect groundwater from contamination. The Act also defined the State's response to groundwater contamination resulting at least in part from non-point source activities. The Act instructs the State to declare an area of groundwater concern or a groundwater management area (GWMA) when groundwater is contaminated above certain regulatory levels.

In 1995, the Legislative Assembly passed Senate Bill 502, amending the Groundwater Protection statutes and assigning functions and authorities pertaining to groundwater management to DEQ. This Bill also requires Oregon Department of Agriculture (ODA) to develop the portion of an Action Plan addressing farming practices in a groundwater management area located on agricultural lands.

The Groundwater Quality Protection Rules (OAR 340-40-90) establish a Maximum Measurable Limit (MML) for nitrate as 10.0 mg/L. MMLs are measurement tools established to protect public health, the environment, and future beneficial uses. MMLs are used when evaluating groundwater quality to determine the need for a Groundwater Management Area (GWMA). If, at least in part, non-point sources have contaminated the groundwater at levels that exceed 50% of a MML for most parameters, or for nitrate at 70% of the MML or 7 mg/l, DEQ is then directed to declare a GWMA.

## Criteria for a GWMA Declaration

Under the Groundwater Protection Act DEQ is to collect groundwater quality information from monitoring and assessment activities or from information provided to the agency. In general, if water quality is found to exceed 50% of a MML (70% of the MML for nitrate) and the origins of the pollution are believed to be primarily non-point sources, then DEQ must confirm the laboratory results, identify the contaminants detected in groundwater; and identify all the groundwater aquifers affected. Before declaring a Groundwater Management Area, a second laboratory must confirm the results that caused DEQ to make the declaration (ORS 468B.180[3]).

The results from DEQ investigations and previous studies conducted by other agencies exhibit a pattern of nitrate contamination in the shallow aquifer of the Southern Willamette Valley. Many areas of the study site report nitrate in the groundwater at levels greater than 7.0 mg/L, which is 70% of the respective MML. Due to extensive contamination of this aquifer and the types of land uses in the area, non-point sources are suspected as the major nitrate contributors. The likely principal non-point sources of contamination are household septic systems and agricultural practices since they are widespread in the area and are recognized sources of nitrogen.

Studies and nitrate reports from OSU Extension Service, Public Water Supplies, USGS and homeowners have indicated nitrate levels greater than 7.0 mg/L in the Southern Willamette Valley. The DEQ Laboratory has confirmed previous results found in other studies with their analyses of the 476 groundwater samples in 2000-2001 and 100 groundwater samples in 2002.

Based upon the data collected to date, DEQ has concluded there is adequate justification to declare a Groundwater Management Area for selected parts of the Southern Willamette Valley. Nitrate contamination of the aquifer likely due to non-point sources is the basis for this potential declaration. However, all sources, point and non-point, should be assessed as part of any future plan for a Groundwater Management Area.

# RECOMMENDATION TO DECLARE A GROUNDWATER MANAGEMENT AREA

## Groundwater Vulnerability in the Southern Willamette Valley

As previously discussed, many of the groundwater quality studies conducted in the Southern Willamette Valley focused on the shallow zone of the Willamette Aquifer. This portion of the aquifer has the greatest potential for nitrate contamination and is a primary source of domestic water supplies in the SWV.

The Willamette Aquifer in the study area is typically first noticed at 4-20 feet below ground surface. Much of the Willamette Aquifer is unconfined and with little in the way of overlying geologic protective barriers. However, there are areas of the Willamette Aquifer that are beneath the Willamette Silt, and are not depicted on the hydrogeologic map (Figure 4).

The combination of a shallow depth to water, limited or nonexistent natural barriers, and 40-plus inches of annual precipitation places a large extent of the Willamette Aquifer at risk to environmental impacts from land uses. The evidence collected to date indicates that there may be several to many nitrate sources responsible for the contamination of the shallow groundwater.

## Contaminants of Concern

The sampling data collected since the 1980's for this area include nitrate, pesticides, arsenic, lead, iron, manganese, basic water quality parameters (such as sulfate, chloride, pH, etc.), caffeine, volatile organic compounds and bacteria. Nitrate is the governing contaminant of concern in the Willamette Aquifer. Isolated areas of contamination from other parameters, such as sulfate, chloride and even some pesticides, are present. The 2002 Southern Willamette Valley Groundwater report (DEQ, 2003b) contains the details on the sampling results.

Nitrate is the only parameter that has exceeded established limits for designating a Groundwater Management Area. Although there have been other contaminants found in the study area, either these parameters did not exceed 50% of a MML or there were no applicable MMLs for comparison. Pesticides were sampled and analyzed during the 2002 SWV study; however no pesticide was detected at or above a level of 1.0 part per billion, or 1.0 micrograms per liter. The highest concentration of any pesticide found during this study was 0.776 parts per billion, or 0.776 micrograms per liter. Although pesticides did not exceed 50% of a MML, further evaluation as part of a broader examination of groundwater contamination issues is appropriate. It is most likely that mitigation of the trace levels of pesticides in the groundwater will be indirectly achieved by addressing the more significant nitrate contamination.

## Extent of Groundwater Contamination

Many of the studies in the Southern Willamette Valley have focused on shallow groundwater as measured by the use of wells that are less than 75 feet below grade. The few deeper wells identified and sampled during the 2002 study did not indicate nitrate at levels greater than 1.3 mg/L, even when the corresponding shallow well reported nitrate values up to 20 mg/L. Except for USGS/WRD investigations, the data collected from other studies often did not include well depth information. Available data are insufficient to determine if there is an unacceptable impact to the deeper (greater than 75 feet) groundwater. The vertical extent of groundwater contamination is an issue that should be addressed in future studies.

However, as found in the 2002 investigation, there is a large proportion of information connecting high nitrate values with recent alluvium and the younger deposits adjacent to the Willamette River. Nitrate levels in these areas have been measured up to 27 mg/L.

Of the 100 wells sampled in 2002, 9 wells that had nitrate values greater than 7 mg/L were located in the area mapped as Willamette Silt. These wells are likely drawing from the portion of the Willamette Aquifer located beneath the silt, as the Willamette Silt unit does not consistently supply an adequate quantity of water to private wells. It is important to note that full extent of groundwater nitrate contamination is not known at this time.

## Aquifers of Concern

The information collected by the numerous studies in the Valley indicates the shallow, mostly unconfined groundwater is the aquifer of concern relative to nitrate contamination.

At this time, any declaration of a Groundwater Management Area should focus on the shallow (less than 75 feet deep) groundwater. As mentioned above, the existing private well analytical data are principally from the shallow (< 75 feet) zone of the aquifer. Additional analysis of the deeper groundwater is needed, and could be conducted as part of a future study. If there are deeper, adjoining portions of the aquifer that are found to also be contaminated with nitrate, then such zones should be addressed in any resultant Action Plan.

## Rationale for a Proposed GWMA Boundary

DEQ staff evaluated the spatial occurrences of nitrate greater than 7.0 mg/L in an attempt to find the best fit for a geographic GWMA boundary. After several failed attempts to link nitrate to geologic unit or hydrogeologic properties, it was decided to construct the GWMA boundaries using recognizable geographical features encapsulating the majority of the identified high nitrate groundwater.

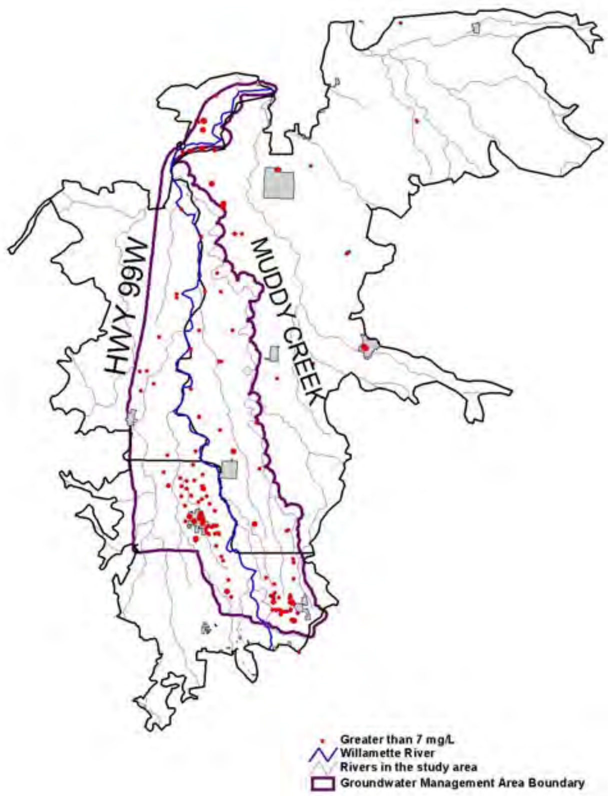



**Figure 8: GWMA boundary outlined in purple.**

The boundary proposed by DEQ uses the percentage of high value nitrate results in a given Township/Range and correlated this with nearby geographical features. In general, the final outline of the GWMA encloses those Townships/Ranges with a 15% or greater frequency of the nitrate values from DEQ & USGS studies exceeding 7.0 mg/L. When the proposed boundary cut through a specific Township/Range, the percent of nitrate values greater than 7.0 mg/L was calculated for only those points lying within the proposed GWMA boundary. The highest frequency of nitrate values greater than 7.0 mg/L in any Township/Range area that was not included in the proposed GWMA was 10%.

The GWMA boundary is shown on Figure 8. When the geographical feature used is the interstate or a waterway, the centerline of that geographic feature will be the actual boundary. Along other roadways in the unincorporated areas of the three counties, the boundary will include a 200-foot extension from the centerline of the geographic feature towards the outside of the area of concern. The intention of this 200-foot extension is to keep neighbors and neighborhoods together. When a road is inside or adjacent to an Urban Growth Boundary (UGB), the centerline of the road will be the actual boundary line. The one exception to this is the area where 99W traverses south Corvallis. In this area, a 200-foot extension to the west of 99W and south of the Highway 34 bypass is used. Neighborhoods in this area of Corvallis are separated by Highway 99W, and most are on septic systems and use private wells as their source of drinking water. The cities of Coburg, Harrisburg, Monroe, and Junction City are included in the GWMA.

The eastern boundary of the Southern Willamette Valley Groundwater Management Area starts at the intersection of I-5 and the McKenzie River, continues north along I-5, encapsulating Coburg's UGB and the developed and committed exception area to the east of I-5, and continues north on 1-5 to the intersection of I-5 with Muddy Creek. The boundary then travels north-northwest along Muddy Creek to the East Channel of the Willamette River. The boundary follows the East Channel of the Willamette River to the north (in the downstream direction) until merging with the main channel of the Willamette River. The boundary continues generally northeast (in the downstream direction) on the Willamette River until reaching the Route 20 bridge over the Willamette River.

At this junction, the GWMA boundary continues west along Route 20 to the intersection of Tyler Street. The boundary then continues east along Tyler Street to 1st Street, south along 1st Street to the Riverside Paved Foot & Bike Trail, south on the Foot & Bike Trail to Route 34 bypass, west on Route 34 to 99W. The boundary continues south on 99W with the 200-foot buffer inside this southern portion of the City of Corvallis. The boundary continues south on 99W and follows the western-edge of the UGB of Monroe including this city in the GWMA, and then continues south on Territorial Highway. At the intersection of Territorial and Route 36, the boundary continues on Route 36 to the east. The boundary crosses Route 99 and follows Prairie Road to the south-southeast. At the T-intersection of Beacon Drive West and Prairie Road, the boundary continues east on Beacon Drive West, and then east and then south on Beacon Drive East, south on River Loop #1, and then east on Chapman Drive to the Whitley Landing. At the Whitley Landing, the boundary continues northwest and then southeast on the Willamette River until the confluence with the McKenzie River, and then southeast along the McKenzie River (in the upstream direction) to I-5.

## Recommendation

In accordance with the requirements of the Oregon Groundwater Quality Protection Act and ORS468B.180, a groundwater management area should be established in the SWV based upon the nitrate groundwater contamination.

# AFER DECLARATION: REVIEW OF THE NEXT STEPS

**Lead Agency**

Designation of a Lead Agency

If a GWMA is declared, then DEQ must designate a lead agency within 90 days. The lead agency should be the most effective entity for this project, and the attributes considered in making a recommendation included agency rapport with stakeholders, resources available to the selected agency, and local community needs.

Responsibilities of a Lead Agency

The lead agency must develop the Action Plan. DEQ will assist in drafting the action plan and will request other agencies assume responsibilities appropriate to their mission in the drafting of the Action Plan. In essence, the lead agency must coordinate the reviews of all involved agencies and prepare the draft Action Plan for DEQ approval. DEQ, the lead agency and all other participating agencies shall agree in advance to the report's scope, content and schedule.

Once a draft Action Plan is prepared, the lead agency must provide a 60-day public comment period. The lead agency must consider all suggestions and comments provided during this period prior to completing a final Action Plan.

The lead agency submits the final Action Plan to DEQ, who will either accept the plan as written, or return the plan back to the lead agency with recommended revisions. The lead agency must return the revised plan back to DEQ within 30 days.

When DEQ accepts the final Action Plan, affected agencies have 120 days to adopt rules necessary to perform their respective requirements as detailed in the Plan.

Recommendation for a Lead Agency

After careful evaluation of relevant factors, it is recommended that DEQ retain the lead agency responsibilities. Consideration was given to other potential "lead agencies" such as ODA or DHS. However, when evaluating factors such as staff availability, relationships with the stakeholders and other available resources, it was clear that DEQ would be the most appropriate lead agency. DEQ is closely identified with this project in the Valley. Through field studies conducted over the past years, DEQ developed good relationships with many of those who may be affected by the GWMA. DEQ's involvement in the communities has helped to recognize their needs. Finally, DEQ's resources can currently support the lead agency role, while other agencies have not had sufficient opportunity to plan and secure resources for these activities.

**Oregon Department of Agriculture's Responsibilities**

Oregon's Department of Agriculture (ODA) is responsible for developing all parts of the Action Plan addressing farming practices on exclusive farm use zones or in agricultural lands within the GWMA. This will include the design of all agricultural Best Management Practices (BMPs), such as irrigation practices, application of fertilizer, testing of agricultural soils for nitrate, rotation of crops, etc. The farming practices portion of the Action Plan prepared by the Department of Agriculture will go through the same DEQ review and comment process as the rest of the plan.

**Potential Participating Agencies**

In addition to DEQ and ODA, many other state and local agencies may contribute to the Action Plan. Other state agencies include, but are not limited to Water Resources Department, Division of Human Services and the Department of Land Conservation and Development. The missions of each of these Departments fit with the goals of a Groundwater Management Area.

<u>Water Resource Department (WRD)</u>
WRD manages quantity issues for Oregon's public water, ensuring a sufficient supply to sustain its growing economy, quality of life and natural heritage. This agency also promotes water conservation and coordinates water-planning activities with other agencies and citizen groups

<u>Department of Human Services (DHS)</u>
DHS sets public health policy and provides assistance to county health departments and other local partners. A goal of the Department of Human Services is to help Oregon communities create healthy environments so their residents can be well.

<u>Department of Land Conservation and Development</u> (DLCD)
DLCC manages a statewide planning program to protect Oregon's quality of life. DLCD is a partner with cities and counties for planning issues, working closely with local government and other state agencies. DLCD sets planning standards and provides grants and technical assistance to local governments so they can meet those standards.

<u>Other Agencies</u>
OSU Extension Service, Farm Service Agency, East Lane, Benton and Linn Soil and Water Conservation Districts, Natural Resource Conservation Service, and OSU all have ties to the agricultural community. Their input to the Action Plan would certainly help develop BMPs for agricultural lands.

Governmental groups and agencies that may want to be involved would include the cities of Coburg, Junction City and Harrisburg because the proposed GWMA encompasses these towns. Lane Council of Governments, the Planning and Environmental/Public Health Departments of Lane, Benton & Linn Counties; County

Commissioners, the United State Geological Survey and interested State Senators and Representatives are all expected participants.

## Development of an Action Plan

Elements of the Plan

The elements of the Action Plan for the SWV should, at a minimum, include:

- identification of practices contributing nitrate to the groundwater;
- consideration of alternatives to reduce nitrate loading to the groundwater;
- assessment of other contaminants in the groundwater;
- recommendation of actions to be taken;
- a timetable for implementation of the recommendations; and
- amendments to city or county comprehensive plans required to address protection and management of the groundwater resource.

However, it is difficult to determine practical alternatives for reducing groundwater contamination without having a firm understanding of all the sources for this contamination. Prior to drafting an Action Plan, completion of additional technical studies will be necessary to address the information gaps.

Technical Advisory Committee

The Technical Advisory Committee would likely be made up of individuals, state agency staff and other agency staff with appropriate technical expertise. This committee would recommend appropriate studies to support the development of the Action. Although it is likely in this area that septic systems and agricultural practices are the major contributors of the nitrate to the groundwater, the Technical Advisory Committee could help identify all nitrate sources. Studies that identify the nitrate sources and other factors contributing to groundwater contamination must be completed prior to developing the Action Plan.

Once there is a better understanding of the source issue, the agencies involved in developing the Action Plan would be better able to recommend appropriate BMPs and groundwater restoration activities.

Appointment of a Groundwater Management Committee

If a SWV Groundwater Management Area is declared, DEQ would be required to appoint a Groundwater Management Committee (GWMC). DEQ will consult with other agencies and stakeholders to determine the makeup of this committee. At a minimum, this committee will consist of at least seven people who represent various interests in the GWMA and are available to serve in this capacity. DEQ's Director, with input from Regional, Program and Headquarters staff, will make appointments of the GWMC Chair and all members to the GWMC.  There is no established timeframe for appointing this committee, but it should occur prior to drafting of the Action Plan.

The primary function of this committee will be to advise the agencies developing the Action Plan on the local elements of the plan.  There may be subcommittees formed to provide information to the GWMC on specific issues, such as planning recommendations.

**Data Gaps and Information Needs to Consider before Developing an Action Plan**

<u>Source Identification</u>

There are significant nitrate impacts to the groundwater in some areas of the Valley. However, more information is needed to identify the activities that have contributed to the nitrate contamination. It is necessary to assess all possible point and non-point source ‘signatures’, including golf courses, CAFOs, lawn and agricultural fertilizers, septic systems, etc.

A ‘signature’ is the chemical makeup of a release, as measured in the groundwater, which can be attributed to a specific source.  Recent scientific studies provide some information on useful constituents for this exploration.  Analyses of nitrogen isotopes, common ions and EDTA are examples of possible tools that could shed light on potential sources.  Personal care products, such as shampoos and cleansers might be good candidates to assess septic system contributions to the groundwater.

<u>Irrigation, Fertilizers and Crop Types</u>

There is a potential that over-irrigating of crops may contribute to the nitrate in the groundwater.  Fertilization techniques may also be a factor to consider, along with the types of crops grown on different soils and the underlying geologic units.  The Technical Advisory Committee could coordinate with OSU Extension Service, WRD and other agencies to bring in GIS layers for irrigated lands, nitrogen applications and crop types.  Using these layers with the existing nitrate database may help determine possible associations.

<u>Groundwater Model</u>

Development of a groundwater model of the study area can be helpful in understanding impacts to groundwater and groundwater movements. This type of knowledge would be important in designing an effective monitoring program to track groundwater changes in response to implementing the Action Plan.

<u>Residual Nitrate in the Environment</u>

It is important to understand how much nitrate is present in the soils and groundwater to correctly design and monitor BMP implementation. Residual nitrate in the soils may keep nitrate levels in the groundwater artificially high for a period of time after BMPs introduction.

Age Dating of Groundwater

The USGS found that some shallow wells in the Valley measure groundwater older than 1953 (Hinkle, 1997). The age of groundwater may be important in determining when the nitrate was released, and establishing goals for the restoring the aquifer.

Geochemical Assessment of Existing Data

There is a significant database of high quality geochemical information available for assessment. Additional review of this information would be helpful in understanding the geochemistry of the area and in developing the Action Plan. For example, the correlation of nitrate with other parameters might aid in the identification of sources.

## Recommendation

It is recommended that DEQ's Director evaluate the potential of declaring portions of the Southern Willamette Valley a Groundwater Management Area. A final determination should be made based upon the information contained in this report and in previous SWV reports, and on the comments received by other agencies, organizations and the public.

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## APPENDIX 1: SUMMARY OF SOUTHERN WILLAMETTE VALLEY GROUNDWATER STUDIES

### DEQ Groundwater Studies

<u>1985-1987 Studies</u>

As part of a statewide assessment of shallow groundwater contamination from agricultural chemicals (including nitrates), DEQ collaborated with local, state, and federal agencies in the mid 1980s in sampling groundwater from 45 shallow wells in Lane and Linn Counties (DEQ, 1988). The nitrate data from this study have a high level of quality control including strict field sampling techniques by experienced professionals, laboratory analysis using EPA-specified protocols and a rigorous Quality Assurance/Quality Control program. Of the 16 wells tested in the Coburg Area, 9 wells had nitrate concentrations ranging between 3.0 and 7.0 mg/L; the remaining Coburg wells had nitrate levels lower than 3.0 mg/L. Of the 29 wells sampled in the North Albany area, 8 samples had nitrate levels greater than 5.0 mg/L. None of the samples exceeded the 10.0 mg/L MCL for nitrate.

<u>1993-1994 Studies</u>

DEQ initiated the Statewide Groundwater Quality Monitoring Program in 1993 (DEQ, 1993a) to assess the impact of various sources on the quality of Oregon's groundwater resources. Based on known or suspected area-wide contamination and concerns about groundwater vulnerability, DEQ prioritized 32 areas within the state for assessment, including three areas (DEQ 1993b, 1994a, and 1994b) within the Southern Willamette Valley (Coburg, Junction City, and the Albany-Lebanon Plain). Between 1993 & 1994, three separate assessments were conducted around the Coburg area, the Junction City area, and the Albany-Lebanon Plains area. Groundwater samples were collected from about 60 wells, and nitrate levels above 7.0 mg/l were reported in the vicinity of the Coburg and Junction City areas (see Figure A-1). The highest nitrate value for the Albany-Lebanon Plains was 6.5 mg/L.

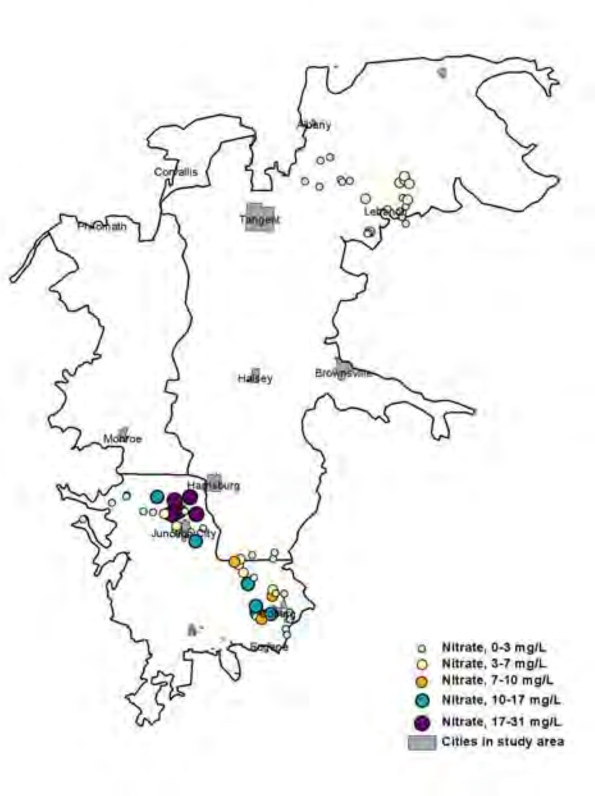


**Figure A-1: Nitrate values from the 1993-1994 DEQ Study**

<u>2000-2001 Survey</u>

DEQ's Water Quality Program, in consultation with Oregon Health Division (OHD), Oregon Water Resources Division (WRD), Oregon State University Extension Service (OSU), Oregon Department of Agriculture (ODA), and the United States Geological Survey (USGS)completed this groundwater survey (DEQ, 2003a). During 2000-2001, DEQ completed an area-wide survey of private water well quality, gathering nitrate data from 476 wells. Approximately 100 of these wells indicated nitrate present at concentrations exceeding 7.0 mg/L (see Figure A-2). The greatest concentration of wells exceeding 7.0 mg/L was in areas close to Coburg, Junction City, Corvallis, Shedd, and Monroe.

Although the primary objective of this study was to determine the magnitude and extent of nitrate contamination in the shallow alluvial aquifer from non-point sources, an important secondary objective was to perform outreach to the rural residents, farmers, and local government officials about groundwater quality and protection from non-point sources in the Valley. Outreach activities included radio interviews, open houses, and neighborhood meetings where free nitrate testing was offered to the residents.

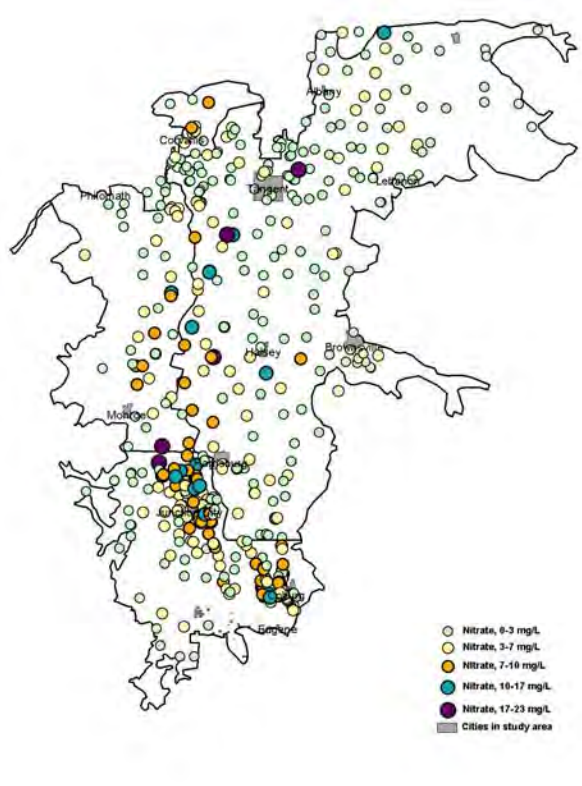


**Figure A-2: Nitrate values from the 2000-2001 DEQ Study**

2002 Southern Willamette Valley Study

This groundwater assessment was undertaken as a Western Region Regional Environmental Solutions and Groundwater Program initiative, in consultation with Oregon State University Extension Service, Oregon Department of Human Services (DHS, formerly OHD), and Oregon Water Resources Division (DEQ 2003b). During this study, DEQ resampled most of the 100 wells with nitrate levels above 7.0 mg/L from the 2000-2001 assessment. Analyses were conducted for nitrate, pesticides, caffeine, iron, bacteria and common anions and cations. Caffeine analyses were included as a potential indicator of influences from septic systems.

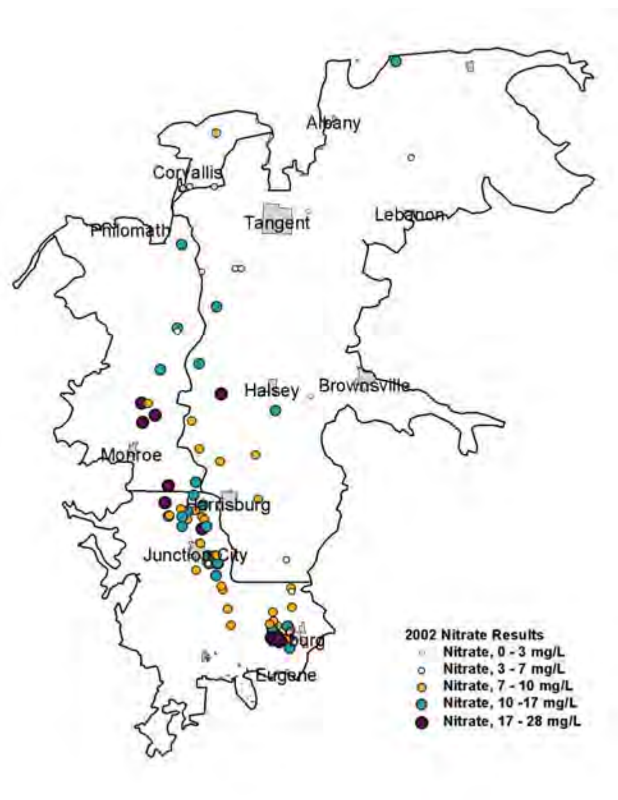


**Figure A-3: Nitrate values from the 2002 DEQ Study**

Groundwater samples were collected from the targeted wells over a three-month period, from May to July 2002. Several residents from the previous study indicated they had installed new wells or had deepened their existing wells based upon their receipt of the 2000-2001 sampling results. In the instance when a deeper well was installed and the shallower well was still available, samples were collected from both wells.

The high levels of nitrate (i.e, greater than 7.0 mg/l) found in the 2000-2001 study were confirmed (see Figure A-3). Most of the high nitrate values were associated with the Younger Upper Sedimentary Unit, which is primarily an alluvial material.

No other analyzed constituents were found at levels that would exceed 50% of their respective MCL. There were no detections of pesticides at levels greater than one-third of a MCL or Drinking Water Standard. The highest pesticide detection was 776 parts per trillion (ug/L). There was one detection of caffeine, at a very low concentration.

## Oregon State University Extension Volunteer Testing

During 1995-1997, staff of the Lane County office of the Oregon State University (OSU) Extension Service surveyed approximately 500 domestic well owners in northern Lane County, including Junction City and Coburg areas, to increase awareness about groundwater quality protection,. Nitrate concentrations generally ranged up to 34.0 mg/L, and one sample had a nitrate concentration of 233 mg/L. There were exceedances of the 10.0 mg/L MCL in 167 wells. Nitrate concentrations ranged between 3.0 and 10.0 mg/L in 191 wells. These data are useful in showing approximate distribution of nitrate in the groundwater; however the methods used for these analyses are not comparable to those employed by DEQ and USGS. It would be inappropriate to assume all data sets are interchangeable.

Wells with elevated nitrate tended to be located near Coburg and Junction City, and within the younger alluvium near the Willamette River between these two cities. Another significant number of wells with high nitrate levels occurred west of Harrisburg near the floodplain of Ferguson Creek.

## Real Estate Transaction Testing

Since 1989, Oregon has required sellers of residential property with domestic wells to have their well water sampled and analyzed for nitrate and bacteria. Property sellers routinely submit nitrate testing data to the Oregon Department of Human Services. Results submitted more recently than 1996 are not currently in an organized format.

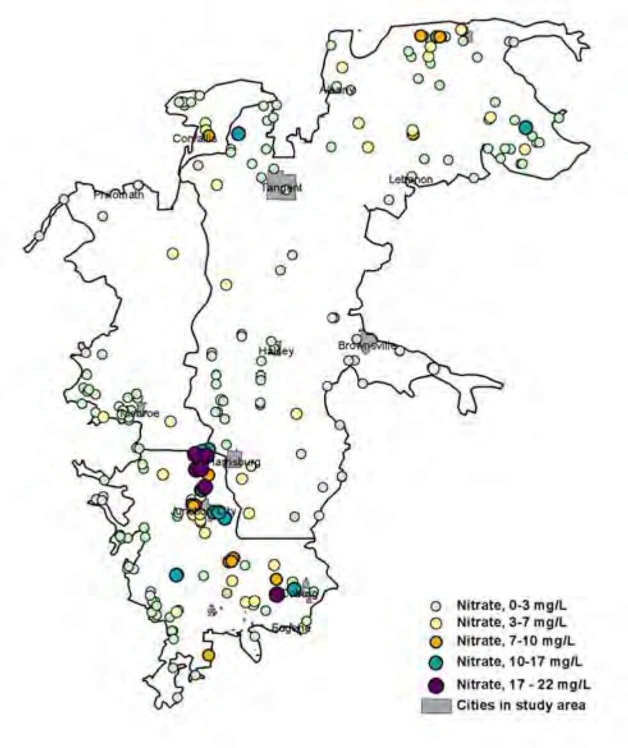


**Figure A-4: Nitrate results from real estate transactions 1989-1996**

Laboratory sample results from 964 wells sampled between 1989 and 1996 in the Counties of Linn, Lane, and Benton have been reported to OHD as a result of this program. DEQ considers these data to have a low level of quality control, given the absence of strict field sampling or laboratory analysis protocols. These data are still valuable in showing the approximate distribution of elevated nitrate concentrations.

Only a portion of the 964 domestic wells in these three counties were actually in the Southern Willamette Valley study area. Of this group, 564 wells had addresses that were recognized by the ArcView mapping program. The nitrate results from those recognizable addresses sampled in the project study area between 1989 and 1996 are presented in Figure A-4 and described below:

- Nitrate exceeded the 10.0 mg/L MCL in 34 wells. The majority of these wells occurred in the Junction City area (19), north Eugene-Coburg area (4), and the Albany-Lebanon Plain area (7).

- Nitrate ranged between 3.0 and 10.0 mg/L in 175 domestic wells. Many of these wells werelocated in the Albany-Lebanon Plain area (47), Corvallis (23), north Eugene-Coburg (27), Harrisburg (7), Junction City (39), and Scio (14).

**Public Drinking Water Supply Data**

Pursuant to the Safe Drinking Water Act, the Oregon Department of Human Services requires testing of public drinking water supplies including restaurants, hotels, mobile home parks, and any drinking water supply regularly accessible to the public. DEQ staff reviewed these records and found at least 112 permitted public water supply systems dependent on a groundwater source within the study area. These systems are required to monitor water quality on a routine basis, including laboratory analysis for nitrate. These data are considered to have a mixed level of quality control, when compared to samples collected by experienced professionals and laboratory analysis conducted using EPA-specified protocols and a rigorous laboratory Quality Assurance/Quality Control program. Untrained individuals may have collected samples but the analyses were required to be completed by a laboratory certified for drinking water samples.

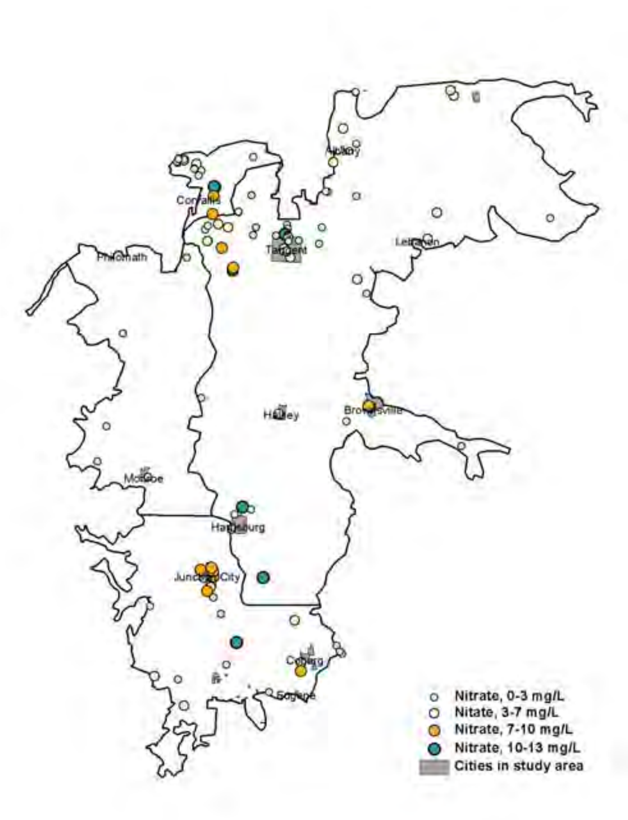


**FIGURE A-5: Historical highest nitrate value for individual public water supplies**

Figure A-5 shows the approximate locations of public water supply systems found in the project study area and the highest nitrate value ever reported at each individual public water supply. Nitrate levels of 3-10 mg/L were reported at least once in 27 systems, predominantly east of Corvallis, Tangent, Albany-Lebanon Plain area, Scio, Halsey, Harrisburg, and Junction City areas. Nitrate concentrations greater than the 10 mg/L MCL were reported at least once in 8 systems within the project study area, including systems near Coburg, Junction City, Harrisburg, Brownsville, Corvallis and Tangent.

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**USGS Willamette Valley Groundwater Assessment**

The United States Geological Survey studied groundwater quality in the Willamette Valley (Hinkle, 1997), including laboratory analyses of nitrate in samples collected in 1991 and 1993 from 30 water supply wells distributed broadly across the project study area. These data are considered to have a high level of quality control, including strict well selection, field sampling, and laboratory analysis protocols.

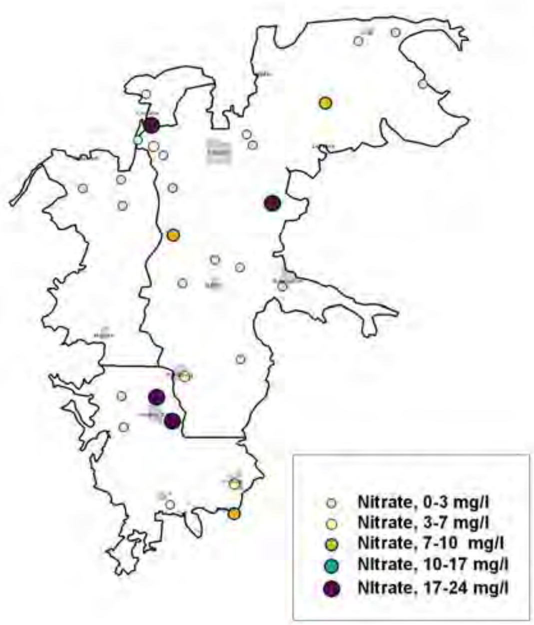


**FIGURE A-6: USGS NAWQA study Nitrate results from 1991 and 1993**

Figure A-6 includes locations and nitrate concentration ranges for these 30 wells. Nitrate concentrations ranging from 3.0-10.0 mg/L occurred in six wells, and exceedances of the nitrate MCL (10.0 mg/L) occurred in four wells. The limited number of wells sampled in this study and their wide spatial distribution across the study area makes it difficult to determine any general patterns in nitrate distribution. However, these data are consistent with the data from other studies showing elevated nitrate concentrations near Junction City, Harrisburg, and Coburg.

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