Southern Willamette Valley Groundwater Management Area Action Plan

Submitted By:
Southern Willamette Valley Groundwater Management Area Committee
Submitted To:
Oregon Department of Environmental Quality

Prepared by Lane Council of Governments
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Southern Willamette Valley Groundwater Management Area

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Acronyms Related to the Southern Willamette Valley Groundwater Management Area

BMP	Best Management Practice
CAFO	Confined Animal Feeding Operation
CIP	Conservation Improvement Practice
CPRCD	Cascade Pacific Resource Conservation and Development
DEQ	Department of Environmental Quality
DHS	Department of Human Services
DLCD	Department of Land and Conservation
DOGAMI	Department of Geology and Mineral Industries
DWPA	Drinking Water Protection Act
EPA	U.S. Environmental Protection Agency
GWMA	Groundwater Management Area
GWMAC	Groundwater Management Area Committee
LCOG	Lane Council of Governments
MCL	Maximum Contaminant Load
Mg/L	Milligrams per Liter
NRCS	Natural Resource Conservation Service
OAR	Oregon Administrative Rules
OAWU	Oregon Association of Water Utilities
ODA	Oregon Department of Agriculture
ODHS	Oregon Department of Human Services
ORS	Oregon Revised Statutes
OSU	Oregon State University
O2WA	Oregon On-site Wastewater Association
PCAP	Passive Capillary Station
PPM	Parts per Million (=micrograms per liter [mg/L])
PWS	Public Water System
RARE	Resource Assistance for Rural Environments
RCAC	Rural Community Assistance Corporation
SDWA	Safe Drinking Water Act
SWCD	Soil and Water Conservation District
UGB	Urban Growth Boundary
UO PPPM	U of O Dept. of Planning, Public Policy, & Management
USGS	United States Geological Survey
WQMP	Water Quality Management Plan
WRD	Water Resources Department
WSC	Watershed Council

Chapter 1 – Introduction and Background

Introduction

The Oregon Department of Environmental Quality (DEQ) considers the Southern Willamette Valley to be a priority area for groundwater assessment and protection for four primary reasons: 1) severity and extent of documented non-point source groundwater contamination; 2) vulnerability of shallow groundwater to adverse impacts from population growth; 3) reliance of nearly all residents of the valley on groundwater for drinking water; and 4) need for integration of groundwater quality protection strategies with other ongoing water quality improvement efforts, such as the total maximum daily load allocations for impaired waterways and Oregon Department of Agriculture (ODA) Water Quality Plans (Kalakay, 2004).

"Far and away the best prize that life has to offer is the chance to work hard at work worth doing."
- Theodore Roosevelt

Over the last 20 years, many studies and sampling programs have focused on groundwater quality in the Southern Willamette Valley. The results have identified nitrate contamination of shallow groundwater in some parts of the Valley. In May 2004, the Department of Environmental Quality declared a portion of the Southern Willamette Valley a Groundwater Management Area (GWMA) because of elevated groundwater nitrate levels. Although low levels of nitrate are natural, a variety of human activities have caused high nitrate concentrations in the groundwater in the Southern Willamette Valley (DEQ, 2004).

In addition to nitrate, DEQ's justification for declaring the GWMA included the need to identify other potential contaminants in the groundwater. At the time of the GWMA declaration, the DEQ and Department of Human Services were just completing Source Water Assessments for the public water systems in the area. These assessments delineate the area from which public systems get their drinking water and generate an inventory of potential contaminant sources within that area.

In 2004, the DEQ formed a stakeholder group, known as the Groundwater Management Area Committee (GWMA Committee), to develop nitrate reduction strategy recommendations for a region-wide, DEQ-approved Action Plan. This plan was also to include strategies to address other potential risks to the 52 public water systems in the GWMA. The stakeholder group represents a cross-section of land use sectors in the region. Their Committee's vision is to foster efforts to reduce nitrate contributions and prevent further groundwater contamination through the implementation of this Action Plan.

Purpose and Goals

The overarching goals of this Action Plan are to:

- Reduce nitrate levels to less than 7 milligrams per liter (mg/L) throughout the region and sustain this reduction in order to rescind the declaration of the GWMA.

- Disseminate information about the area to solicit input and encourage actions that will protect the groundwater resource in order to engage and involve all groups and citizens concerned with, interested in and/or affected by GWMA plans or programs.

- Support efforts to reduce nitrate and protect the aquifer from other potential contaminants by encouraging both a short- and long-term commitment from federal, state, and local agencies.

- Preserve and enhance the health of the aquifer while maintaining traditional and/or locally appropriate land uses. Emphasis is on the development of specific voluntary strategies that avoid leaching nitrate to groundwater.

Plan Organization
This plan is organized into four chapters:

Chapter One – Introduction and Background includes a regional profile describing the area's characteristics such as land use and local jurisdictions. This chapter also provides an overview of the sampling studies conducted in the area, health concerns related to nitrate, the GWMA boundary, and a broad overview of potential nitrate sources in the region.

The 230-square-mile GWMA is a mixture of urban & rural lands

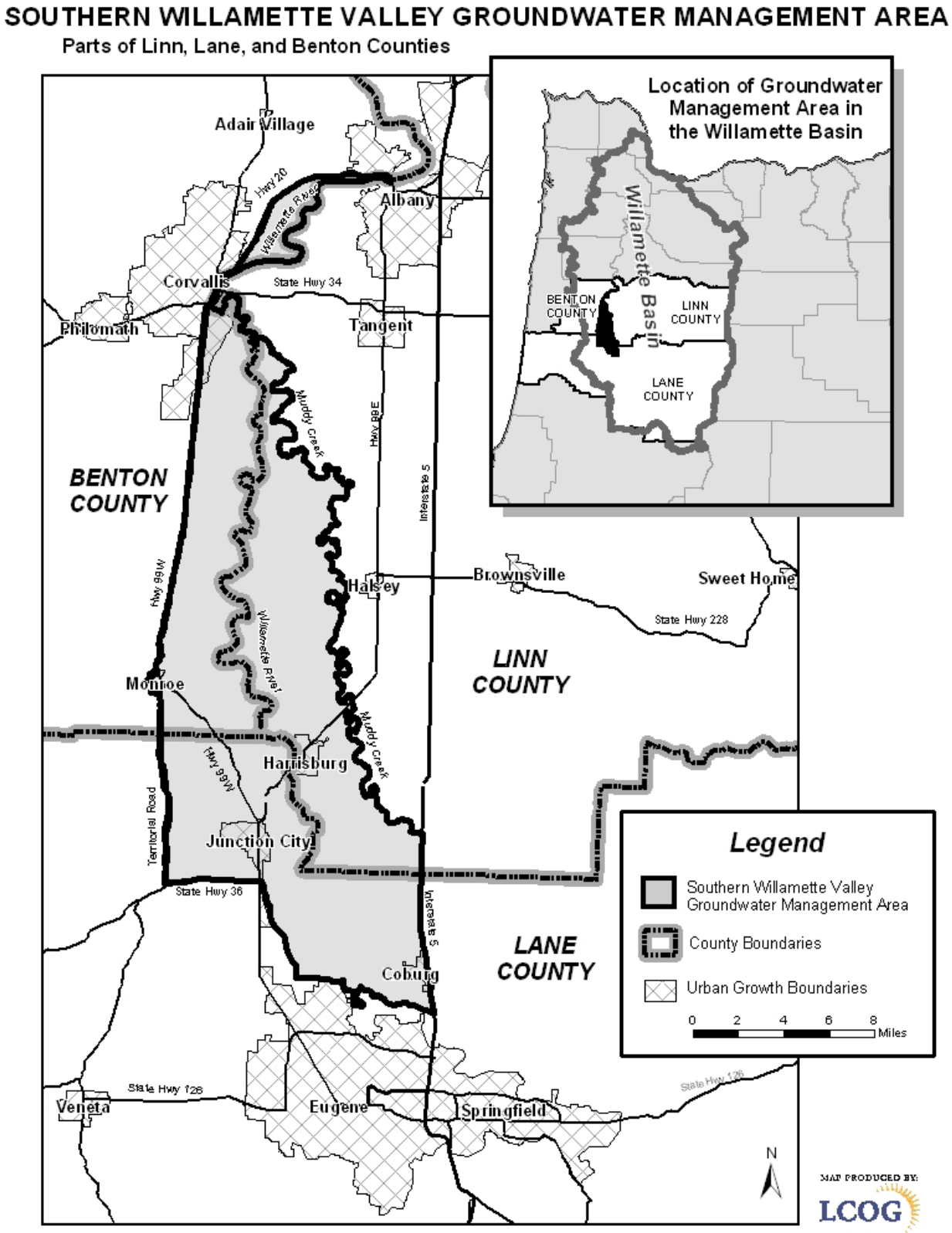
Chapter Two – Action Planning Process and Public Participation explains stakeholder representation, the process used in developing this Action Plan, partnerships, agency roles and responsibilities, and public involvement activities.

Chapter Three – Sources and Solutions identifies specific potential nitrate contamination sources within the GWMA and how they relate to land use. This chapter includes the goals and specific management strategies and actions for agricultural, residential, and commercial/industrial/municipal land use activities. Chapter Three also examines potential contamination risks to public water supplies and strategies to prevent contamination.

Chapter Four – Implementation: Measuring Success through Performance Indicators and Groundwater Monitoring provides a description of the nitrate monitoring approach for both baseline and long-term data collection. This chapter also describes how the overall effectiveness of the plan will be measured through process and outcome indicators.

Regional Profile
The Willamette Valley is one of Oregon's fastest growing regions and depends heavily on groundwater for private wells, public drinking water, irrigation, industrial operations, and other beneficial uses. The GWMA is comprised of approximately 230 square miles of land within the Southern Willamette Valley. The GWMA boundary begins on the northern edge of the Eugene/ Springfield metropolitan area, the second largest in the state of Oregon, and extends 50 miles north just beyond the city of Corvallis. The GWMA encompasses the 100-year Willamette River floodplain and a number of tributaries that flow into the Willamette River. The area includes portions of Lane, Linn, and Benton counties and the cities of Harrisburg, Junction City, Coburg, Monroe, and a small portion of Corvallis (see Map 1).

Map 1: Regional Context



Residents

There are approximately 21,200 residents in the GWMA, 80 percent of which rely solely on groundwater for their drinking water supply. Approximately 12,500 residents live in urban areas and get their drinking water from public water systems. There are also several small public water system wells that serve GWMA residents living outside of municipal areas. Virtually all of the estimated 8,700 residents living within the GWMA who are not served by a public water system use groundwater from household wells. Table 1 shows the breakdown of urban and rural residents within the GWMA by county. The Lane County portion of the GWMA is the most heavily populated with half of all GWMA residents and nearly 60 percent of all rural residents. Map 2 displays the relative distribution and density of the GWMA population by square mile.

Table 1
Southern Willamette Valley Groundwater Management Area
Urban and Rural Population by County

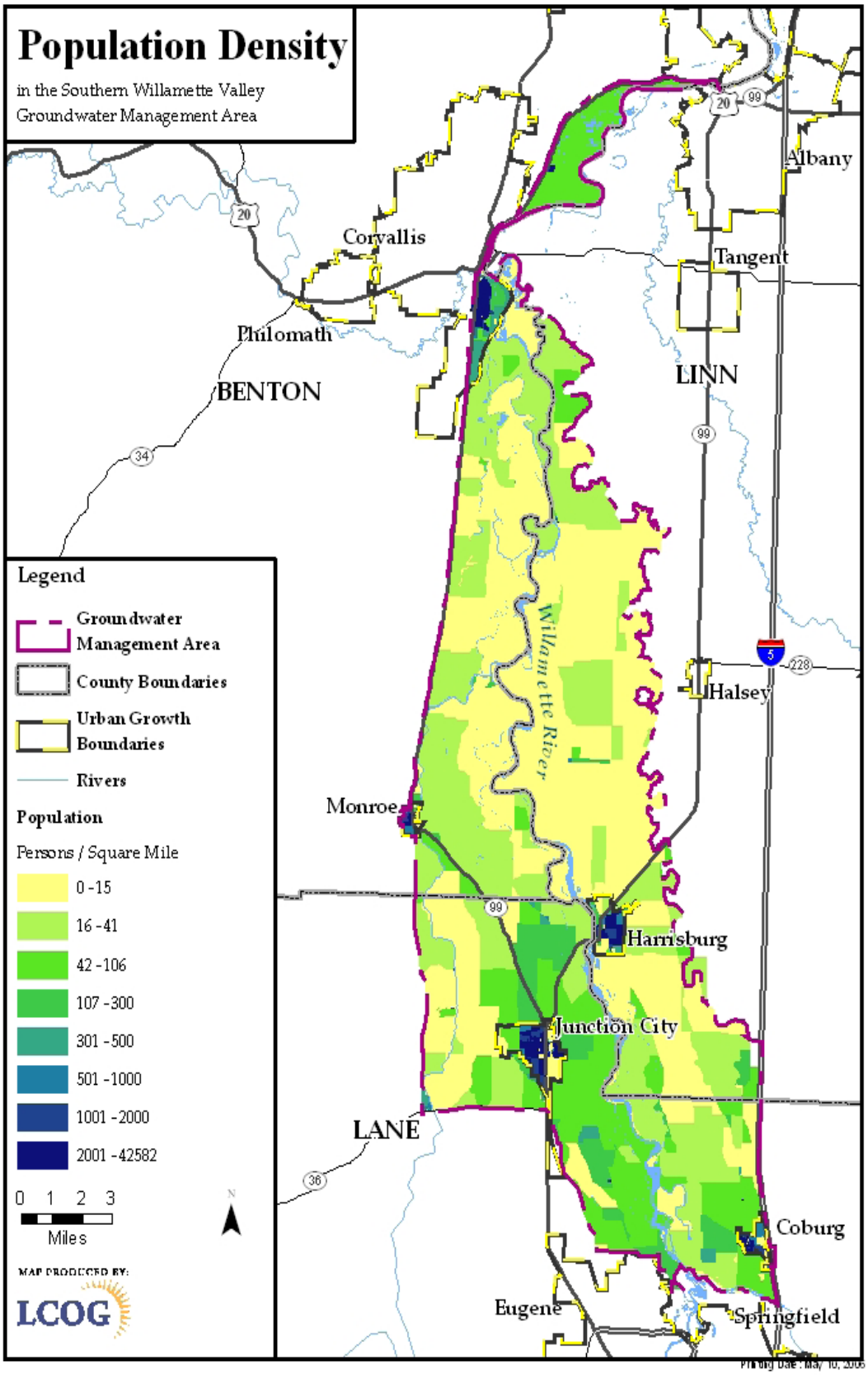
	Lane County	Benton County	Linn County	Total
Rural Population	5,033	2,010	1,640	**8,683**
Population by City				
Coburg	958			
Junction City	4,630			
Corvallis*		3,936		
Monroe		597		
Harrisburg			2,427	
Urban Total	5,588	4,533	2,427	**12,538**
Total Population	10,621	6,533	4,067	**21,221**

Rural population from 2002 Census based on location of block center falling outside of city limits.
Urban population from 2002 Census based on location of block center falling in city limits.
*Corvallis population only includes Census Block whose centers fall within the GWMA Study Area

Surface and Groundwater

The main surface water feature in the GWMA is the Willamette River. In the Southern Willamette Valley, the Willamette River is fed by the Long Tom, Middle Fork, Coast Fork, and McKenzie rivers. Groundwater flow generally follows the contour of the land and slowly moves towards the Willamette River. In the Willamette basin there is good connection between the groundwater and the rivers. As groundwater flows closer to a river, it starts to move in the same direction as the river and some groundwater can be incorporated into the river. Under certain circumstances, especially during the wetter times of the year, water can change directions and flow into the aquifer from the river. During the drier months, groundwater will often flow out from the aquifer and help sustain river flows.

Map 2: Population Density



The Willamette River has played a significant historical role in shaping the geology and soil compositions on land near the river. Some 12,000 to 15,000 years ago, massive flooding events distributed large cobbles, gravels, sands, and silts over the valley and created temporary lakes in the area. Finer-grained materials eventually settled out of these lakes, and created the hydrogeologic unit know as the Willamette Silt. Evidence suggests that the Willamette Silt may provide some protection to the aquifer from land activities because the smaller soil particles are less permeable and can act as a barrier to contaminant movement (Conlon et al., 2005). Some studies have even demonstrated that the Willamette Silt may help break down nitrate to nitrogen gas, offering even more protection to the groundwater under the silt layers (Arighi and Haggerty, 2004).

The majority of the drinking water supply in the region comes from the underlying groundwater resource known as the Willamette Aquifer. According to the US Geologic Survey water supply data (Hinkle, 1997), "more than 80 percent of the groundwater used in the Willamette Basin is pumped from the alluvial aquifer" (the shallow portion of the aquifer made up of sediments). There are several productive zones within this aquifer including a very productive shallow zone, which is primarily adjacent to, or on the west side of, the river. This productive zone is an *unconfined* aquifer usually less than 40 feet deep, averaging about 20 feet in thickness. An *unconfined* aquifer is one where there is a direct link between the aquifer and the land surface, meaning there is no relatively impermeable soil or rock barrier to restrict the downward percolation of water.

Surface water and groundwater are interconnected

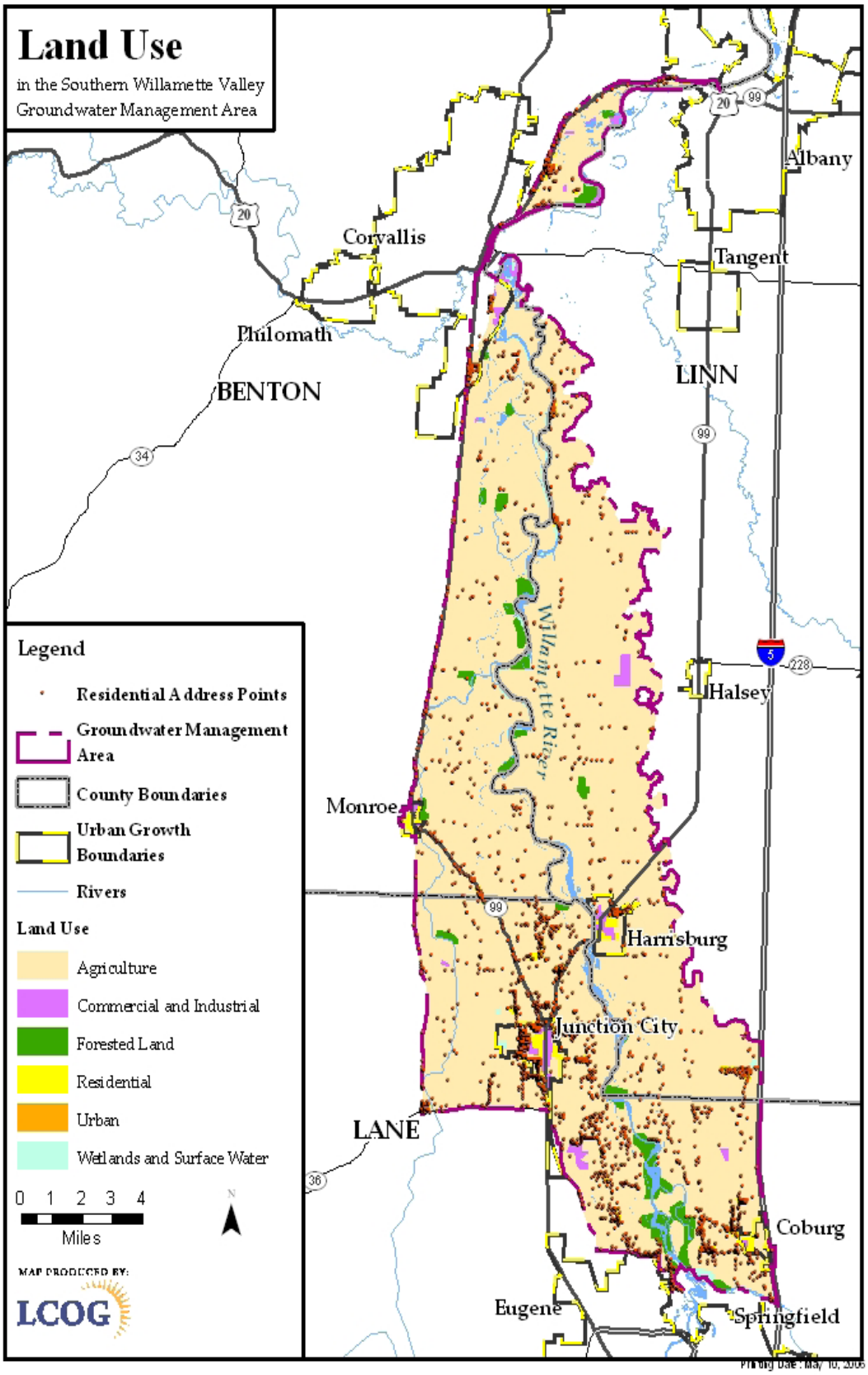
The majority of the soil overlying the shallow aquifer is very permeable. The historically high amount of rainfall makes this shallow groundwater very susceptible to any land use contamination. Due to the geology of the area, this heavily used, uppermost aquifer is the groundwater resource most likely affected by human activities (DEQ, 2004).

In some areas beneath this productive upper zone, there is a deeper zone which can extend to over 200 feet thick, especially in areas where rivers have merged (such as the McKenzie and the Willamette). The deeper zone generally starts around 60 feet below the surface and can contain localized, relatively impermeable zones of rock or soil, known as *confining* layers. Due to this fact, some areas of the GWMA will have very good connections between the shallow and deeper zones of the aquifer, while other areas contain impediments (confining layers) that may restrict contaminated groundwater from moving directly into the deeper zones.

Land Use

The fertile lands of the Willamette Valley have been, and continue to be, a natural place for people to live and for cities to develop. The region is one of the most productive agricultural areas in the world. Map 3 displays the types of land use that exist in the GWMA.

Map 3: Land Use



About 93 percent of the GWMA is in agricultural land use, providing a significant economic base for all three counties in the GWMA. The valley soils and climate are ideal for crop, livestock, and dairy production. Over six percent of the GWMA is dedicated to urban or rural residential land use. Urban uses include city residential areas, as well as commercial and industrial operations both inside and outside of city boundaries. Businesses in the Southern Willamette Valley range from golf courses to recreational vehicle manufacturers to pulp and paper industries. There are approximately 2,700 rural residential homes in the area. The majority of these homes rely on private wells and septic systems. Many of these rural residential lots also support small-scale livestock production.

Groundwater Quality Studies and Results

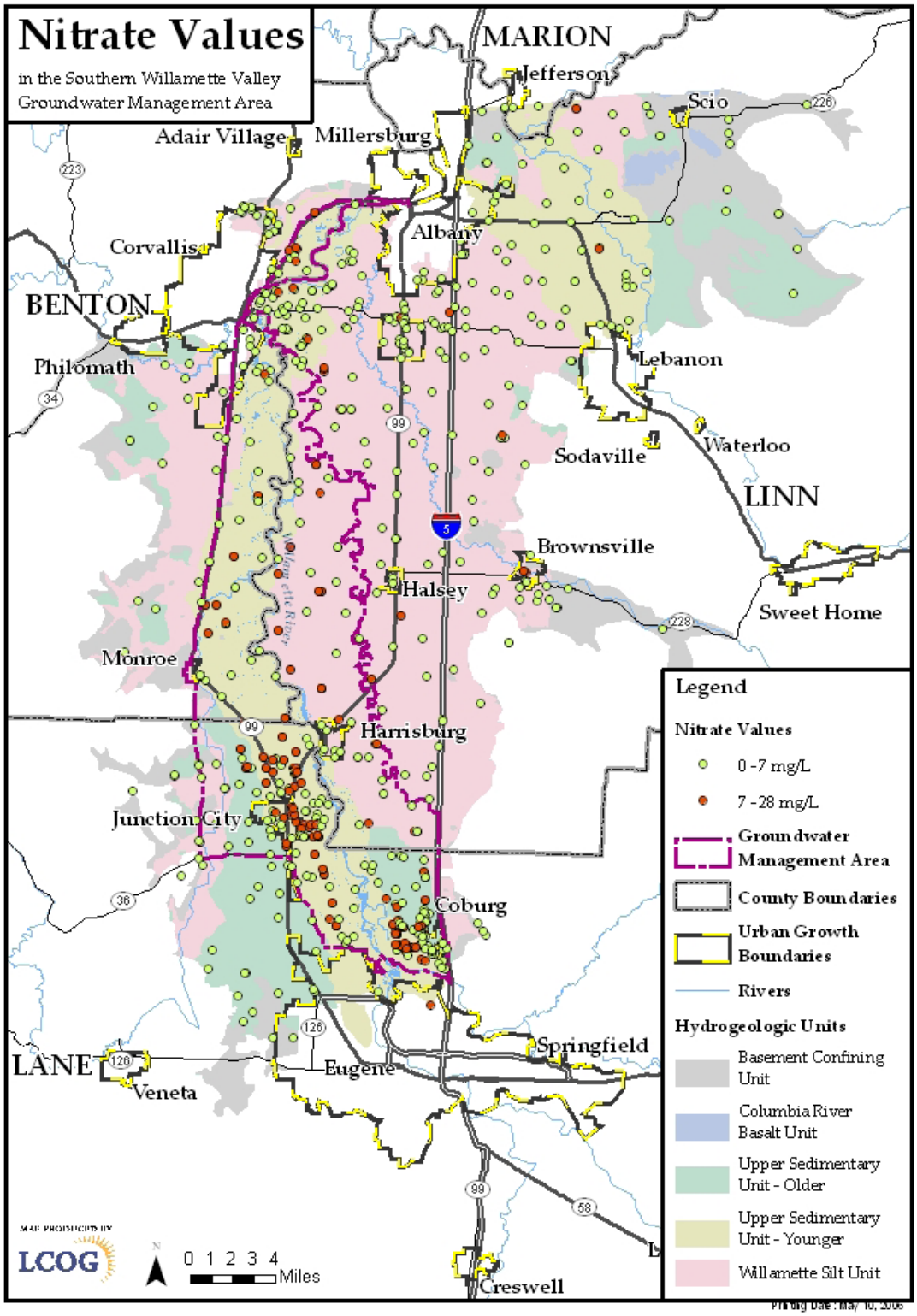
Numerous studies provide evidence of widespread nitrate contamination in portions of the Willamette Valley. Sampling in the 1990s by the DEQ, Oregon State University (OSU) Lane County Extension Service, and the U.S. Geological Survey indicated elevated nitrate values in the region (DEQ, 2004). The DHS Drinking Water Program requires public water systems to monitor for nitrate and 15 systems in the GWMA have tested positive for nitrate levels greater than 7 mg/L in the past five years. More recent sampling and analysis by the DEQ Laboratory has confirmed previous nitrate study results. Between 2000 and 2002, the DEQ undertook two additional studies to examine the magnitude and extent of nitrate in shallow groundwater. The 2000-2001 study sampled 476 wells in the study area and over 20 percent (100 wells) had nitrate at or above 7 mg/L. In 2002, DEQ re-sampled the wells that had nitrate values greater than 7mg/L. This re-sampling found nitrate values that were consistent with previous levels.

Many samples taken from the shallow aquifer have nitrate levels greater than 7mg/L

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 the land surface. The few deeper wells identified and sampled during the 2002 study all had low nitrate concentrations (none with levels greater than 1.3 mg/L), even though a corresponding shallow well in the same area had nitrate values up to 20 mg/L. There is insufficient data to determine if there is an impact to the deeper (greater than 75 feet) groundwater. However, as found in the 2002 investigation, there is a large amount of information connecting high nitrate values with recent alluvium and the younger deposits adjacent to the Willamette River in the 100-year floodplain. Nitrate levels in these areas have been measured up to 27 mg/L (DEQ, 2004).

Of the 100 wells sampled in 2002, nine 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 aquifer located beneath the silt, as the Willamette Silt unit is not known to be capable of consistently supplying an adequate quantity of water to private wells. Map 4 shows the DEQ study area and the results of the nitrate sampling conducted by the U.S. Geologic Survey, public water systems, and the DEQ 2000-2002 study. The map also shows the relationship of nitrate values to the hydrogeologic composition of the area. It is important to note that the full extent of groundwater nitrate contamination is not known at this time.

Map 4: Nitrate Values



Groundwater sampling data collected since the 1980s for the Southern Willamette Valley included parameters other than nitrate such as pesticides, arsenic, lead, iron, manganese, caffeine, volatile organic compounds, bacteria, and basic water quality parameters such as sulfate, chloride, and pH. This data revealed isolated areas of contamination from other parameters, such as sulfate, chloride, and some pesticides. However, nitrate was the only parameter that exceeded established thresholds, triggering the designation of a groundwater management area. Pesticides sampled and analyzed during the 2002 Southern Willamette Valley study occurred at very low concentrations, however, a number of wells contained two or more different pesticides. Little is known about the synergistic effects of multiple pesticides occurring in drinking water at any concentration, but no single pesticide was detected at or above very low levels. It is possible that strategies to address nitrate contamination will indirectly result in a reduction in the trace levels of some pesticides found in the area's groundwater during these studies.

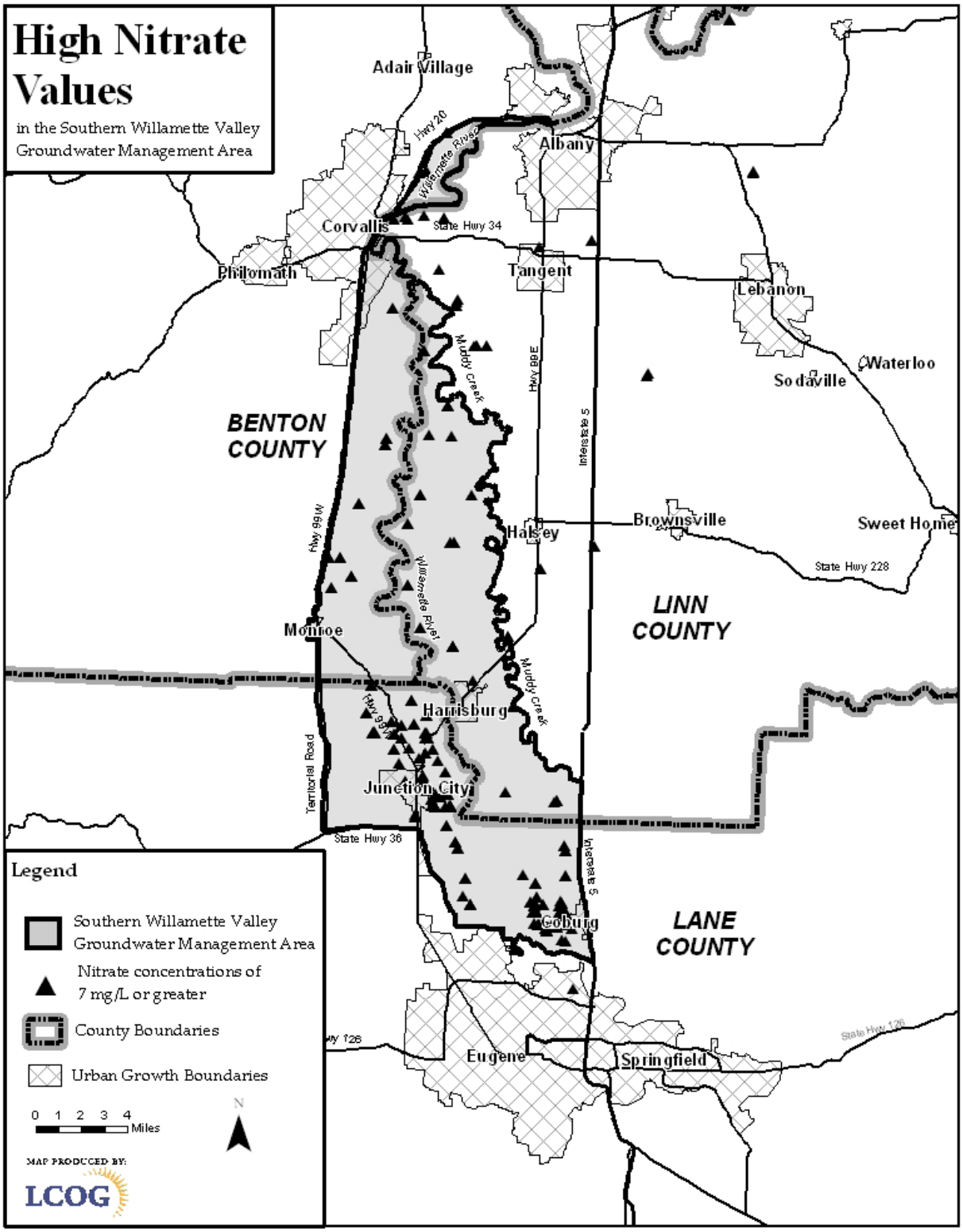
Groundwater Management Area Boundary

The area designated as the GWMA is less than half (41 percent) of DEQ's 2000-2002 original study area. The final area that was selected to be designated used the percentage of high value nitrate results in a given Township/Range correlated with nearby geographical features. In general, the final outline of the GWMA encompasses those Townships/Ranges with a 15 percent or greater frequency of the nitrate values from DEQ and U.S. Geologic Survey studies exceeding 7 mg/L. When the proposed GWMA boundary cut through a specific Township/Range, the percent of nitrate values greater than 7 mg/L was calculated for only those points lying within the proposed boundary. For Township/Range areas not included in the proposed GWMA, the highest frequency of nitrate values greater than 7 mg/L was 10 percent.

The GWMA boundary captures the area with the most sample sites with nitrate values greater than 7 mg/L. However, it is important to note that sites outside of the GWMA boundary may have groundwater above the 7 mg/L threshold just as wells within the GWMA boundary may have nitrate levels below 7 mg/L.

The GWMA boundary and sampling points greater than 7 mg/L are shown on Map 5. When the geographic feature used to delineate the boundary is the Interstate or a waterway, the centerline of that geographic feature is the actual boundary.

Map 5: High Nitrate Values



Along other roadways in the unincorporated areas of the three counties, the boundary includes 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, the centerline of the road is the actual boundary line. The one exception to this is the area where Highway 99W traverses south Corvallis. In this area, a 200-foot extension to the west of Highway 99W and south of the Highway 34 bypass is used. Neighborhoods in this area of Corvallis are separated by Highway 99W and most use septic systems and private wells.

Preventing Future Groundwater Contamination

Nitrate is a known problem in the region and the governing contaminant of concern in the GWMA. In addition to dealing with a known contaminant, the federal Safe Drinking Water Act requires states to examine potential contaminant risks to public water supplies as a first step in preventing contamination problems. As part of this effort, the DEQ and Oregon Department of Human Services completed Source Water Assessments for public water systems in the GWMA. Source Water Assessments use an established methodology that was developed by the DEQ and Department of Human Services with input from a stakeholder committee and approved by the Environmental Protection Agency (EPA). These assessments provide the basis for identifying potential risks to public drinking water sources from the full array of land use activities.

Health Concerns

Public water systems must adhere to specific EPA drinking water standards for nitrate and other contaminants. The EPA drinking water standard for nitrate is 10 mg/L. Public water systems are required to monitor water quality on a regular basis, report their results, and apply treatment when necessary. Owners of individual household wells are not required to monitor regularly or adhere to drinking water standards.

The 10 mg/L EPA drinking water standard was established due to health concerns

Public health officials have been concerned for over 50 years about a connection between high levels of nitrate in drinking water and methemoglobinemia, also known as blue-baby syndrome. At prenatal visits, heath care professionals routinely recommend that well water be tested for nitrate. Although methemoglobinemia is very rare, the EPA standard for public drinking water was set at 10 mg/L to protect the susceptible infant population. Until recently it was widely believed that nitrate was only a concern for households with infants. However, in the past ten years, toxicology and public health research has suggested that adults may develop other illnesses as a result of consuming high levels of nitrate.

Scientific studies have found that in addition to methemoglobinemia, nitrate may be associated with diabetes, various forms of cancer, and adverse reproductive outcomes such as miscarriages, congenital defects, and premature birth (Ward, 2005). A limited number of studies have also found links to thyroid dysfunction, impaired immune response, decreased liver function, and respiratory infection. However, at this time, research findings are not consistent and evidence is not conclusive.

Overview of Nitrate Sources

Nitrate is an inorganic compound that naturally occurs at low levels in soil, air, and water. Low levels of nitrate (3-4 mg/L) are generally considered to be naturally occurring background concentrations (Lamond et al., 1999). Human activities can increase nitrate levels and cause contamination of water supplies. Nitrate is essential to life because it is used and converted by plants to meet some of their nutrient requirements for nitrogen. Nitrate is highly soluble in water and mobile in the soil. This makes it relatively easy for nitrate from a variety of point and non-point sources to leach through the soil and into the groundwater.

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.

Non-point sources of pollution are caused by rainfall, snowmelt, or irrigation water moving over and through the ground. As the water moves, it can pick up and carry away natural and human-made pollutants, ultimately depositing them into ground and surface waters. Non-point sources of pollution can originate from relatively large areas, can be associated with particular land uses, and may consist of several pollutants. These features make it extremely difficult to trace all individual sources and identify which pollutant came from which specific source. In general, these pollutants can arise from activities that the everyday person has control over.

Potential point and non-point sources of nitrate pollution in the Southern Willamette Valley study are found across land use sectors in the region and include:

- Fertilizers
- Animal waste
- Septic systems
- Wastewater
- Unused or poorly constructed wells

Fertilizers: The three fertilizer manufacturing and sales facilities in the GWMA are potential point sources for fertilizer contamination. A bulk fertilizer facility generally offers commercial quantities of various custom-blended fertilizers, herbicides, and pesticides for the agricultural community and other large fertilizer applications. There are no known releases of fertilizers from existing businesses in the GWMA. Previous manufacturing facilities at these same locations, however, may have had periodic releases to the ground that could still have residual contributions.

Fertilizer is converted to nitrate in the soil

Non-point sources of nitrate can come from fertilizers used by homeowners, commercial and industrial businesses, farmers, and city and county parks. The actual use of a fertilizer is not necessarily a practice that will contribute nitrate to the groundwater. Rather, it is the amount, timing, frequency and type of fertilizer, as well as the timing of irrigation relative to the application of fertilizers that can cause nitrate to be flushed beyond the root zone.

Fertilizers come in many different forms such as granular, water soluble, foliar applied, quick release, and slow release. Slow-release fertilizers, as their classification implies, release nutrients at a slower rate throughout the season and are less likely to leach to the groundwater. Although they are initially more expensive, less frequent applications are required.

Regardless of the form of nitrogen applied, it is eventually converted in the soil to nitrate. Nitrate in soil water solution is readily taken up by actively growing plants. However, if plants are not actively growing or are unable to take up all available nitrate, nitrate dissolved in water percolates through the soil below the root zone into groundwater. Over-watering practices combined with over-fertilizing can exacerbate the problem and be a cause for groundwater impacts.

Livestock and domestic pets can contribute nitrate

Animal Waste: Animal waste has the potential to contribute nitrate to groundwater if not managed properly. All animal waste contains nitrogen/nitrate although the amount is largely dependent on animal species and diet. Nitrate contributions from animal waste can come from either point or non-point sources. By law, confined animal feeding operations (CAFOs) are considered point sources. These facilities are often permitted and hold relatively large numbers of animals including chickens, swine, and cattle. Small acreage rural residential lots with fewer animals are considered non-point sources and can also contribute to nitrate loading in the groundwater. Even the family dog can contribute a small amount of nitrate. Like fertilizer, animal waste does not have to be a source of nitrate to groundwater. Larger permitted facilities address nitrate leaching by implementing Animal Waste Management Plans. Animal waste on small acreage lots can often be managed by covering manure during the rainy season and then using the waste as compost during the growing season.

Septic Systems: Septic systems can be a non-point source of nitrate contamination. Standard septic systems used at individual households release water containing nitrate from the drainfield even if they are functioning properly. While values can vary depending on the system and household load, nitrate in effluent percolating through the soil one to three feet below the drainfield trench can be as high as 40 mg/L (Anderson and Gustafson, 2004). A large number of septic systems in close proximity may introduce more nitrate than can be diluted by the underlying groundwater, and thus contribute to increased groundwater nitrate levels. Sand-filter septic systems provide some additional treatment of the water leaving the septic tank before it reaches the drainfield. While results vary, sand-filters generally do not reduce the nitrate concentration by more than half. There are also alternative treatment technology wastewater systems that can substantially reduce nitrate levels, some of which can nearly eliminate nitrate contributions to the groundwater. While more effective than standard systems in treating nitrate, they are also more expensive.

Wastewater: Potential point sources of nitrogen/nitrate include permitted public wastewater treatment facilities. Most of the cities within the GWMA and many of the commercial and industrial facilities located outside of cities have their own permitted wastewater treatment system. These systems include relatively large onsite treatment that uses a drainfield (similar to an individual septic system only at a larger scale), or treatment lagoons followed by land applications. The water usage in these facilities is different than a typical household, because water is primarily used for kitchen and

restroom purposes and rarely includes shower and laundry facilities. Total nitrogen levels in the effluent are typically higher in these larger systems than for household septic systems because the waste is more concentrated. Treatment lagoons have the potential for nitrate contributions if the lagoon is not sealed properly. Certain organic waste materials such as processed municipal sewage sludge, reclaimed water, food processing wastes, and other similar materials may be recycled and land applied under DEQ regulations and permit. Some of these wastes may be high in nitrogen or nitrate, and must be properly managed through land application.

There are at least 10 large permitted wastewater facilities in the GWMA

Unused or Poorly Constructed Wells: Wells properly installed to meet Oregon Water Resources Department (OWRD) Minimum Well Construction Standards help prevent surface water from reaching groundwater by way of the well opening. However, wells that may have been improperly constructed, damaged or altered, or are no longer in use may provide a pathway for nitrate and other surface contaminants to enter groundwater. Driven wells, sometimes referred to as sand-point wells, typically consist of a pipe, two inches or less in diameter, pounded into the earth until groundwater is encountered. Driven wells provide an easy access to water; but, in many cases, these wells were not installed by an Oregon licensed well contractor.

Chapter 2
Action Planning Process and Public Participation

Introduction

The groundwater management area process involves seven steps:

1. Documentation of contamination in a widespread area at least in part from non-point pollution sources
2. Declaration of a Groundwater Management Area
3. Appointment of an advisory committee
4. Development of an Action Plan
5. Public comment and review of the Action Plan
6. Upon approval from DEQ, implementation and monitoring of the Action Plan
7. Rescinding of the Groundwater Management Area once contaminant concentrations reach acceptable levels

This chapter provides an overview of the Southern Willamette Valley GWMA declaration, the appointment of the GWMA Committee, and the process and structure used in creating this Action Plan.

Groundwater Management Area Declaration

In May 2004, the DEQ declared the Southern Willamette Valley a Groundwater Management Area under provisions of the Oregon Groundwater Quality Protection Act (ORS 468B.150-190). Enacted in 1989, the Groundwater Quality Protection Act addresses groundwater contamination from non-point pollution sources. The law's goal is "to prevent contamination of Oregon's groundwater resource while striving to conserve and restore this resource and to maintain the high quality of Oregon's groundwater resource for present and future uses."

Under the Groundwater Quality Protection Act, the DEQ must declare a groundwater management area if it is confirmed that the groundwater in a widespread area exceeds regulatory trigger levels and that contamination is suspected to be, at least in part, the result of non-point source pollution. These state-defined contaminant levels are listed in OAR Chapter 340, Division 40. For nitrate, that trigger level is 7 mg/L nitrate-nitrogen.

In 1995, the Legislative Assembly passed Senate Bill 502, which amended the Groundwater Protection statutes and assigned functions and authorities pertaining to groundwater management to DEQ. This Bill also required ODA to develop the portion of an Action Plan addressing farming practices in a groundwater management area located on agricultural lands.

In the letter of declaration for the Southern Willamette Valley GWMA, the Director of the DEQ stated the following support for the Department's action,

> "DEQ conducted groundwater quality monitoring in the Coburg and Junction City areas in 1993 and 1994 as part of statewide monitoring and assessment activities. DEQ conducted additional groundwater quality assessments in the Southern Willamette Valley in 2000 - 2001, and in 2002. Monitoring information from 2000-2001 identified contaminants in groundwater at concentrations exceeding levels set in ORS 468B.180. These initial monitoring results were confirmed by the 2002 study. Nitrate in the shallow

groundwater in parts of the Southern Willamette Valley exceeds 7 mg/L, a level which is 70% of the maximum measurable level (MML) established in OAR 340-040-0090."

In addition to the rigorous assessment and monitoring efforts, the DEQ also opened the process to public comment from September to December, 2003. The agency published a formal public notice and held seven open house/public hearings throughout the region.

GWMA Committee

Following the public involvement process and the DEQ's response to comments, the agency officially designated the GWMA and initiated the next step in groundwater protection by forming a citizen-based advisory committee. There are a total of 16 people on the GWMA Committee. The DEQ appointed representatives from each of the major stakeholder groups in the Southern Willamette Valley. The advisory group includes:

- Local farmers (2),
- An agribusiness representative,
- A rural resident with ties to a CAFO,
- An onsite system engineer,
- A realtor,
- A public water supply operator,
- A small business owner and rural resident,
- A large business representative,
- A small city mayor,
- County Commissioners (3),
- A representative of Cascade Pacific Resource Conservation and Development,
- A Watershed Council representative, and
- A natural resource protection consultant.

The GWMA committee melds the ideas of diverse stakeholders

The Committee has the following responsibilities:

- Provide information and recommendations to the DEQ including:
  - Practices that may be contributing to groundwater contamination,
  - Strategies to reduce nitrate in the groundwater from multiple land use groups,
  - Specific actions to implement the strategies,
  - Potentially capable entities to conduct the actions,
  - A schedule for implementing strategies and achieving results, and
  - Measurements of significant progress and success.
- Solicit and consider input from all groups and citizens concerned with, interested in, and/or affected by GWMA plans or programs.
- Ensure involvement of the public throughout the GWMA planning process.
- Disseminate information about the GWMA Action Plan and/or decisions to all interested, affected, and/or concerned groups and citizens.

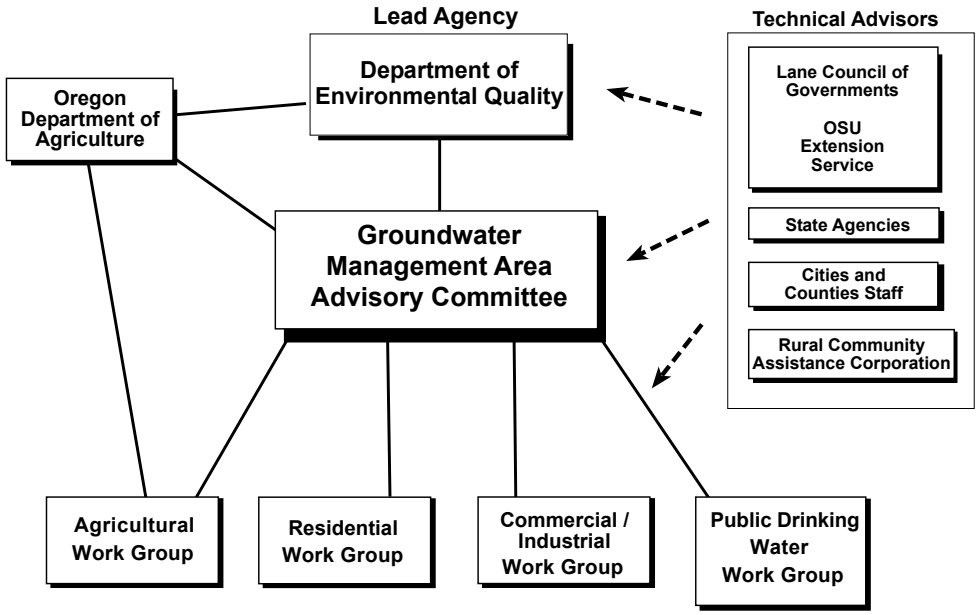
Action Plan Development

The GWMA Committee held its first meeting in September 2004 and continued to meet regularly for two years to develop the Action Plan. All meetings associated with the Committee and working groups have been open to the public. Figure 1 on the next page graphically represents the organizational structure used in the action planning process.

Figure 1: Organizational Structure

Structure to Achieve the Development of the Action Plan

Southern Willamette Valley Groundwater Management Area



August 2006

As the schematic displays, the Committee is the central component of this process. All products and applicable technical information go through and come from the Committee. The Committee's primary role is to make Action Plan recommendations to the DEQ for final approval. The DEQ, as the current lead agency, has overall responsibility for the coordination of the Committee and the development of the Action Plan.

The Committee established four working groups to draft strategy recommendations on how to reduce nitrate contributions from each land use while protecting local interests. The four Working Groups are: Agriculture, Commercial/Industrial/Municipal, Residential, and Public Water Supplies. Each working group included at least two members of the GWMA Committee. These members participated in the working group deliberations and maintained communication with the entire Committee on working group progress. Staff, public employees, technical experts, and interested citizens were also involved in the working groups.

At the direction of the Committee, the working groups developed reports on contamination sources related to their specific area along with community-based methods that could be used to reduce groundwater contamination. The Committee used these recommendations as the foundation for deliberations on the goals, strategies, and actions, incorporated into this Action Plan. Working group reports used the most current data that was available at the time. If new data was found during the Action Plan finalization stages, working group reports were left unchanged.

Nearly 20 agencies and organizations provided technical assistance to the GWMA Committee, the DEQ, and the working groups throughout the process. Both Lane Council of Governments (LCOG) and the OSU Extension Service received grant funds from the 319 non-point source pollution program to assist in the development of the Action Plan. LCOG brought extensive regional

planning and coordination experience and OSU Extension brought a direct connection to residential landowners. Other technical assistance and active participation came from the full realm of agencies and organizations in the region that have an interest in water resources including: Oregon State University, public officials from all three counties and five cities; staff from Environmental Health, Planning, and Public Works departments of local jurisdictions; Oregon Department of Human Services, Oregon Department of Land Conservation and Development; Oregon Water Resources Department; Long Tom Watershed Council; Cascade Pacific Resource Conservation and Development Council; Rural Community Assistance Corporation; Oregon Association of Water Utilities; public water system providers; and ODA to name a few.

As has been noted, by law the ODA is responsible for developing the agriculture portion of this Action Plan. The ODA is instrumental in helping to raise awareness among the agricultural community and in integrating proposed groundwater protection strategies with existing efforts.

Public Participation

The following mechanisms disseminate information about the GWMA and the Action Plan. While the focus of the public participation efforts is to encourage and collect input from interested parties, many of these strategies also include an education component.

- *Newsletters and Articles*
  Information about the GWMA and the Action Plan was and will continue to be presented in articles in a variety of local organizations' newsletters.

- *Press Releases*

- *Presentations*
  Where possible, these presentations are conducted jointly by GWMA Committee members and project staff. Presentation venues include public official meetings, watershed councils, agricultural producer meetings, and professional organizations such as the realtor association.

Free nitrate testing is usually offered at GWMA information booths

- *Posters in Public Places*

- *Mailings to GWMA Residents*

- *Information Distributed at Well Water Clinics and Other Classes*

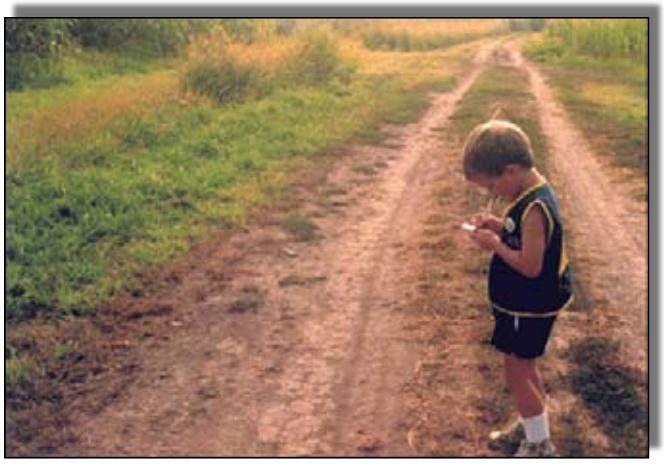
- *Public Meetings*
  During the public comment period, five public meetings were held throughout the GWMA. The meetings include the presentation of information with time for questions and comment followed by well water testing.

Chapter 3
Sources and Solutions

Introduction

This chapter provides a comprehensive summary of the factors that are potentially impacting groundwater in the Southern Willamette Valley and the methods that can be used to protect groundwater quality for the benefit of the entire region. It is organized into sub-sections according to the four major focus areas addressed by the Southern Willamette Valley GWMA working groups. These four focus areas include:

- Agricultural
- Residential
- Commercial, Industrial, and Municipal
- Public Water Supplies



"There are risks and costs to a program of action. But they are far less than the long-range risks and costs of comfortable inaction." - John F. Kennedy

Each sub-section consists of an overview, inventory of potential contaminant sources, and goals, objectives, strategies, and actions. The overview describes how a particular land use or activity is potentially impacting and/or is impacted by nitrate. In the case of public water supplies, other potential contaminants identified in the Source Water Assessments completed by DEQ and DHS are also considered. The inventory of potential sources catalogs the activities associated with each focus area that may be impacting groundwater quality. The Public Water Supply section identifies all the potential sources of groundwater contamination within a portion of the Drinking Water Supply Areas for those systems.

The core elements of each sub-section are the goals, objectives, strategies, and actions that the GWMA Committee recommends as the optimal ways to address the problem of groundwater contamination in the region. Most of the recommendations are specific to a particular interest and source category, such as the recommendation to support the City of Coburg in their efforts to install and/or implement a public wastewater treatment system. Other recommendations suggest actions that cut across all land uses and interest groups, such as erecting signs along major roadways to inform people that they are entering a drinking water supply area.

Each interest category has five to seven goals with specific strategies under each goal. Each strategy then contains detailed actions on how to implement the strategy. Each goal has one or more objectives. The following definitions provide a guide to understanding the differences between these four components: Additional background and inventory information for all the sections can be found in the individual Working Group Reports.

- **Goal:** An ultimate aim or aspiration
- **Objective:** Measurable, longer-term ways to determine if the goals are being achieved
- **Strategy:** Conceptual means to achieve goals
- **Action:** Specific procedures, processes, and activities to accomplish strategies and, ultimately, the goal

Overview

There are 111,350 acres under agricultural use encompassing over 93 percent of the GWMA. These lands are mostly in crop production but also include a few CAFOs. Rural residential properties with a small number of large animals (such as horses, llamas, cows, etc.) are also under the umbrella of agricultural land uses.

The Willamette Valley is one of the most highly productive agricultural areas in the world. Today, hundreds of commodities are grown in the Willamette Valley, many of these in the Southern Willamette Valley. Grains, hay and forage, seed crops (grass and legume), field crops (primarily peppermint), vegetables, fruits, and various specialty crops make up the bulk of the crop production. Map 6 displays the predominant crops in the GWMA.

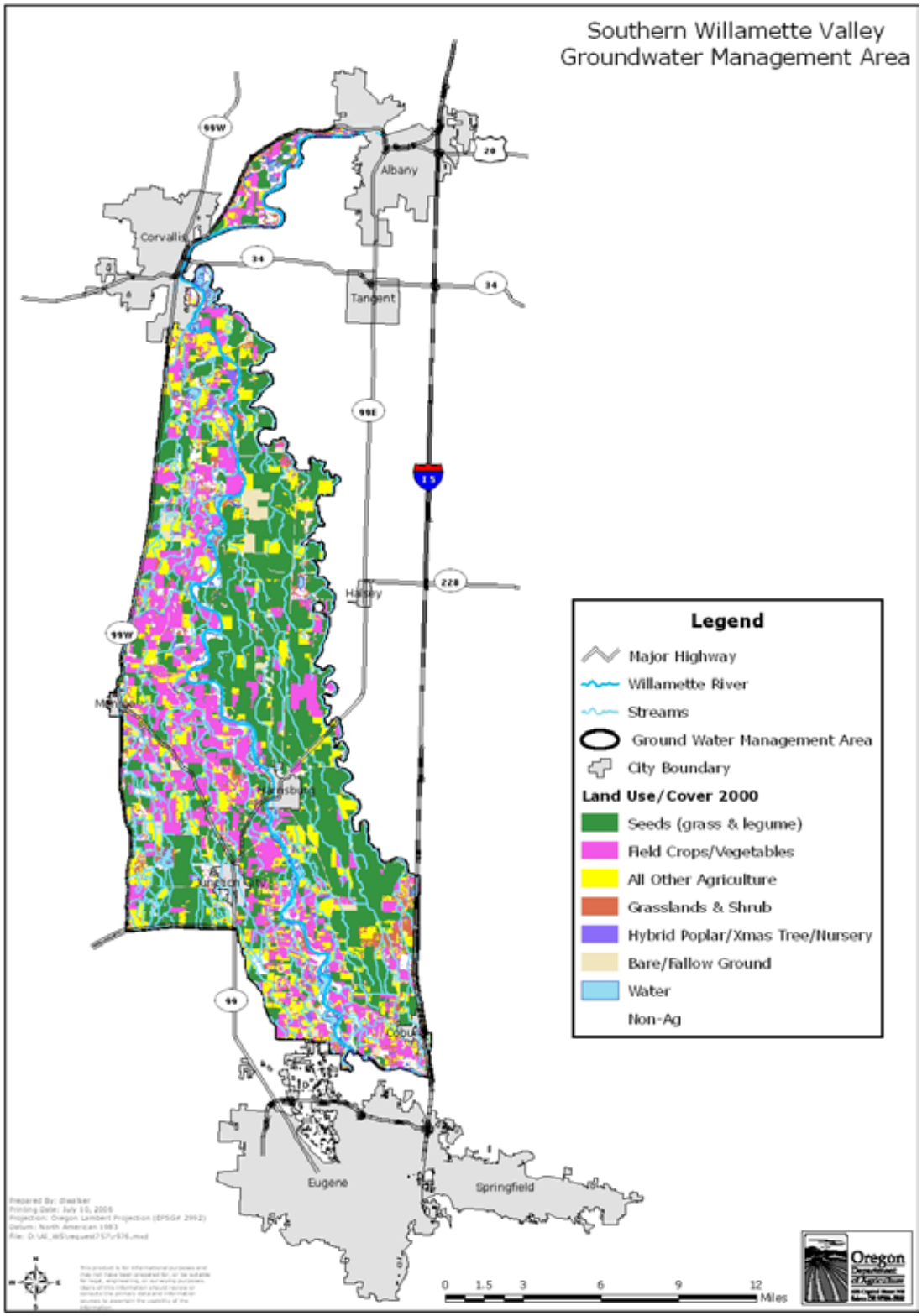
Crop producers use fertilizers to boost production and maintain economic viability in a competitive world marketplace. Beginning in the 1990s, there have been a number of changes in fertilization and irrigation practices in Southern Willamette Valley agriculture, which resulted in the reduction of nitrogen loss below the root zone as well as lower overall fertilizer and irrigation water applications. During this period, Oregon State University Extension Service (OSU Extension) embarked on an intense outreach and education effort to area growers. Some experts believe that many producers responded with appropriate management changes to reduce nitrogen loss to both ground and surface waters.

Agriculture is critical to the economic base of Linn, Lane, and Benton counties

At about the same time, the primary vegetable processing facility in the Southern Willamette Valley closed, the price of peppermint (a plant with high fertilizer and water needs) declined, and nitrogen fertilizer prices began to rise, a trend that continues today. Vegetables and peppermint represent the primary high value crops in the region. They are also grown extensively on the highly productive and permeable soils located mainly on the west side of the Willamette River. The loss of the primary vegetable processing facility and the lower price of peppermint resulted in a decline in acreage planted to these high value crops and conversion primarily to grass seed production. While this conversion may result in a small decrease in total nitrogen applications (because of generally lower required rates), the primary benefit may be the ability of grass seed crops to scavenge and store soil nitrogen. In addition, the soaring fuel costs of the mid-2000s provided another incentive for members of the farming community to only apply fertilizer when absolutely necessary and/or to apply slow release fertilizers to reduce the number of applications necessary.

Today the area's most productive producers continually work to capture input efficiencies, and this ongoing effort includes evaluating their operations to reduce nitrogen applications, increase irrigation efficiencies, and take advantage of research to reduce nitrogen losses. Successful growers know this is vital to protect the area's natural resources as well as to operate a profitable business in an extremely competitive marketplace.

Map 6: Crop Types



In addition to crop producers, livestock operations constitute another important agricultural activity in the GWMA that supports local markets and the economy. These operations are considered to be Confined Animal Feeding Operations, or CAFOs, when they meet at least one of the following criteria:

- Animals confined in a building or pen or lot with an improved surface (e.g., concrete, rock, or fibrous material),
- The facility has a waste treatment works (manure pile, lagoon, tank, etc.), or
- The facility has potential to discharge or is discharging waste.

Initially the program regulating CAFOs was complaint driven. In 1999 ODA introduced the Performance Based Inspection requiring all permitted CAFOs receive at least one routine inspection per year. The switch to performance based inspections also included more rigorous groundwater protection requirements (Youse, 2005).

In response to new federal CAFO standards adopted by the U.S. EPA in 2003, Oregon again revised the CAFO program. Changes brought in a segment of Oregon livestock operations that had never before been permitted. The new CAFO permit also represents a strengthening of CAFO regulations and incorporates increased protection for both surface and groundwater.

As the population continues to expand in the Southern Willamette Valley, residents recognize that the area provides an ideal rural landscape for an increasingly popular country life. Many people include livestock such as horses, llamas, cows, or sheep as part of their country lifestyle. Although these livestock are not typically a business enterprise, and are not permitted facilities, they are under the regulatory structure of the ODA.

Southern Willamette Valley agriculture must continue to make changes as it works with neighboring land uses to lower groundwater nitrate levels. Following is the identification of the potential sources of nitrate from agricultural land uses and the goals and strategies to achieve success.

Inventory of Potential Agricultural Sources of Nitrate

Potential agricultural sources of nitrate in the groundwater include:

- Fertilizer and irrigation
- Confined animal feeding operations
- Small acreage landowners with livestock

Fertilizer and Irrigation

A number of groundwater studies in the 1990s indicate that nitrate has been leaching from both irrigated and non-irrigated cropland soils. These sources may contribute to nitrate groundwater contamination in the Southern Willamette Valley. These studies emphasize the need for greater awareness of potential nitrate issues and the incorporation of this awareness into fertilizer and irrigation practices.

Many studies show that where intensive agricultural production occurs with high nitrogen inputs and irrigation practices, groundwater nitrate levels can be expected to approach and exceed the 10 mg/L drinking water standard. Studies measuring nitrate loss to groundwater from vegetable fields, mint crops, and even organic growing operations found nitrate levels exceeding 10 mg/L below the root

zone (Feaga and Selker, 2004). Both timing and amount of fertilizer are often a factor in nitrogen loss. OSU Extension Service found that applying nitrogen late in the season or applying amounts above the recommended 225 lbs/acre (mint crop rate), resulted in excess soil nitrogen remaining after harvest. In one study of grass seed production, Mark Mellbye (2002) found increased residual soil nitrate levels at rates of 180 lbs/acre on annual ryegrass. He also found that maximum profit per acre was reached at lower nitrogen application rates, showing that careful fertilizer applications can protect water quality and maximize income

Confined Animal Feeding Operations (CAFOs)

About two percent of the GWMA includes permitted CAFOs. There are currently nine CAFOs in the GWMA permitted by the CAFO Program of the ODA (see Map 7). These include dairy, beef, hog, and chicken facilities. Operations that require a permit are those where the animals are confined for at least 120 days and have a waste treatment works or have the potential to discharge or are discharging wastewater to surface or groundwater. As mentioned previously, these facilities hold annual operating permits, must meet state requirements, and are inspected once a year to ensure compliance. The potential for nitrate from these facilities is predominantly associated with manure waste leaching into groundwater.

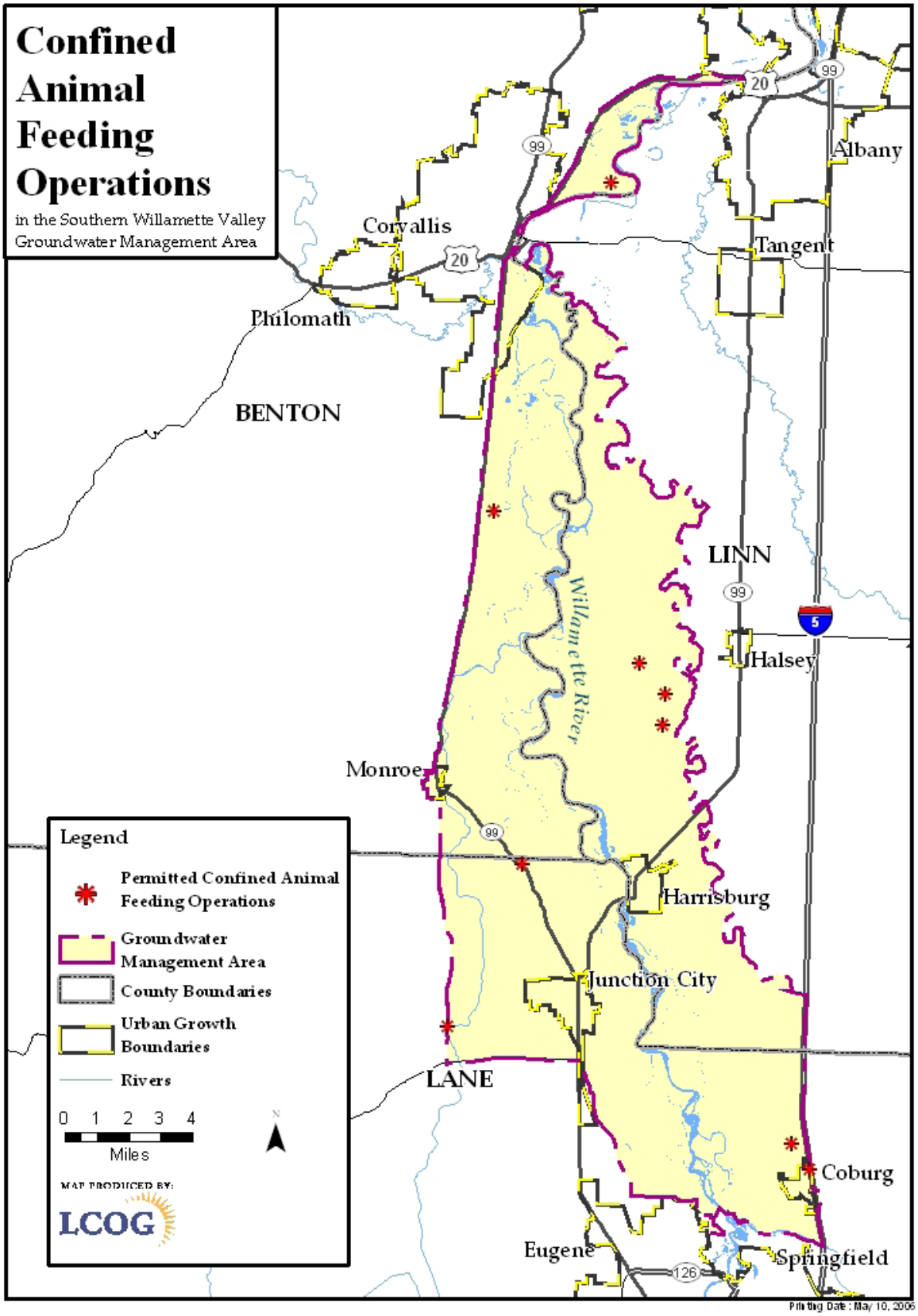
Nitrogen inputs and irrigation influence nitrate levels

Small Acreage Landowners with Livestock

There are an unknown number of smaller animal operations, such as horse farms that do not require a permit for operation due to limited size, lack of confinement, and other factors. In addition there are about 2,700 rural homes outside of city limits in the GWMA. Many of these households have a small number of large animals such as horses, llamas, goats, sheep, and or cows. While these operations do not require a permit, they are still regulated by local Senate Bill 1010 Agriculture Water Quality Management Area rules, and are prohibited from discharging pollution to surface or groundwater. Oversight is based on a complaint-driven system. The largest numbers of complaints received by the ODA relate to waste from a few animals on small acreages. The complaints are often related to uncovered manure on neighboring properties.

The following section identifies the strategies and actions associated with five goals of equal priority for achieving continued reduction of nitrate inputs from agricultural lands.

Map 7: Confined Animal Feeding Operations



Agricultural Goals, Objectives, Strategies, and Actions

These goals and the associated strategies focus on integrating GWMA efforts with the three existing Agricultural Water Quality Management Area Plans in the Southern Willamette Valley. Education and outreach is the primary mode for helping producers understand the best and most economical means for making any necessary changes to reduce nitrate loading to groundwater. Monitoring and research goals are vital to accurately measure how well the Action Plan is performing and to continually improve management options for producers. Finally, financial resources are necessary to undertake actions for the protection and improvement of the groundwater resource. The funding strategies suggest ways for producers, agribusiness, and government partners to collaborate in the development of successful initiatives.

Goal 1: Coordinate groundwater pollution control efforts among the various agriculture-related organizations and plans in the GWMA

Goal 2: Organize outreach and education efforts to increase the agricultural community's awareness of groundwater vulnerability and best management practices

Goal 3: Monitor groundwater quality in agricultural areas to evaluate the impacts of agricultural actions

Goal 4: Research best management practice effectiveness and best management practice adoption

Goal 5: Obtain adequate financial resources to fund research and provide assistance for best management practice adoption

Goal 1: Coordinate groundwater pollution control efforts among the various agriculture-related organizations and plans in the GWMA

Objectives:

- At least four groundwater quality task items included in local Area Agricultural Water Quality management plans and SWCDs scopes of work over a five year time frame.
- Local SWCDs implement at least four groundwater protection activities within five years.

Strategy 1.1 Within the Southern Willamette Valley GWMA, coordinate agricultural surface water and groundwater pollution control efforts.

Actions

- Revise the Benton, East Lane, and Linn SWCD Scopes of Work to include groundwater quality task items. This should be accomplished in state fiscal year 2006-2007.
- Revise the South Santiam, Middle Willamette, and Upper Willamette Agricultural Water Quality Management Area Plans to include groundwater quality items in the Goals and Objectives sections. This should be accomplished during the next biennial review for each Management Area.

Goal 2: Organize outreach and education efforts to increase the agricultural community's awareness of groundwater vulnerability and best management practices

Objectives:

- The number of new applicants for federal grant and assistance programs increases at least 25 percent within five years after Action Plan approval.
- By 2011, the number of acres enrolled in conservation programs has increased by 20 percent.
- In five years, a survey of agricultural producers and field representatives in the GWMA shows that 100 percent are aware of the GWMA and 25 percent are taking steps to protect groundwater.

Strategy 2.1 Write and publish articles to promote/improve the agricultural community's awareness of water quality issues in the Groundwater Management Area.

Actions

- Once a year, provide an update on the status of the Southern Willamette Valley GWMA and associated water quality data in each of the Benton, East Lane, and Linn SWCD newsletters. This should begin in the first state fiscal year after DEQ approves and implements the Action Plan.
- Publish three media articles or public service announcements per year in the Southern Willamette Valley GWMA about successful agricultural resource management practices. Primary publication outlets include the Corvallis Gazette-Times, the Eugene Register-Guard, the Junction City Tri-County News, and the OSU Extension Update.

Strategy 2.2 Share information and coordinate with agribusiness, producers, and producer groups to promote groundwater quality.

Actions

- Starting in the first state fiscal year after DEQ approves the Action Plan, meet with agribusiness field representatives active in the Southern Willamette Valley GWMA to review the groundwater nitrate issue and share appropriate outreach materials from ODA, DEQ, SWCDs, OSU Extension Service, and other appropriate sources. This should occur once every two years. Some possible ways to meet with field representatives include:
    - Grower meetings
    - Individual company meetings
    - Oregon Agriculture Chemical and Fertilizer safety training workshops
    - Breakfast or lunch for local field representatives sponsored by local SWCDs and partners such as ODA, OSU Extension Service, and Natural Resource Conservation Service
- Each SWCD will deliver one groundwater quality presentation (either as a stand-alone presentation or part of a broader presentation) at one agribusiness or producer group meeting per year.
- Target one producer group per year and distribute OSU Extension Service best management practice (BMP) descriptions to producers and field representatives.
- Make at least 100 groundwater quality contacts per year within the areas served by the Benton, East Lane, and Linn SWCDs. The service areas of these SWCDs intersect within the Southern Willamette Valley GWMA. These contacts will be to provide information, answer questions, help with technical assistance, obtain financial assistance, etc.

Strategy 2.3 Organize and deliver workshops and demonstration projects aimed at producers to show BMP implementation and foster improved BMP use.

Actions

- Develop two demonstration projects at least once every two years showcasing successful BMPs and systems.
- Each year organize one tour of each demonstration project for agricultural managers and producers.
- Each year sponsor two small acreage resource management workshops that provide presentations on groundwater and surface water quality issues to horse, small livestock, natural resource, recreation, education, and other groups.
- Attract at least 100 participants annually to these demonstrations and workshops.

Strategy 2.4 Hold workshops and coordinate with existing efforts to educate producers about federal assistance programs and sustainable agriculture opportunities that provide market incentives to protect surface and groundwater.

Actions

- Hold Conservation Security Program information and assessment workshops. Eight to 12 workshops should be held when Conservation Security Program becomes available, likely in state 2006-2007 or 2007-2008 fiscal years. Enroll 200 producers in Conservation Security Program.
- Hold workshops to educate producers of sustainable practices, incentive programs, and third-party certification. Six workshops should be held in state 2006-2007 fiscal year. Attract 100 producers to these workshops and enroll 20 producers in third-party certification programs.

- Enroll 1000 acres per year in NRCS conservation practices on cropland.

Goal 3: Monitor groundwater quality in agricultural areas to evaluate the impacts of agricultural actions

Objective:

- Groundwater monitoring samples from agricultural areas indicate that nitrate levels in groundwater have decreased below 7 mg/L threshold.

Strategy 3.1 Develop a groundwater monitoring plan for agricultural areas.

Actions

- Coordinate local, state, and federal partners conducting groundwater monitoring to evaluate the completeness of existing programs and identify additional monitoring needs.
- Agree on consistent protocols to gather baseline groundwater data. This must precede deployment of the monitoring network.
- Establish a plan for monitoring groundwater that will accurately identify baseline conditions.
- Establish a plan for accurately monitoring groundwater trends and more clearly identifying sources of contamination.
- Coordinate surface water and groundwater monitoring where feasible and advantageous.
- Complete these actions during the state 2006-2007 fiscal year.

Sampling can be done to determine the amount of nitrate below the root zone

Strategy 3.2 Document groundwater-related violations of Agricultural Water Quality Management Area Rules and CAFO permit conditions within the Southern Willamette Valley GWMA.

Actions

- Each year document the amount, subject, validity, and outcome of complaints regarding potential violations of Agricultural Water Quality Management Area Rules where the violations could impact groundwater.
- Each year document CAFO violations and outcomes.
- Incorporate these results into the periodic review.
- Begin these actions in the first state fiscal year after DEQ approval of the Action Plan.

Goal 4: Research best management practice effectiveness and best management practice adoption

Objectives:

- Document the adoption of groundwater protection BMPs by at least 25 percent of the agricultural producers in the region by 2011.
- Within five years at least 50 percent of all agricultural producers in the GWMA time irrigation and apply fertilizer at agronomic rates to reduce nitrate leaching.

Strategy 4.1 Research and document BMP effectiveness with an emphasis on coordinating state, federal, and university efforts.

Actions

- Bring representatives of DEQ, ODA, OSU, OSU Extension, Natural Resource Conservation Service, US Department of Agriculture, Agricultural Research Service in Corvallis, producers, and agribusiness together to discuss and prioritize methods of researching and documenting BMP and systems effectiveness in the Southern Willamette Valley GWMA.
- Design a follow-up program to OSU's nitrate leaching studies at a scale that provides a general characterization of Southern Willamette Valley GWMA agriculture.
- Develop a prioritized research plan, with identified sources of funding. Focus should be placed on identifying the greatest factors in agricultural contributions to groundwater nitrate
- The three actions above should occur during the state 2006-2007 fiscal year.
- Implement new research to measure BMP and systems effectiveness and to identify the priority factors affecting groundwater nitrate levels from agricultural practices.
- The action above should begin during the state 2007-2008 fiscal year and continue until DEQ rescinds the GWMA declaration.
- Publish a summary of research findings every five years as part of the DEQ periodic review. The first summary should be prepared five years after DEQ approval of the Action Plan.

Strategy 4.2 Measure the success of BMP Implementation efforts.

Actions

- Measure producer awareness of groundwater quality issues and the level of BMP implementation to create a baseline of BMP use.
- Measure the ease of implementing BMPs and barriers to BMP implementation.
- Repeat the first and second action measurements every five years.
- Publish the findings every five years as part of the DEQ periodic review.
- Implement this suite of actions in the first state fiscal year after DEQ approval of the Action Plan.

Goal 5: Obtain adequate financial resources to fund research and provide assistance for best management practice adoption

Objectives:

- Submit at least two proposals annually to fund agriculture-related groundwater protection activities.
- Increase the utilization of the Pollution Abatement Tax Credit and Riparian Tax Credit programs by 25 percent within five years of Action Plan adoption.

Strategy 5.1 Obtain sufficient funding to support priority research needs.

Actions

- After research needs are identified and prioritized (see Goal 4), submit research grant applications to support high priority research needs. Potential grant sources include the DEQ 319 Program, ODA, EPA, US Department of Agriculture, and other agencies and private organizations.

- This should begin in the state 2006-2007 fiscal year.
- Funding should be reviewed every five years until DEQ rescinds the GWMA designation.

Strategy 5.2 Obtain sufficient financial assistance to support implementation of resource management practices, technical assistance to producers, and outreach and education.

Actions

- Seek an ODA SWCD Technical Assistance grant with an allocation 20 percent higher than the 2003-2005 allocation in order to provide groundwater protection assistance to producers. This should begin in the state 2006-2007 fiscal year in preparation for the state 2007-2009 biennium.
- Seek increased funds for US Department of Agriculture incentive-based cost-share programs to assist producers. For example, seek to increase funding levels for the Environmental Quality Incentive Program, the Conservation Reserve Program, and the Conservation Reserve Enhancement Program. Efforts must focus on the 2007 Farm Bill. This should occur immediately to influence federal decisions on funding levels.
- Seek DEQ 319 Program funds to bolster agricultural on-the-ground projects and management practices that minimize groundwater nitrate pollution. This should occur immediately and yearly for at least the first five years, and thereafter as ODA and DEQ deem it necessary.
- Insert Scope of Work tasks in SWCD work plans to promote the Pollution Abatement Tax Credit and Riparian Tax Credit programs with producers in the Southern Willamette Valley GWMA. This should happen each year of the GWMA Action Plan.
- Continue to include the promotion and support of US Department of Agriculture programs such as Environmental Quality Incentive Program and Conservation Reserve Enhancement Program in SWCD work plans and Scopes of Work. This should happen yearly.

Overview

The overriding purpose of this Action Plan is to provide safe drinking water for the more than 21,000 people living within the GWMA. The 11,600 residents living in the communities of Harrisburg, Junction City and Monroe, as well as parts of Corvallis, are connected to public water and sewer systems. The nearly 1,000 residents of Coburg are served by a public water system, but wastewater is treated by individual septic systems. The remainder of the 8,700 GWMA residents live in unincorporated areas on about 2,700 different parcels, most of which have septic systems and private household wells. Lane County is by far the most densely populated portion of the GWMA, followed by Benton and Linn Counties, for both urban and rural population (US Census Bureau, 2002). Map 8 shows the locations of residential dwellings outside of urban growth boundaries in the GWMA.

Over 80 percent of GWMA residents rely soley on groundwater for their drinking water supply

As was discussed in the introduction to this Plan, public water systems are required to monitor water quality on a regular basis, report their results, and apply treatment when necessary. Owners of individual household wells are not required to monitor regularly or adhere to drinking water standards. Many residents are unaware of their drinking water quality, the connection between land use practices and groundwater pollution, and the health implications of specific contaminants. As nitrate cannot be tasted, seen or smelled, many people may be unaware of their potential nitrate exposure. The only way to determine drinking water exposure is to test the water supply. Homeowners may not be testing their well water for nitrate for a number of reasons, including:

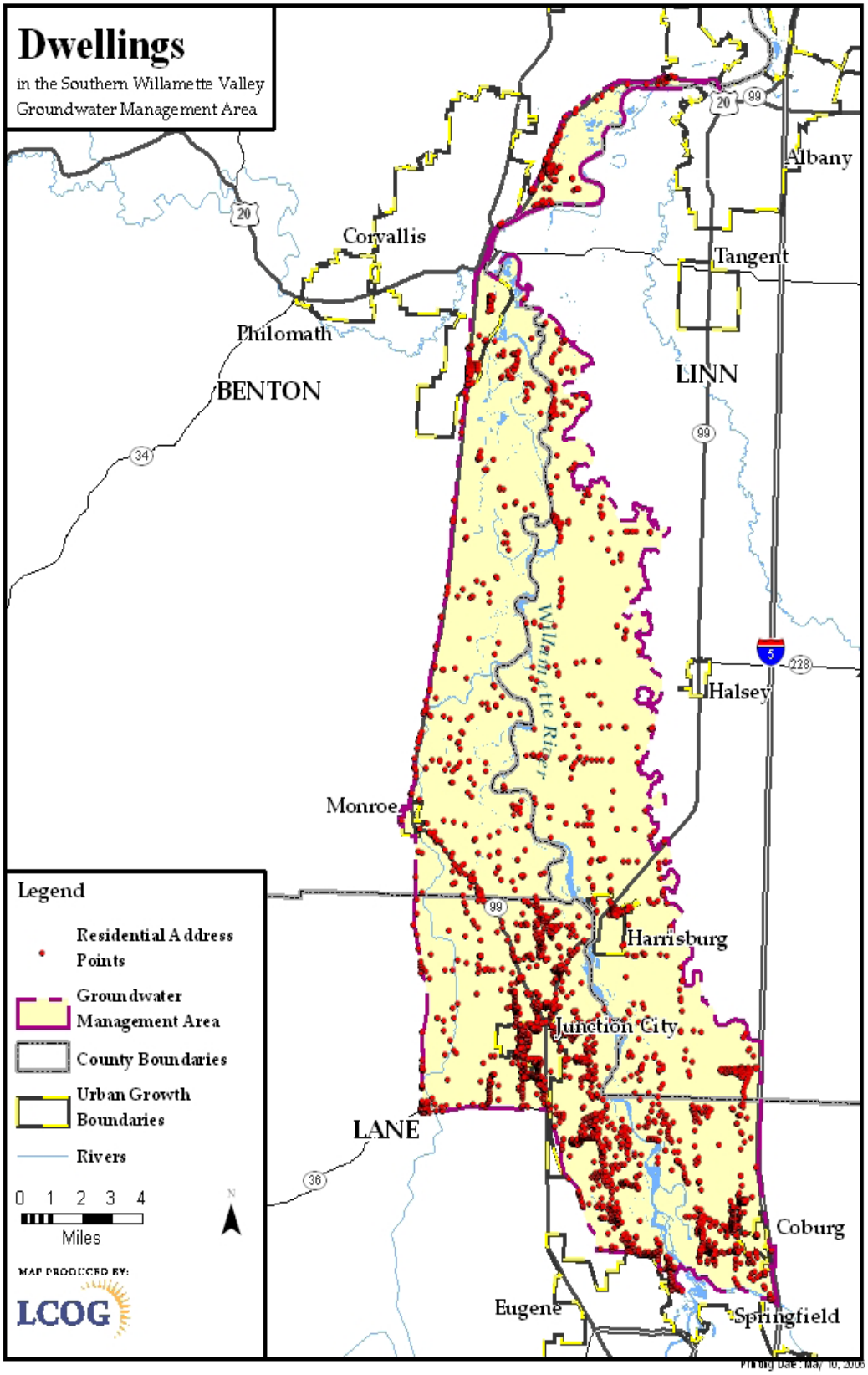
- Lack of information about when or how to test the water
- Perception that testing is not worth the time or money
- Misconception that taste and appearance are indicators of water quality
- Anxiety over possible results

Helping individuals to understand the risks and determine how best to respond presents a significant, but necessary, challenge (Ward et al., 2005). Two studies reveal that many residents may lack some of the information that would allow them to make a more considered decision about their drinking water. In a study that surveyed a random sample from the 500 residences that had wells tested by DEQ in 2000-2001, residents generally described the quality of groundwater as good and their perception of drinking water quality was not associated with actual nitrate levels (Kite-Powell, 2003). In a cultural anthropology study based on in-depth interviews with eight farmers residing in the GWMA, residents generally did not believe that their well water had a problem and indicated that they were not overly concerned about nitrate-related health risks (Rolston, 2006).

Nitrate levels can vary greatly in a particular well over the course of a year, which further complicates risk communication. Mutti and Haggerty (2005) monitored 19 wells monthly for 15 months and found considerable variation in the time of year when well water had the highest nitrate concentration. Because of this, it is very possible that a well water nitrate test is not providing an accurate indication of the actual exposure to nitrate throughout the year.

The following section describes the potential sources of nitrate contamination that exist in the GWMA in areas of residential land use.

Map 8: Residential Dwellings

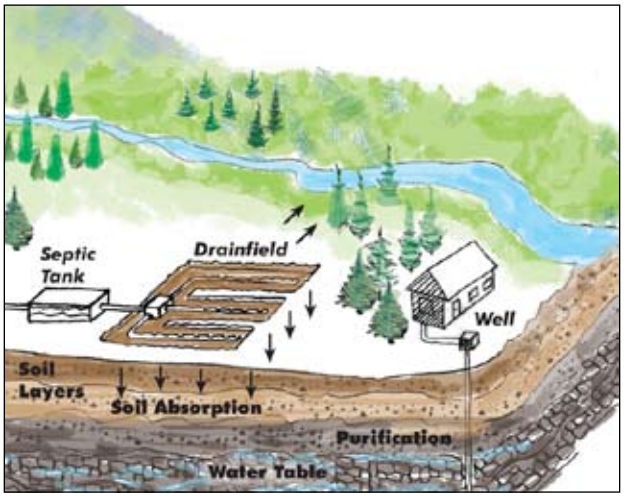


Inventory of Potential Residential Sources of Nitrate

The principle residential structures or activities that may contribute nitrate to groundwater include septic systems, lawn and garden practices, and wells that are unused or in poor condition.

Septic Systems

As was noted in the introductory chapter, even a properly functioning standard septic system typically contributes around 40 mg/L of nitrate in the effluent leaving the septic tank drainfield trenches. All of the rural residential tax lots with houses as well as a few small commercial facilities within the GWMA, have a septic system for treating wastewater. The City of Coburg also includes nearly a thousand residents residing on about 310 lots, that all rely on septic systems rather than a public treatment facility. A large number of septic systems in close proximity may introduce more nitrate than can be diluted by the underlying groundwater, and thus contribute to increased groundwater nitrate levels. As can be seen on Map 8, some areas of the GWMA have dense clusters of rural homes.



As shown in Table 2, the majority (68 percent) of the estimated residential septic systems in the GWMA do not have a septic system record. Systems without a record have not been installed, repaired, or altered since 1974, when significant changes were made to DEQ's onsite wastewater treatment rules. Older systems may have been installed much closer to wells and, since older wells were often driven or hand-dug, this may create a scenario where nitrate can move directly to the aquifer without being filtered by the soil. The 1974 rules refined and strengthened the standards related to soil requirements for adequate wastewater treatment. Older systems installed in soils without proper drainage may allow sewage to flow overland in the winter and reach the aquifer. Map 9 displays the areas in the GWMA where there are relatively high concentrations of small residential parcels without septic system records.

Table 2
Estimated Permitted Septic Systems Within the Southern Willamette Valley Groundwater Management Area

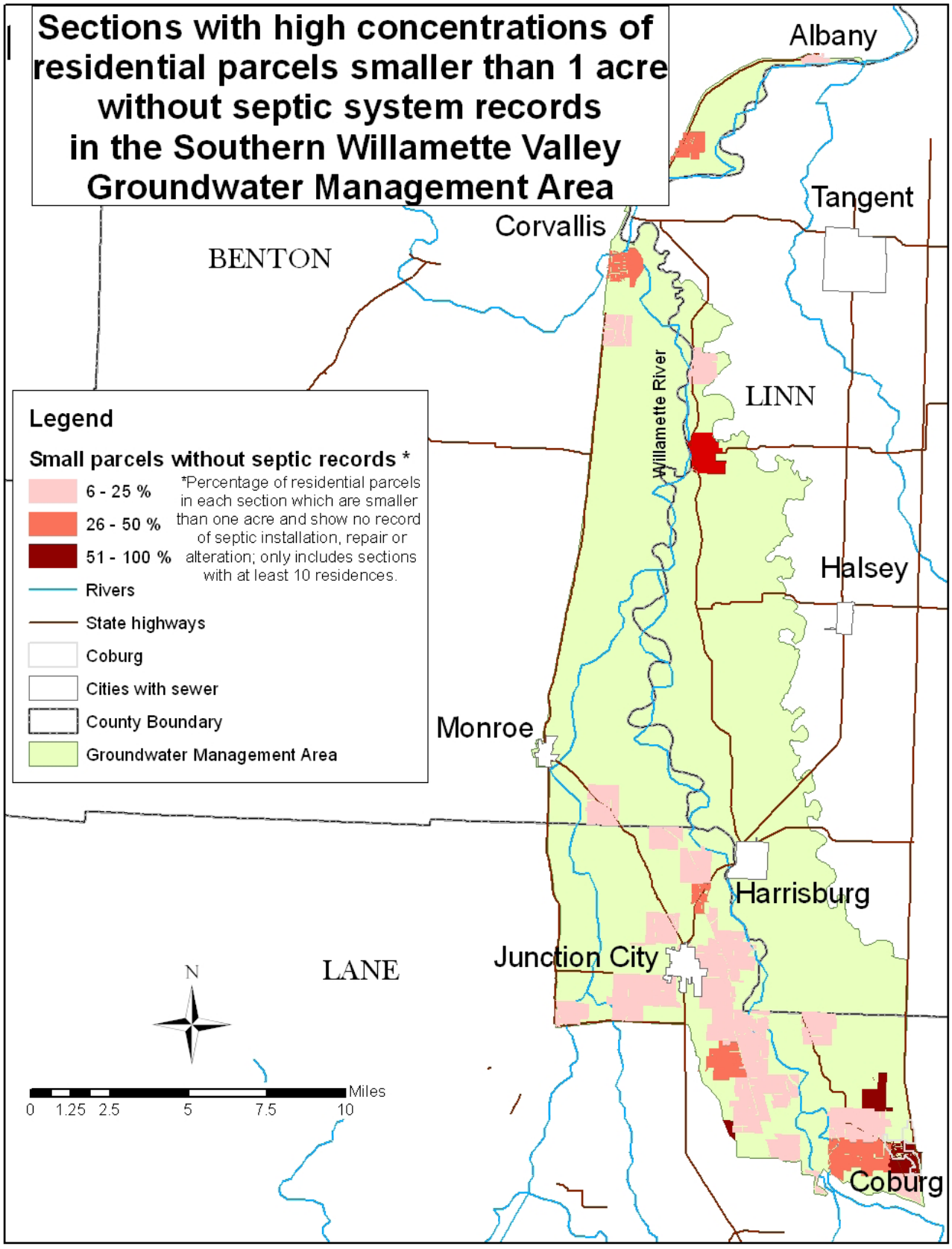
SEPTIC RECORD SUMMARY	Lane County	Benton County	Linn County	Total
Residential parcels with dwelling unit with septic system record †	592	128	153	873
Residential parcels with dwelling unit without and identified septic permit	1,112	481	279	1,872
Total Residential Parcels *	1,704	609	432	2,745

† defined as permits issued since 1974 for new installations, repairs or alterations

* defined as non-vacant residential lots outside of city limits, as well as lots within Coburg city limits

Source: Benton, Linn, and Lane County Environmental Health Records

Map 9: One Acre or Smaller Parcels without Septic Records



Wells

Most of the 8,700 rural residents in the GWMA rely on domestic wells for their drinking water supply. As shown in Table 3, about 85 percent of the wells with a well construction record (well log) have a well depth of 75 feet or less indicating that most people draw their drinking water from the shallow aquifer. Wells that may have been improperly constructed, damaged or altered, or are no longer in use may provide a direct pathway for nitrate and other surface contaminants to enter groundwater.

Settlement in the Southern Willamette Valley began over 150 years ago. At the time homesteads were being developed, the shallow groundwater was easily accessible to settlers who dug wells by hand. Some of these wells are still being used and others exist as holes in the ground that allow surface water to drain to groundwater. Wells created by pounding a pipe into the groundwater (driven wells) provide an easy access to water. In most cases, these wells are not installed by an Oregon licensed well contractor and do not have a well log on file. Despite being illegal, the practice of driving your own well still occurs in the Southern Willamette Valley.

Table 3
Wells Log Records Within the
Southern Willamette Valley Groundwater Management Area

WELL RECORD SUMMARY	Lane County	Benton County	Linn County	Total
Rural residential lots *	1704	609	432	2055
Well log records	1135	401	336	1872
Construction methods as recorded in well logs:				
Drilled	925	378	328	1631
Driven	180	13	4	197
Unknown	30	10	4	44
Well depths as recorded in well logs:				
Shallower than 25 feet	116	13	3	132
25 - 50 feet	557	233	200	990
50 - 75 feet	245	114	103	462
75 - 100 feet	79	13	15	107
Deeper than 100 feet	104	22	14	140
Unknown	34	6	1	41

* Defined as lots outside of city limits
Source: Oregon Water Resources Department well log records

Through the years, many residents have upgraded their water systems by drilling a new well. If not properly decommissioned, the old well, whether hand-dug, driven or drilled, may serve as direct conduit for contaminated surface water to reach the groundwater. It is difficult to estimate the number of unused wells that have not been *properly* decommissioned, but given the length of time since initial settlement in the area, and the cost associated with hiring a well contractor to abandon a well according to Water Resources Department standards, there may be a significant number of unused wells serving as pathways for nitrate to reach groundwater.

Fertilizer (Home and Garden Activities)

About six percent of the GWMA is in urban or rural residential land use. Lawns and garden comprise much of that area. In areas with well-drained soils, the nitrogen in fertilizer intended to produce a

lush lawn, abundant vegetable garden, or showcase flower displays may unknowingly end up as nitrate in groundwater. Unfortunately, signs of excess nitrate are not always obvious. Furthermore, many home gardeners may be unaware of the connection between landscape activities and the groundwater that is supplying their drinking water.

Residential Goals, Objectives, Strategies, and Actions

Education and outreach are the primary methods used to increase residents' awareness of the importance of the groundwater resource and provide information to help prevent contamination in higher risk areas. In addition, it is recommended that adequate technical support be provided to local governments that may choose to implement regulatory strategies. Finally, specific strategies and actions address nitrate reaching groundwater from septic systems and wells. Strategies and actions are recommended to overcome the financial barriers that residents face in implementing changes that could help to protect the groundwater resource. In addition to strategies to reduce the contribution from residential sources of nitrate to groundwater, this section of the Action Plan also identifies actions to reduce the risks to residents from nitrate in groundwater.

Goal 1: Develop a recognition among residents throughout the region that groundwater is a valuable and vulnerable resource

Goal 2: Perform focused outreach that addresses specific risks to groundwater quality

Goal 3: Provide technical support for interested local governing bodies

Goal 4: Reduce the nitrate contribution from septic systems to groundwater

Goal 5: Reduce the potential for wells to serve as conduits for nitrate to groundwater

Goal 1: Develop recognition among residents throughout the region that groundwater is a valuable and vulnerable resource

Objectives:

- After five years, 80 percent of the GWMA population is aware of groundwater vulnerability and groundwater protection activities
- By 2011 fifty percent of residents have changed at least one practice to improve groundwater protection

Strategy 1.1 Launch Southern Willamette Valley GWMA public information campaign.

Actions:

- Maintain a GWMA website that includes specific information for residents.
- Send press releases to local media outlets regarding the extent and purpose of the GWMA, tips for groundwater protection, human interest stories, promotion of the web site and GWMA events, and other groundwater-related topics.
- Work with organizations that have newsletters to include groundwater-related articles tailored to their interest.
- Partner with utilities to include groundwater protection tips in utility bills.
- Promote the use of a GWMA speakers' bureau with local service organizations, granges, watershed councils and other groups.
- Create displays and posters for community events, store windows, etc.

Strategy 1.2 Offer groundwater educational programs to residents in Lane, Linn and Benton counties, focusing on GWMA communities.

Actions

- Offer classes providing unbiased information for residences with wells and septic systems.
- Offer nitrate screening and consultations on wells, septic systems and water treatment options at community events, Extension offices, and other venues.
- Work with Realtors to disseminate groundwater-related materials.
- Work with health care providers to address nitrate-related health issues.

Strategy 1.3 Extend K-12 groundwater education and outreach programs.

Actions

- Work with existing educational programs that focus on water quality or natural resources such as 4-H clubs, the 4-H Wildlife Stewards Program, the Hydroville Curriculum Project, the SMILE Program, or Scouts.
- Where applicable, involve students and parents in activities related to the school's Drinking Water Protection Plan.
- Identify teachers interested in covering groundwater in their classroom and offer them support that meets their needs, such as tailoring activities appropriate to their students or providing a groundwater model or other equipment for their use.
- Create and distribute a GWMA Teachers' Newsletter with classroom activities linked to the state curriculum standards

Strategy 1.4 Provide information on groundwater-friendly lawn and garden products and practices.

Actions

- Partner with Master Gardeners so that they may assist in educating others in groundwater-friendly practices.
- Support a Water-Friendly Gardening speakers bureau to present at gardening clubs, community lecture series, schools, etc.
- Develop demonstration gardens that illustrate groundwater protection practices. This may be done in conjunction with K-12 activities.
- Supply groundwater-friendly lawn and garden information sheets to retail garden businesses on multiple topics, including information reminding people to read the fertilizer labels.
- In collaboration with local retail garden businesses in the GWMA, launch a "groundwater-friendly" labeling campaign to identify appropriate products.

Goal 2: Perform focused outreach that addresses specific risks to groundwater quality

Objectives:

- By June 2007, a volunteer network has been established and is still operating five years after Action Plan approval with at least 50 wells being sampled and collecting usable data.
- Awareness of groundwater issues is increased through each volunteer discussing groundwater issues with at least three other people.
- A survey sent six months after a site assessment indicates that at the end of a five year period the site-assessment tool and program initiated individual action at 80 percent of all sites assessed.

Strategy 2.1 Establish a volunteer well monitoring network that incorporates neighbor-to-neighbor outreach.

Actions

- Recruit and train volunteers to participate in the network.
- Maintain ongoing support for the monitoring network, including sample analysis.

Strategy 2.2 Establish a site-visit program to assist residents in assessing potential risks to groundwater.

Actions

- Consider staffing options that may include interns or volunteers.
- Train team in outreach and assessment techniques.
- Develop a site-assessment tool based on previous products such as Home-A-Syst.

Goal 3: Provide technical support for local governing bodies

Objective:

- All elected officials and local jurisdiction staff have had the opportunity to receive educational materials about groundwater protection within two years after Action Plan approval.

Strategy 3.1 Offer educational support to elected officials, city and county staff, and citizens' advisory

groups about the GWMA and associated issues.

Actions

- Work with NEMO (Non-point Education for Municipal Officials, an EPA funded program) to design and implement an outreach plan.
- Provide workshops, briefing sheets, meeting speakers, and other educational tools and strategies for local policy-makers and those who would be implementing the policies.
- Coordinate with local partners to include relevant GWMA-related information on their websites.

Strategy 3.2 In cooperation with representatives of willing local governing entities, develop a GWMA Planning Kit containing options that could decrease the contribution of nitrate to groundwater.

Actions

- Communicate clearly that use of any of the tools is strictly voluntary and to be determined by local authority.
- Work cooperatively with the potential users of the Planning Kit to ensure that it contains appropriate tools.
- Research options used in other regions and incorporate lessons learned.
- Assist local groups in gaining input and support for potential changes.

Goal 4: Reduce the nitrate contribution from septic systems to groundwater

Objectives:

- Within three years, changes to the State Onsite rules will have been examined and a Geographic Area Rule will be adopted if warranted.
- Within five years 100 percent of low or moderate income residents within high risk areas of the GWMA have access to financial assistance for technologies that reduce nitrate contributions.

Strategy 4.1 Ensure that site-suitable wastewater treatment technologies can be used to reduce nitrate.

Actions

- In cooperation with DEQ and interested parties from other GWMAs, assemble a technical team to review relevant research, including the LaPine nitrate study, gather empirical data, and produce a proposal to amend the Onsite Wastewater Treatment System rules, if the research shows that the proposal is needed and a general assessment of the cost-benefit indicates the additional long- and short-term protection of public health and welfare is worth the potential investment.
- Recommend, with supporting documents, that DEQ amend the Geographic Area Special Considerations rule (OAR 340-071-0400) to allow the use of best available technologies for nitrate reduction in the development, repair and replacement of onsite wastewater treatment systems in areas of the GWMA where soil or geologic conditions would preclude the use of standard septic systems. The “best available technology” should remove nitrate to the level allowable for a specific site, and take into consideration the cost to the consumer, long-term maintenance requirements, and the expected life of the system.

Strategy 4.2 Facilitate the use of financial incentives to encourage the use of technologies that reduce nitrate contributions from septic systems to groundwater.

Actions

- Explore options to make use of the State Revolving Loan Fund to finance grants and loans to low- and moderate-income residents for installations or upgrades to meet an approved nitrate reduction standard.
- Investigate the possibilities of using current or new state income tax or county property tax credits or deductions for individuals who install onsite wastewater systems that meet an approved nitrate reduction standard, similar to the idea of a tax credit for water conserving appliances.
- Network with local, state, and federal agencies that provide financial assistance for home rehabilitation and water-quality-protection to ensure that septic system enhancement is an allowable use of those funds.

Alternative treatment technology exists to significantly reduce nitrate contributions

Goal 5: Reduce the potential for wells to serve as conduits for nitrate to groundwater

Objectives:

- The number of repairs and proper well decommissioning within the GWMA increases by 20 percent within five years of the adoption of the Action Plan.
- One-hundred percent of low or moderate income residents within high risk areas of the GWMA have access to financial assistance for proper decommissioning or repair of wells by the year 2011.

Strategy 5.1 Focus on wells that might be conduits for nitrate to groundwater, raising landowner awareness of the risks and assisting them in resolving any issues.

Actions

- In conjunction with planned outreach efforts, provide Well Action Packets to landowners who may have problem wells and refer them to OWRD to determine how to proceed.
- Create an incentives program that would encourage owners of problem wells to begin taking steps to address the situation.
- Request increased inspection of wells by OWRD and take necessary steps to support the agency in doing this.

Strategy 5.2 Facilitate the use of financial incentives to encourage proper abandonment or repair of wells.

Actions

- Network with local, state, and federal agencies that provide financial assistance for home rehabilitation and water-quality-protection incentives to ensure that well repair and decommissioning is an allowable use of those funds.
- Work with the business sector and service organizations to establish programs such as

special-needs discounts, charitable mini-grants, earn-a-well with community service, or other creative solutions.

Commercial/Industrial/Municipal

Overview

There are many commercial, industrial, and government facilities and activities in the Southern Willamette Valley. The numerous existing businesses range from golf courses to recreational vehicle manufacturers to pulp and paper industries. As the population in this area grows it is likely that additional businesses will start up, expand, or move to the Southern Willamette Valley. Recent examples of industrial and commercial growth in 2005 include the new recreational vehicle park in Harrisburg and the expansion of Monaco, a recreational vehicle manufacturing plant, to accommodate 200 employees from their Bend facility.

Large industries in the region support an economic base

Businesses outside of a city urban growth boundary or anywhere in Coburg must individually manage their wastewater, which is generally high in nitrate or nitrogen and usually requires a permit from the DEQ or a County. To a great extent, these businesses have been successful in obtaining and maintaining these permits. At least one large manufacturer has developed such a complex wastewater treatment system that daily maintenance is required. The commercial and industrial businesses in the GWMA actively support groundwater protection and in participate in efforts to find potential solutions.

Reducing the nitrate contribution from commercial, industrial, and municipal sources will require all businesses and local governments to re-evaluate their current practices and determine how they can incorporate the goal of reducing nitrate to less that 7 mg/L into their future practices. This review should not only cover the individual wastewater treatment systems, but also include how the grounds are maintained and how certain materials are applied to the land.

Inventory of Potential Commercial/Industrial/Municipal Nitrate Sources

There are several types of business and government facilities and practices that have the potential to increase nitrate contamination of groundwater. These include:

- Fertilizers and Fertilization Practices
  - Bulk Fertilizer Facilities
  - Fertilizer Practices
- Wastewater Treatment
  - Individual Large Onsite Systems/Treatment Facilities
  - Public Wastewater Treatment Lagoons
- Land Application of Reclaimed Water, Biosolids and Similar Wastes

Fertilizers

Bulk Fertilizer Facilities

There are at least three bulk fertilizer facilities in the GWMA, one in Monroe and two in Harrisburg. A

fourth facility lies just outside of the southern GWMA boundary that follows Route 36 near Junction City. DEQ has evaluated the potential risk from several bulk fertilizer facilities located outside of the GWMA and found historical releases to be the cause of localized groundwater contamination. In general, current management and handling practices have greatly improved the situation. DEQ is evaluating the potential of conducting Preliminary Assessments for these facilities inside of the GWMA to determine if there have been any historical releases to the environment that need to be addressed.

Fertilizer Practices

Businesses and government agencies managing parks and grounds often use fertilizer for their turf and grounds maintenance. Both the public and private sectors can evaluate and improve their fertilizer practices to minimize the amount of nitrate that reaches the groundwater.

In the public sector, most of the cities and counties indicated that the fertilization of green spaces (schools, parks, public lands, etc) is either done using a minimal amount of a slow release fertilizer or it is not conducted at all. This is due in large part to budgetary concerns. Private businesses either contract with landscaping companies or use their own staff to fertilize lawns and grounds. Some businesses are not employing any fertilizer practices while others want their turf and grounds to have a lush park-like look. The 125 acre Shadow Hills Country Club is the only golf course within the GWMA boundary. This facility was given special consideration because of its size, location, and the perceived use of significant amounts of fertilizers. Because of wear and tear, some grass growth is needed all year. Quick-release fertilizers are used between October and April but slow release fertilizer is used the rest of the year.

Wastewater

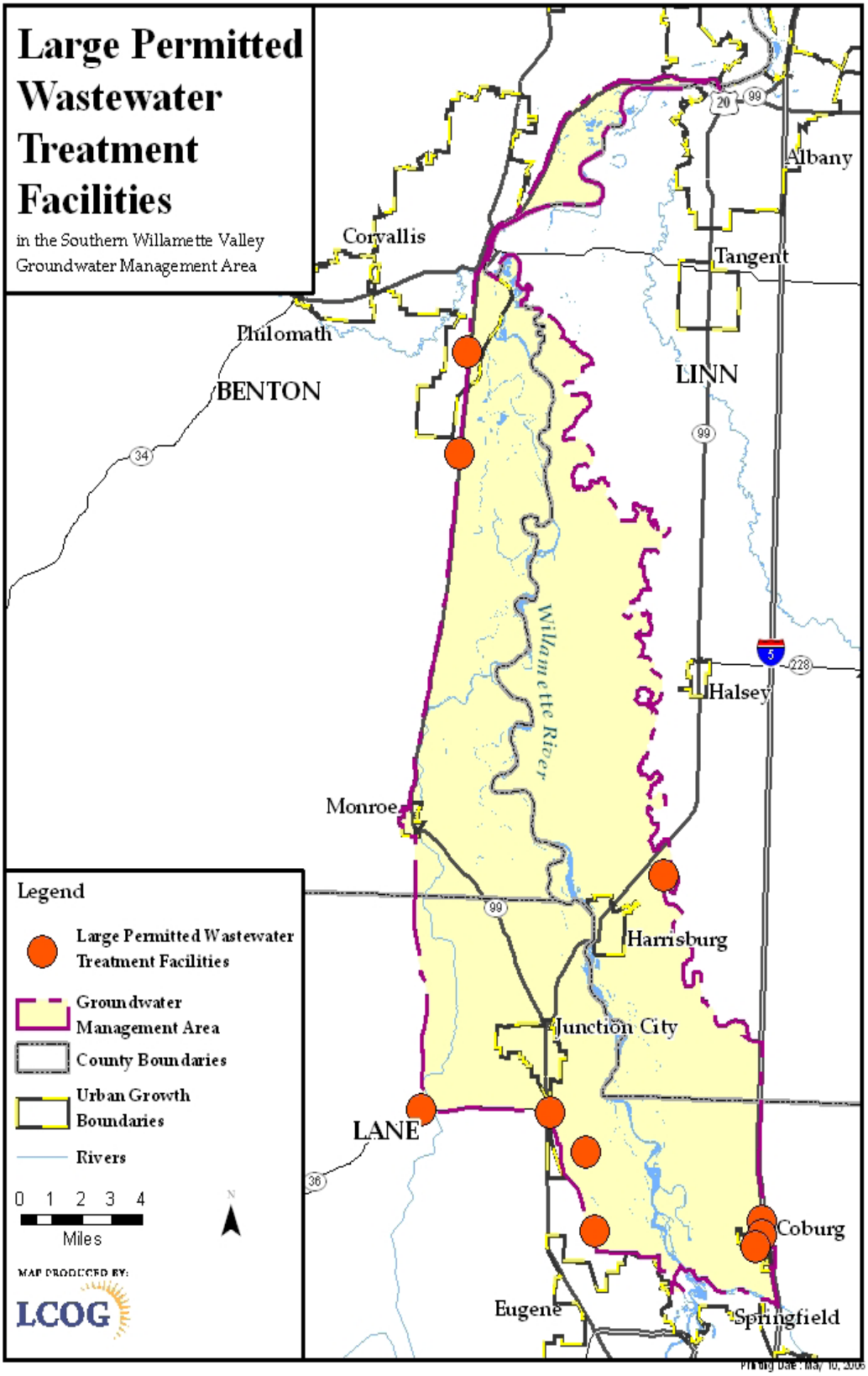
Commercial, industrial and municipal treatment facilities within the City of Coburg or outside other urban areas must manage their wastewater on an individual basis. This is usually done through the use of a large-scale onsite wastewater treatment system, wastewater treatment lagoons and/or some sort of land application. All of these facilities hold permits issued through the DEQ. Map 10 shows the locations of the large permitted treatment facilities in the GWMA. The table below displays the type of water quality permits, the total number of permits present in the GWMA, and the number of renewals necessary before December 2007.

Table 4
DEQ Water Quality Permits in the
Southern Willamette Valley Groundwater Management Area

Type of Water Quality Permit	Total Number	Renewals before 12/2007
Large onsite	5	2
Public wastewater teatment lagoons	4	2
Other permits that allow discharges to groundwater	4	3

Source: DEQ, 2005

Map 10: Large Permitted Wastewater Treatment Facilities



Large Onsite Systems and Wastewater Treatment Facilities

There are at least four large onsite systems in the Coburg area in the southeast corner of the GWMA. There is at least one other DEQ-permitted individual large onsite systems in the GWMA. These facilities receive individual permits from the DEQ and wastewater monitored at the edge of the facility must meet the EPA drinking water standard for nitrate (10 mg/L). Unless using advanced technology, these systems are typically contributing a much higher than 10 mg/L level of nitrogen-nitrate to the drainfield, but the mg/L level can be greatly reduced once it is diluted in the groundwater.

Wastewater Treatment Lagoons

This category includes those wastewater treatment systems that have the potential to impact groundwater from the lagoon portion of their treatment facilities. Public treatment facilities may be located inside or outside of urban areas. These facilities are permitted by the DEQ, but there is still potential for contamination if the lagoon base or liner is not adequately sealed.

Lagoons treat wastewater in several cities and an industry in the GWMA

There are four public wastewater treatment systems in the GWMA including facilities for Harrisburg, Junction City, Monroe, and a Springfield public school. There is also one private industrial facility that uses its own wastewater lagoon for employee and kitchen wastes. Although not actually inside the GWMA, the Eugene/Springfield Water Pollution Control Facility and the Eugene/Springfield Regional Biosolids Management Facility are directly adjacent to the southwest border of the GWMA.

Land Application of Reclaimed Water, Biosolids, and Other Materials

Biosolids (processed municipal sewage sludge), reclaimed water (water that has gone through an initial treatment), and other similar materials can be applied to land under DEQ regulations and permit. The waste is usually applied to crops and/or poplar tree farms so that the plants take up the nutrients rather than allowing the nitrogen to leach into the ground. Land application of these wastes can help maintain productive soils and stimulate plant growth while reducing the need to add other fertilizers. The DEQ is currently reviewing the inventory of land application sites in the Southern Willamette Valley. Although this information was not available before drafting the Action Plan, the lack of this data does not affect the recommended strategies.

Commercial/Industrial/Municipal Goals, Objectives, Strategies, and Actions

The following goals, objectives, strategies, and actions outline how commercial, industrial and municipal facilities in the Southern Willamette Valley can continue to help decrease groundwater nitrate levels for the protection of the water that the local population uses everyday for drinking and production.

Goal 1: Integrate the GWMA 7 mg/L Action Level into DEQ-permitted groundwater pollution control efforts

Goal 2: Integrate the protection of groundwater in the GWMA into county and city planning actions

Goal 3: Use education, technical assistance, and recognition programs to advance groundwater protection efforts

Goal 4: Monitor and evaluate groundwater quality in commercial, industrial and municipal areas

Goal 5: Evaluate wastewater treatment alternatives to understand effectiveness

Goal 6: Research and document financial resources to fund the installation and implementation of alternate treatment technologies

Goal 1: Integrate the GWMA 7 mg/L Action Level into DEQ-permitted groundwater pollution control efforts

Objective:

- By 2011, nitrate contributions from all DEQ-permitted facilities will meet the 7 mg/L threshold at point of compliance.

Strategy 1.1 Within the Southern Willamette Valley, DEQ-permitted point sources should not exceed the GWMA Action Level for Nitrate of 7 mg/L at their respective point of groundwater compliance.

Actions

- DEQ should review all permitted facilities inside the GWMA that have the potential to discharge nitrate to the groundwater, and determine if these facilities are having an adverse impact on groundwater quality.
- When writing a permit renewal or a new permit for a facility in the GWMA, DEQ should evaluate implementing groundwater pollution control efforts that are in concert with the GWMA Action Level (7 mg/L Nitrate-N).

Strategy 1.2 Encourage alternate sewage treatment technologies as methods to protect the groundwater resource including the use of subsurface irrigation of treated effluent to provide nutrients for grassy and treed areas in lieu of fertilizers.

Actions

- DEQ should promote the education of wastewater treatment operators regarding the land application of wastewater and biosolids at agronomic rates (applied at a rate that is not greater than plant uptake).
- DEQ should distribute information about alternate treatment technologies to currently operating sewerage facilities and/or land application facilities.

Goal 2: Integrate the protection of groundwater in the GWMA by using county and city planning actions

Objectives:

- Within five years, all local jurisdictions have considered using planning actions in their efforts to protect groundwater.
- By 2011, the City of Coburg implements a central wastewater treatment system to reduce nitrate inputs from that area.

Strategy 2.1 Jurisdictions within the GWMA should evaluate mechanisms for reducing future groundwater impacts that would originate from new commercial, industrial or municipal developments with large onsite systems planned to be built in "*high-risk"* areas (areas that have little or no protective soils overlying the groundwater aquifer).

Actions

- Counties and cities in the GWMA should review all options available to them when permitting new development in areas where there is a potential for an adverse nitrate impact to groundwater from such development.
- Counties and cities are encouraged to establish an overlay zone that will require new

commercial, industrial and municipal development with wastewater treatment and a potential for an adverse impact to groundwater from nitrate discharges to meet a GWMA water quality standard.
- Provide materials about overlay zones and case studies on successfully implemented overlay zones to local jurisdictions .

Strategy 2.2 Support the City of Coburg in their mission to centralize their wastewater treatment by installing and/or implementing a public wastewater treatment system.

Actions
- The GWMA Committee and staff should continue to be available to provide letters of support, reference materials, and other information to the City of Coburg.

Goal 3: Use education, technical assistance, and recognition programs to advance groundwater protection efforts

Objectives:
- Within five years, 100 percent of municipalities and commercial and industrial businesses have received educational materials about the GWMA and had the opportunity for technical assistance related to groundwater protection.
- All operators that land-apply materials are aware of the groundwater concerns and are applying wastewater and biosolids with nitrogen at agronomic rates.

City of Coburg residents rely on individual onsite septic systems

Strategy 3.1 Write and publish articles and brochures to increase awareness among the commercial, industrial, and municipal community about the Groundwater Management Area and relevant water quality issues.

Actions
- The Lead Agency should develop or make available outreach materials on how to prevent over-fertilizing and over-watering. The materials should include information on other successful resource management practices. These materials should be useful for both the commercial, industrial and municipal facilities and for any hired landscape maintenance companies.
- The Lead Agency or other involved agencies should publish two website article or public service announcements per year in the major area newspapers (Corvallis, Eugene, Junction City, Coburg) or GWMA newsletter that provides an update on the status of the Southern Willamette Valley GWMA.

Strategy 3.2 Utilize existing and new forums to discuss the GWMA and present information on successful approaches to reducing nitrate.

Actions
- The Lead Agency is encouraged to attend, on an annual basis, at least one workshop or conference aimed at interested commercial, industrial and municipal facilities and/or

wastewater treatment operators, to discuss the GWMA situation, present information or identify successful approaches.
- The Lead Agency, Commercial, Industrial and Municipal representatives, and organizations active in the Southern Willamette GWMA should meet to review the groundwater nitrate issue and share appropriate outreach materials from DEQ, LCOG, OSU Extension, and other appropriate sources.

Strategy 3.3 Provide technical assistance opportunities related to groundwater protection and coordinate with interested organizations to provide assistance to commercial, industrial and municipal facilities.

Actions
- DEQ should provide technical assistance as needed to the bulk fertilizer facilities, focusing on any assistance that may be necessary to help protect the groundwater resource from fertilizer releases.
- The Lead Agency should, in coordination with county sanitarians and/or DEQ onsite or land application staff, promote technical assistance site visits to help property owners determine potential risks to groundwater from wastewater management.

Strategy 3.4 Develop a recognition program for commercial, industrial and municipal landowners who manage their lawns, landscaping and/or wastewater/biosolids treatment in a manner that protects the groundwater resource.

Actions
- In conjunction with the recognition program for Commercial, Industrial and Municipal entities, the Lead Agency or the responsible lead for the program should prepare project summaries that describe best management practices (BMPs) these facilities have implemented to protect groundwater resources.
- These BMP summaries will serve as working examples and will assist others considering their implementation in similar industries.
- As development of industry-specific BMPs progress, those agencies involved should develop a web site with how-to information and details about the technical aspects of the best management practices. This web site can also be used to provide periodic updates on specific projects and associated water quality trends.

Goal 4: Monitor and evaluate groundwater quality in commercial, industrial and municipal areas

Objectives:
- Within two years, the DEQ or the Lead Agency prepares baseline information to accurately portray current groundwater conditions and within three years, has a long-term monitoring program in place with an appropriate methodology established to measure overall groundwater quality.
- By 2011, all of the large onsite facilities are using monitoring wells or passive capillary sampling stations to measure groundwater quality.

Strategy 4.1 Gather accurate baseline groundwater data in commercial, industrial and municipal areas.

Actions

- DEQ should coordinate with ODA, LCOG, OSU Extension, Water Resource Department (WRD), Department of Human Resources (DHS) and other agencies or groups conducting groundwater monitoring to evaluate the completeness of existing programs and identify additional monitoring needs.
- All involved agencies and groups should agree on consistent protocols to gather baseline groundwater data.
- With the concurrence of the GWMA Committee, DEQ should implement a plan for monitoring groundwater quality that will accurately identify baseline conditions.

Strategy 4.2 Monitor and evaluate groundwater improvements in areas impacted by commercial, industrial and municipal treatment facilities.

Actions

- The GWMA Committee should establish a plan for accurately monitoring groundwater trends and more clearly identifying sources of contamination.
- Encourage commercial, industrial and municipal facilities to install and monitor passive capillary sampling stations at large onsite facilities within the GWMA.
- The Lead Agency should implement a plan for long-term monitoring of groundwater trends.

Goal 5: Evaluate wastewater treatment alternatives to understand effectiveness

Objectives:

- By 2010, the most appropriate treatment alternatives for the Southern Willamette Valley have been determined.

Strategy 5.1 Research and document wastewater treatment technologies based on their effectiveness in minimizing nitrate discharges to groundwater with an emphasis on coordinating state, federal, and business efforts.

Actions

- In coordination with the Residential Working Group, the Lead Agency and the Commercial, Industrial and Municipal Working Group should produce a scientific literature review of the impact of wastewater treatment technologies on groundwater quality with a focus on reducing nitrate impacts to groundwater.
- Representatives of DEQ, EPA, Association of Oregon Industries, Oregon Onsite Wastewater Association and/or Association of Clean Water Agencies and other interested businesses should meet to discuss treatment technologies and create a list of ideas to evaluate the effectiveness of alternative treatment technologies.

Goal 6: Research and document financial resources to fund the installation and implementation of alternate treatment technologies

Objectives:

- By 2010 a comprehensive funding options database is available to those seeking to install alternate treatment technology systems.

Strategy 6.1 Document and evaluate funding options to support priority research and resource needs. Incorporate the scientific literature review in the process to prioritize research needs.

Actions

- The Lead Agency and the Commercial, Industrial and Municipal Working Group should research and evaluate potential funding mechanisms available to Commercial, Industrial and Municipal facilities. Potential funding sources include the DEQ 319 Program, the Pollution Abatement Tax Credit, Clean Water Revolving Fund, US EPA and other agencies and private organizations.

Overview

There are 52 water systems providing drinking water to approximately 65 percent of the people in the GWMA (Oregon Department of Human Services and Oregon Department of Environmental Quality, 1999-2005). Public water systems are defined as having either more than three connections or serving greater than 10 people. Most of the public systems in the region depend on the shallow aquifer to provide a clean, steady supply of water. The Drinking Water Source Areas of public water supplies encompass less than five percent of the total land area within the GWMA.

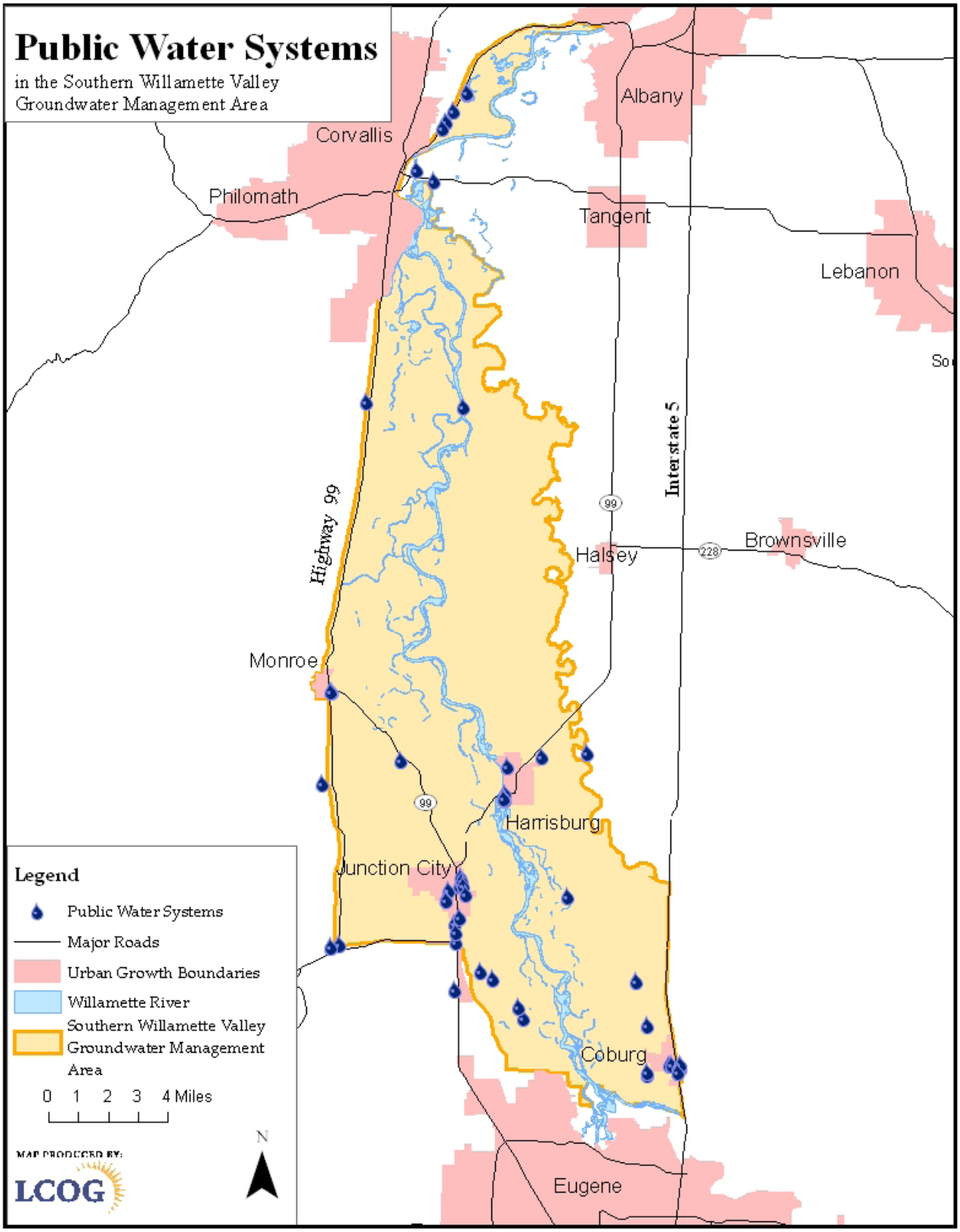
Junction City is the largest public water system in the GWMA

There is a blend of both large and small public water systems in the region. There are 37 larger public water systems (systems serving at least 25 people or having 15 connections) such as Junction City, serving over 4,000 people, and Shadow Hills, serving about 45 people. The remainder of public water systems consists of 15 smaller state regulated systems, such as trailer parks or small businesses, which serve fewer than 25 people or have less than 15 connections. As can be seen on Map 11, the majority of water systems are located in or near municipalities clustered in the southern portion and the northern fringe of the GWMA.

Public water supply systems are concerned about nitrate because they want to provide safe water and are required meet drinking water standards. Fifteen public water systems in the GWMA have tested positive for nitrate levels greater than 7 mg/L in the past five years (Oregon Department of Human Services, 2000-2005). Nitrate is difficult and expensive to remove from public systems. Therefore, measures to prevent nitrate contamination can help meet health standards while reducing the need for expensive treatment. Public water systems are also concerned about contaminants other than nitrate because nitrate indicates vulnerability to other types of contamination. The DEQ and Department of Human Services Drinking Water Program have completed Source Water Assessments for the public water systems in the GWMA. These assessments clearly identify the area from which public systems get their water and include an inventory of potential risks and risk ratings within that area.

The established methodology of the Source Water Assessments provides a tool to examine all potential risks to groundwater for a limited area within the GWMA. Although not confirmed, some of the same risks may exist for people who rely on household wells. The Source Water Assessment work provides valuable information that, although specific to a defined portion of the GWMA, can be a useful tool for overall evaluation of groundwater risk in the area.

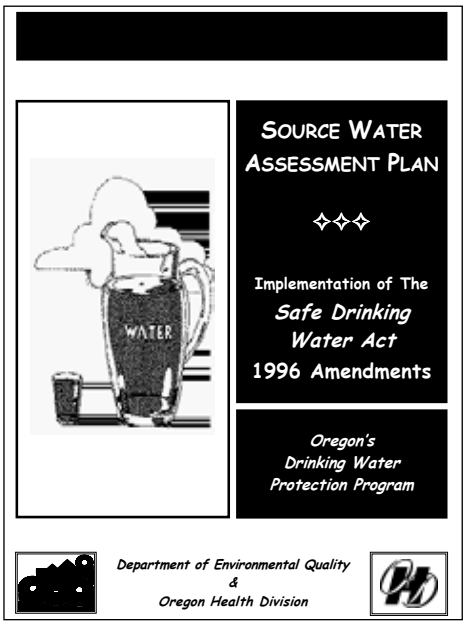
Map 11: Public Water Systems



Inventory of Potential Risks to Public Water Supplies

The Source Water Assessment delineation identifies the area from which a well draws its water. Time of travel zones were developed to give a tangible indication of how quickly contamination could reach the water distribution network. There are two-, five-, ten-, and fifteen-year time of travel zones. According to the models used, a drop of water that enters the aquifer within the two-year time of travel zone will be assimilated into the drinking water supply within two years, in the five-year zone it will take five years, and so on.

The Source Water Assessment inventory of potential contaminant sources is designed to identify and locate significant potential sources of contamination within the drinking water protection area. The sites and areas identified are only potential sources of contamination to the drinking water, and water quality is not likely to be impacted if contaminants are managed properly. Potential contaminant sources are assigned a risk rating of high, medium, or low to indicate the level of potential risk to the water supply. The risk ratings were developed by the EPA. These ratings are not site specific, but are based on the general nature of the land use activity



Oregon's Source Water Assessment Plan establishes the methodology for assessing risk to public water supplies

Within the area that is relatively close to the wells, where it is estimated that a contaminant could reach the water supply within a five-year time frame, there are 40 different types of potential contaminant sources in the GWMA. About 75 percent of those are considered a high or medium risk (Oregon Department of Human Services and Oregon Department of Environmental Quality, 1999-2005). Table 5 displays the high, moderate, and most prevalent risks in the five year time of travel zones of assessed public water systems in the GWMA.

The most common potential contaminant sources identified in the assessments of over two-thirds of the public water systems include agriculture (irrigated and non-irrigated), heavily used transportation corridors, large onsite septic systems, wells/abandoned wells, and high-density housing. With the exception of transportation corridors, all of these are potential sources of nitrate. Potential sources of nitrate are the same for public water supplies as in other areas of the GWMA and have been discussed in previous sections. Other risks to drinking water safety include everything from a hazardous waste spill on a heavily used highway or railroad, to vehicle and equipment repair facilities, current and past fuel or chemical storage tanks, and a variety of commercial enterprises.

Table 5

High, Moderate, and Most Prevalent Risks in the Five-Year Time of Travel Zones of the Drinking Water Source Areas in the Southern Willamette Valley Groundwater Management Area by Number of Systems Impacted

Potential Contaminant Source	Number of Sources	Risk
Non-Irrigated Crops	13	Lower
Transportation-Heavy Use Roads	13	Moderate
Large Capacity Septic Systems	12	High
Wells/Abandoned Wells	12	High
Automobiles- Gas Stations and Repair Shops	11	High
Crops-Irrigated	11	Moderate
High-Density Housing	11	Moderate
Underground Storage Tank-Confirmed Leaking, Status unknown, or unregulated	11	High
Above-ground Storage Tanks	10	Moderate
Other	9	
Chemical/Petroleum Storage and Processing	7	High
Historic Gas Stations/Waste Dumps	4	High
Transportation-Railroads	4	Moderate
Furniture/Lumber/Parts Stores	3	Moderate
Machine Shops	3	High
Sewer Lines	3	High
Wood Preserving/Treatment/Pulp/Paper Processing and Mills	3	High
Boarding Stables	2	Moderate
Golf Courses	2	Moderate
Grazing Animals	2	High
Rural Homesteads- Machine Shops	2	High
Lagoons/Liquid Wastes	2	High
Parking Lots/Malls	2	High
Pesticide/Fertilizer/Petroleum Storage and Processing	2	High
Waste Transfer/Recycling Stations	2	Moderate
Wastewater Treatment Plant	2	Moderate
Construction/Demolition	1	High
Dry Cleaners	1	High
Electric/Electrical Manufacturing	1	High
Food Processing	1	Moderate
Fleet Trucking/Bus Terminals	1	Moderate
Food Processing	1	Moderate
Injection Wells-Class V Underground Injection	1	Moderate
Highly Maintained Lawn Areas	1	Moderate
Medical/Vet Offices	1	Moderate
Mines/Gravel Pits	1	High
Dump Sites	1	Moderate
High-Density Septic Systems	1	High
Stormwater Retention Basin	1	Moderate
Transportation-Right of Ways	1	Moderate

Source: Department of Environmental Quality and Department of Human Services-Drinking Water Program, Source Water Assessment Reports, 1999-2005

Public Water Supply Goals, Objectives, Strategies, and Actions

The Source Water Assessment information provided a thorough evaluation of the potential contamination sources in the region and ensured that the strategies are targeted to the most pressing risks. The goals strategies and actions addressing potential risks to public water supplies focus on pollution prevention to: protect the drinking water source, meet water quality standards, avoid costly remediation, prevent the burden of finding a new source, and uphold the community's reputation for having a clean drinking water supply.

Goal 1: Increase public awareness of groundwater vulnerability, what can be done to protect drinking water, and what resources are available to aid protection efforts

Goal 2: Help landowners and businesses to implement drinking water protection strategies by establishing incentives that lessen economic barriers and assisting interested parties in acquiring resources to implement protection strategies

Goal 3: Increase water conservation in public and private operations

Goal 4: Recognize and promote actions that are being taken to protect drinking water.

Goal 5: Supplement existing employee training programs, provide GWMA-specific information to trainers, and seek out technical assistance opportunities related to drinking water protection.

Goal 6: Encourage land use planning and public health procedures that prevent or minimize groundwater contamination.

Goal 7: Work with regulatory authorities to provide prioritized, focused, and customized enforcement efforts for regulated and permitted activities within the five year time of travel drinking water protection areas

Goal 1: Increase public awareness of groundwater vulnerability, what can be done to protect drinking water, and what resources are available to aid protection efforts

Objectives:

- After five years, at least 80 percent of the GWMA population is aware of groundwater vulnerability and groundwater protection activities.
- Within five years after Action Plan approval 50 percent of residents and 50 percent of targeted businesses have changed at least one practice to improve groundwater protection and/or water conservation.

Strategy 1.1 Notify local emergency response planners of the locations of the Drinking Water Source Areas and ensure that water system operators are notified in case of a spill or other emergency that may impact the water supply.

Actions:

- Compile a list of all the agencies involved with spill response, create maps of the Drinking Water Source Areas in the region, and obtain contact information.
- Contact agencies and determine if they need maps of Drinking Water Source Areas and provide them with water system operator contact information and other information if needed
- Keep information current and make contacts every 2-3 years.

Strategy 1.2 Distribute GWMA-specific educational materials and drinking water protection materials focused on new development through local planning departments, with permit applications, and at public works offices.

Actions:

- Review available information and develop new GMWA-specific materials as necessary.
- Identify distribution methods and locations, get approval, and begin distribution.

Strategy 1.3 Erect signs along major roadways to inform people that they are entering a drinking water supply area and provide a contact number for more information.

Actions:

- Determine what information to include and design signs.
- Establish informational phone number to include on the sign.
- Contact public works departments, determine locations for signs, contact appropriate jurisdictions for approval, and erect signs.

Strategy 1.4 Mail a booklet on proper septic system care, maintenance, and inspection to rural residents within the five-year time of travel zones of drinking water protection areas.

Actions:

- Develop address list of rural residents in the five-year time of travel zones and obtain booklet.
- Send booklet (This could be coordinated with a rural resident workshop).

Strategy 1.5 Mail letters to residents, commercial and industrial businesses, and farmers informing them of their location within the GWMA and the Drinking Water Source Area of a public water system and identify things they can do to help protect the resource.

Actions:

- Develop address list and divide into categories.
- Obtain information specific to different land uses and write letters.
- Send mailing (This could be coordinated with a rural resident workshop).

Goal 2: Help landowners and businesses to implement drinking water protection strategies by establishing incentives that lessen economic barriers and assisting interested parties in acquiring resources to implement protection strategies

Objectives:

- At least three groundwater protection funding proposals are submitted per year.
- By 2011, there is a 50 percent increase in the number of household hazardous waste events held in the region.
- A cost share program for well abandonment and a tax credit program is established within five years of the approval of the Action Plan.

Strategy 2.1 Document all available funding sources to address drinking water protection issues and share this information with water system operators, public officials, and interested residents (This goal is a precursor to many other strategies).

Actions:

- Identify all sources and prepare matrix of funding sources.
- Make information available to water system operators via website or mailing.

Free household hazardous waste collection events are an incentive to dispose of hazardous materials

Strategy 2.2 Explore the possibility of holding region-wide, free household hazardous waste collection events.

Actions:

- Research existing county and city programs and promote existing efforts (partner with schools).
- Obtain support to hold region-wide free collection event and advertise collection event.
- Hold event and evaluate success.

Strategy 2.3 Institute tax credits for pollution control technologies and alternative treatment septic systems.

Actions:

- Research the process for establishing tax credits, contact state agencies and state representatives from the region, and develop credit structure.
- Determine qualified technologies and systems.
- Prepare project details for legislative session, gather support, and begin political process.
- Implement tax credit and begin promoting the opportunity.

Goal 3: Increase water conservation in public and private operations

Objectives:

- Decrease the average household use of water by 10 percent within five years after the approval of the Action Plan. This can be measured by compiling data on existing average household use from systems that meter water and tracking changes.
- Compare that amount with average household use every two years after approval of the Action Plan.

Strategy 3.1 Present information on utility bills to show that water conservation equals costs savings and provide to municipalities and other rate collectors in the GWMA.

Actions:

- Contact water systems to gather information about current billing practices and determine willingness to participate.
- Research examples of billing formats and potential cost saving advice.
- Present findings to water system operators and public officials for implementation.

Strategy 3.2 Provide access to water-saving products, such as low-flush toilet converters, low-flow showerheads, and faucet aerators, through public-private partnerships and incentive-based programs.

Actions:

- Identify products available and contact businesses to determine bulk prices and other funding options.
- Meet with city and county staff and present details of implementing a large scale distribution program.
- Create promotional materials for obtaining water-saving products and begin distribution program.

Goal 4: Recognize and promote actions that are being taken to protect drinking water

Objective:

- Programs are established and have active participation within three years and continued participation at five years after Action Plan approval.

Strategy 4.1 Establish a region-wide annual awards program for leaders in protecting drinking water classified by land use (agriculture, residential, commercial/industrial, and municipal).

Actions:

- Decide format for determining recipient and seek business partners/contributions.
- Advertise award and request recommendations, design award, and form committee to meet annually and decide on recipient.
- Present award and advertise results.

Strategy 4.2 Explore the possibility of extending an auto shop certification program into the Southern Willamette Valley.

Actions:

- Research and contact the Eco-Logical Business program in the Portland area, check into existing programs, compile list of auto shops in the region, obtain materials, and set up website.
- Contact auto shop owners, conduct site visits, and form a network for auto shops to share information.
- Recognize outstanding auto shops in various media and advertising outlets.

Goal 5: Supplement existing employee training programs, provide GWMA-specific information to trainers, and seek out technical assistance opportunities related to drinking water protection

Objectives

- Within three years of approval of the Action Plan 100 percent of the high and medium risk businesses within the 5-year time of travel zones have been contacted about the GWMA and within five years 50 percent of those businesses have changed at least one practice that will better protect groundwater.
- By 2011, 75 percent of all high and medium risk businesses in the 5-year time of travel have incorporated drinking water protection information as part of their training programs.

Strategy 5.1 Form and coordinate a multi-jurisdiction Pollution Prevention Team for the Southern Willamette Valley including city staff and officials, county staff and officials, landowners, commercial and industrial operations, homeowners, and public agencies.

Actions:

- Research funding options and examples of pollution prevention teams, prepare supporting documents.
- Obtain support from jurisdictions in the region through presentations and staff contacts, secure funding and in-kind support.
- Invite staff and professionals to be involved in the team and begin developing pollution prevention actions.

Strategy 5.2 Provide forums designed to make technical assistance and training opportunities available to water systems, local government officials, and planning staff regarding protecting drinking water within the established drinking water protection areas.

Actions:

- Public water systems sponsor a training session for area planners and community leaders.
- Establish an annual meeting of public water system operators to be held in the anniversary month of the implementation of the Action Plan.
- Provide drinking water protection training materials to local businesses that have training programs.

Strategy 5.3 Partner with agricultural organizations to offer on-farm technical assistance to landowners regarding risks to public water supplies within the GWMA's Drinking Water Source Areas.

Actions:

- Compile contact list of agricultural organizations, develop project proposal, and make initial contact with staff.
- Advertise opportunity for farmers to participate in on-farm assistance.
- Provide assistance and maintain relationship with participating farmers to monitor results.

Strategy 5.4 Establish a mentoring program with large businesses helping smaller, less regulated businesses in the drinking water protection areas.

Actions:

- Ask businesses to participate in mentoring effort to assist small businesses in developing spill response plans.
- Share spill response resources with small companies and sponsor joint employee training workshops.

Goal 6: Encourage land use planning and public health procedures that prevent or minimize groundwater contamination

Zoning/Health Ordinance Objective

- Within three years of the approval of the Action Plan all local jurisdictions in the GWMA have been approached about possible zoning/health ordinance changes.
- All jurisdictions have at least considered making changes in current zoning designations and land use development review procedures within five years of Action Plan approval.

Strategy 6.1 Work with local jurisdiction to consider establishing drinking water protection overlays in the 5-year time of travel zones of the Community and Non-Transient, Non-Community water systems in the GWMA.

Actions:

- Research drinking water protection overlays and find examples of model ordinances.
- Establish a contact list of planning staff and elected officials in the GWMA, meet with city and county planners and prepare draft overlay zone if requested.
- Assist staff in proposing overlay zone to planning commissions and elected officials if desired.

Local policy-makers can learn about planning options to protect drinking water

Strategy 6.2 Provide information to staff and local officials about model ordinances available to governing bodies to implement drinking water protection measures and information detailing examples of communities that had to address contaminated drinking water.

Actions:

- Compile information about the costs of drinking water contamination and examples of ordinances other than overlay zones.
- Contact public officials and staff and arrange a time to discuss potential drinking water protection measures.

- Meet with cities and counties. Identify barriers to implementation and propose solutions to address these issues.

Strategy 6.3 Request that county and city planning departments notify water system operators of all proposed development actions in the 5-year time of travel zones or provide operators with web-site information where they can access development information

Actions:

- Compile contact information of all county and city planning staff and create detailed maps of the 5-year time of travel zones within each jurisdiction.
- Obtain support from water system operators and provide information to planning staff.
- Monitor development actions within the 5-year time of travel zones

Goal 7: Work with regulatory authorities to provide prioritized, focused, and customized enforcement efforts for regulated and permitted activities within the five year time of travel drinking water protection areas

Objective:

- By 2011, the Water Resources Department (WRD), the DEQ, and the Department of Geology and Mining Industries (DOGAMI) have all initiated steps to focus regulatory and enforcement efforts in the GWMA.

Strategy 7.1 Partner with the WRD to better understand the location and concentration of temporarily and permanently abandoned wells in the five-year time of travel drinking water source areas. Help the WRD to prioritize enforcement efforts regarding temporary and permanent well decommissioning.

Actions:

- Contact the WRD to discuss ways to collaborate on identifying wells that should be permanently and properly decommissioned.
- Establish a method to prioritize 'higher risk' wells.

Strategy 7.2 Alert DEQ to the presence of confirmed leaking underground storage tanks and underground storage tanks of unknown status within public water system five-year time of travel drinking water source areas.

Actions:

- Contact responsible party at regional DEQ office about the known leaking underground storage tanks.
- Bring DEQ personnel to working group and GWMA Committee meetings to talk about the Underground Storage Tank program.
- DEQ enforces clean up of leaking underground storage tanks.

Strategy 7.3 Notify DOGAMI of the sand and gravel mining operation within the Drinking Water Source Area and stress the importance of providing operators with best management practices to reduce risks to groundwater contamination.

Actions:

- Compile groundwater protection mining BMP information, contact DOGAMI and provide them with a map of and information about high priority operations.
- Encourage DOGAMI to focus efforts on operations in or close to drinking water source areas.

Strategy 7.4 Provide ODA with a map of the drinking water source areas and the CAFO sites within the 5-year time of travel zones to help ensure compliance with permits. Provide information to ODA about the GWMA that can be shared with CAFO operators during site visits.

Actions:

- Compile CAFO BMPs, contact ODA, give them a map and information about high priority operations.
- Urge the ODA to maintain routine site visits to these CAFOS and inform operators of their location within the drinking water protection area.

Strategy 7.5 Provide the DEQ with a map of the drinking water source areas and request that they make the Drinking Water Source Areas a priority for enforcing regulations regarding large septic systems and underground injection control.

Actions:

- Contact DEQ and provide them with maps of the drinking water protection areas.
- Prepare a fact sheet targeting permitted and regulated entities that describes the risks, liabilities, and costs related to groundwater contamination and ask the DEQ to distribute to permitted facilities.

Chapter 4 - Implementation: Measuring Success Through Performance Indicators and Groundwater Monitoring

The ultimate goal of the Action Plan is to improve the overall groundwater quality by obtaining a nitrate value of less than 7 mg/L. The achievement of this goal necessitates active involvement from many different entities, assessment of progress in implementing strategies, and, finally, measuring groundwater quality.

Implementation Participants

Implementation of the strategies identified in Chapter 3 is critical to the overall success of this Action Plan and the eventual decline of nitrate levels in the GWMA. Implementation relies on voluntary actions among the agencies and land use groups in the region. This voluntary approach is built on the belief that local jurisdictions in the area are best suited to develop and implement actions to reduce risks to groundwater contamination.

Forward movement will require coordinating oversight from the Lead Agency and/or other entities willing and able to coordinate at least portions of the Action Plan. Implementation of the strategies is highly dependent on allocation of staff resources and/or funding. Using a voluntary approach has benefits and challenges. There has been considerable support from many local governments and individuals to restore groundwater quality to a safer level. However, because of time and resource constraints, these same entities are often under great pressure to complete many mandatory activities prior to implementing voluntary and non-regulatory tasks. An active Lead Agency should offer support and guidance to those entities and individuals who are the best fit for implementing various sections of the Action Plan.

At a time when federal, state, and local budgets are already stretched, many of the strategies will rely on a potential implementing entity or partnering entities either adding the task to their existing work loads, pooling funds from several jurisdictions/agencies to accomplish a set of tasks, and/or finding grant funding to accomplish one or more tasks. Potential grant funding can come from a variety of different resources. Table 6 (next page) displays potential GWMA-related funding mechanisms as of 2006.

The GWMA Committee recognizes that future opportunities may arise to implement innovative voluntary actions to restore and protect groundwater in the GWMA. These opportunities may include implementing strategies that are not specifically identified in the Action Plan. In some cases lessons learned from early activities may change the focus of later activities. The Committee supports other initiatives that maintain the spirit of the Action Plan as expressed in the goals of the Action Plan. Those initiatives should be voluntary in nature, strive to reduce nitrate in groundwater below the 7mg/L threshold, reduce potential risks to the drinking water aquifers, and maintain and support traditional land uses. The Committee requests that organizations applying for grant funding, inform the Committee of the proposal and provide Committee members with a summary of the proposal.

In the Lead Agency role, the DEQ has guided the process leading to the development of this Action Plan. If an organization other than the DEQ is considered for the Lead Agency role, the Committee requests to be made aware of that consideration and be given the chance to provide input. The DEQ and the Department of Human Services have done an exceptional job at documenting the contamination problem and the potential risks to private and public water supplies. It is

Table 6: Funding Machanisms for the GWMA

Funding Source	Responsible Agency	Description	Typical Amount
CATALOG OF FEDERAL FUNDING SOURCES FOR WATERSHED PROTECTION (http://cfpub.epa.gov/fedfund/)	EPA	A catalog of watershed-related funding sources	Varies
HOUSEHOLD WATER WELL SYSTEMS PROGRAM (http://www.usda.gov/rus/water/)	The Rural Utilities Service (RUS)	The HWWS Program targets financial resources to help households finance the costs of constructing or rehabilitating their private wells.	$500,000 to $1,000,000
ENVIRONMENTAL JUSTICE COLLABORATIVE PROBLEM-SOLVING COOPERATIVE AGREEMENT PROGRAM (http://www.epa.gov/compliance/environmentaljustice/grants/)	EPA	This EJ CPS program is designed to provide funding for eligible applicants so that they can address local environmental and/or public health issues using the EJ CPS Model	
COOPERATIVE AGREEMENT FOR INTEGRATING CLEAN WATER, DRINKING WATER AND LAND USE PLANNING EFFORTS GRANT (http://www.epa.gov/safewater/protect/funding.html)	EPA	This funding opportunity seeks to demonstrate methods of integrating drinking water protection into land stewardship/conservation and water programs at the local level.	Up to $600,000 over four years
REGIONAL GEOGRAPHIC INITIATIVE (http://www.epa.gov/regional/rgi.htm)	EPA	RGI funds projects that fill critical gaps in the Agency's ability to protect human health and the environment by fostering and supporting community-driven approaches to long-term, sustainable solutions to environmental challenges.	$20,000 to $50,000
CONSERVATION INNOVATION GRANTS (http://www.nrcs.usda.gov/programs/cig/)	USDA - NRCS	The purpose of CIG is to stimulate the development and adoption of innovative conservation approaches and technologies while leveraging Federal investment in environmental enhancement and protection, in conjunction with agricultural production.	$25,000 to $900,000
COMMUNITY ACTION FOR A RENEWED ENVIRONMENT (CARE) PROGRAM (http://www.epa.gov/oar/grants/)	EPA	CARE is a new and unique community-based, community driven, multimedia demonstration program designed to help communities understand and reduce risks due to toxics from all sources.	Level I: $75,000-$100,000 Level II: $150,000 to $300,000
ASSESSMENT AND WATERSHED PROTECTION PROGRAM GRANTS (AWPPGS) (http://www.epa.gov/owow/funding/rfp.html)	EPA	Support the watershed approach and build the capacity of all levels of government to develop and implement effective, comprehensive programs for watershed protection, restoration, and management.	$20,000 to $150,000
INTEGRATED RESEARCH, EDUCATION, AND EXTENSION COMPETITIVE GRANTS PROGRAM – NATIONAL INTEGRATED WATER QUALITY PROGRAM (http://www.csrees.usda.gov/fo/funding.cfm)	USDA - CSREES	To develop research, education, and extension projects aimed at improving the quality of water resources in agricultural watersheds across the Nation.	Up to $600,000
319 NON-POINT SOURCE GRANTS (http://www.deq.state.or.us/wq/nonpoint/wq319gt.htm)	DEQ	These funds target addressing non-point source water pollution issues. Emphasis usually targets on-the-ground implementation although planning grants are also awarded. Geographic areas and priority projects are often identified prior to the release of the RFP.	$10,000 to $150,000, average of $50,000
DRINKING WATER PROTECTION GRANTS	DHS-Drinking Water Program	Likely to be a new program this Fall. Funds will target drinking water protection efforts (planning and/or plan implementation) related to Public Water Systems.	Approximately $25,000 per water system
STATE REVOLVING LOAN FUNDS (http://www.deq.state.or.us/wq/loans/srfloans.htm)	Department of Human Services and Department of Environmental Quality	Low interest loan program, for public entities. Interest rates range from about 1.2 to 2.9 percent. Would support non-point source pollution control efforts (such as the replacement of old and potentially failing septic systems).	Variable

recommended that the DEQ and the Department of Human Services continue to allocate staffing for the long-term assessment of the GWMA and prioritize staff resources, grant funding, and legislative funding that will assist in the effort to lower the drinking water risks to the residents.

ODA has shown remarkable foresight and commitment in evaluating the means and methods for reducing the potential agricultural impact to groundwater quality. Their willingness to work with the local SWCDs and DEQ to identify priority actions and develop funding requests and allocations will most assuredly assist with the progress in implementing the Action Plan. It is recommended that ODA continue with these efforts throughout the implementation of the Action Plan. LCOG has brought their regional coordination expertise to the project by helping to integrate the efforts of multiple jurisdictions, entities, and land use groups into the process. Their data and mapping resources have brought a better understanding of the area, helping to guide future actions. OSU and OSU Extension Service bring important research to the region and direct contact with residents in the GWMA through outreach and education efforts. These agencies should seek funding for continued involvement as the implementation phase moves forward. In addition, the proximity of Oregon's largest universities offers many opportunities to draw upon additional scientific, planning, and public policy research and expertise.

Work in the GWMA has been successful to date in part due to the extremely active involvement of many partners including: staff and public officials from all three counties and five cities; staff from Environmental Health, Planning, and Public Works departments of local jurisdictions; Oregon Department of Land Conservation and Development; Oregon Water Resources Department; Long Tom Watershed Council; Cascade Pacific Resource Conservation and Development Council; Rural Community Assistance Corporation; Oregon Association of Water Utilities; and public water system providers. All of these entities are encouraged to continue to participate and seek implementation opportunities either individually or in partnership with others.

Implementation Performance Indicators

The GWMA Committee also plays a key role in the implementation process, evaluating the Action Plan success, and recommending adjustments to the Plan as necessary. The GWMA Committee will continue to meet regularly. Staff will provide the Committee with updates on monitoring sampling results and trends as well as updates on progress made towards implementation of the strategies and actions in the Action Plan. The success of the voluntary nature of this Action Plan will be assessed over time by the GWMA Committee. If progress in implementing strategies and reducing the groundwater nitrate levels is not made within a period of time deemed reasonable by the GWMA Committee, then amendments to the Action Plan may be warranted. These changes could include mandatory actions and regulatory changes.

Each strategy identified in Chapter 3 has been matched with Measures of Implementation and Potential (or recommended) Implementing Entities. Measures of Implementations are outcome indicators or the methods used to track the actual implementation of the strategies and an indication of when the activity should be completed. Potential Implementing Entities are the recommended organizations, agencies, jurisdictions, or groups that have the authority and/or capacity, could develop the ability, or could form partnerships to implement actions.

Although a few strategies may ultimately result in some regulatory change, all actions are voluntary to be undertaken (or not) by the potential implementation entity. The measures of implementation and potential implementing entities for each strategy are included in Tables 7 through 14.

Timeline and Benchmarks
Tables 7 through 14 provide an evaluative mechanism to determine progress and set benchmarks for tracking the implementation of the GWMA Committee's strategy recommendations. These eight tables, two for each focus area described in Chapter 3, are included at the end of this chapter.

The tables arrange the measures of implementation in chronological order by group. This list provides a tool for future reporting on plan implementation and for identifying ways to adapt the plan if necessary. For more detailed explanations of the strategies and related information, see Chapter 3.

Groundwater Monitoring Approach

There is no decision matrix in rule or statute for a method to determine when the "less than 7 mg/L" threshold has been accomplished, thus each GWMA Committee can select the tool that makes sense for their situation. There will be several types of groundwater monitoring occurring to evaluate the changes of nitrate as a whole in the Southern Willamette Valley GWMA.

Ongoing monitoring at consistent sites and at specific depths will help evaluate overall success

Baseline Data
It is expected that the groundwater monitoring results will show a great deal of variability. Before determining an improvement of groundwater quality has occurred, it is necessary to first understand the existing groundwater quality, referred to as 'baseline.' As discussed in Chapter 1, several previous studies assessed the differences of nitrate levels in the Southern Willamette Valley, each within a concise timeframe. Conducting long-term monitoring at distinct and consistent locations will create a baseline to measure future results against. Beginning in the summer of 2006, DEQ started monitoring at 40 distinct Southern Willamette Valley locations. Samples from these locations are collected and analyzed quarterly (once every three months).

The 40 monitoring points were determined on a quasi-random basis. First, the GWMA was overlaid with a grid and separated into roughly 40 equal parts. Each segment was randomly assigned a number. In numerical order, a random number generator selected a geographic section for each of the 40 parts. This section was then examined for the ability to use an existing domestic well rather than drilling a new well solely for monitoring purposes. If the use of a domestic well was not a likely option, then a monitoring well location was established based upon three criteria:

1. Situated within the county right-of-way,
2. Ability to operate the drill rig, and
3. Did not directly target a particular land use or was not situated next to a front lawn or driveway.

As mentioned above, evaluation of groundwater quality will include several types of monitoring data evaluated over time. Below is a summary of the types of monitoring assessed during the Action Plan implementation. Only the long-term monitoring network of approximately 25 monitoring wells and 15 residential domestic wells are used to determine baseline.

Long-term Monitoring Program

Monitoring Wells: A groundwater sampling and analysis program will be conducted using the monitoring wells dedicated to the GWMA. There are 25 monitoring wells installed in randomly selected areas of the GWMA. These wells are permanently installed in the aquifer, and monitor a specific depth using a 3-foot screen intake. It is anticipated that these wells will be influenced by seasonality and changes in water table levels, so a sufficient number of samples must be collected to minimize the effect of these variables. A minimum of nine quarterly samples from each location should adequately address these issues. DEQ laboratory technicians will collect and analyze these samples, thus minimizing the potential error that can be introduced into a sampling program by differing collection and sampling techniques.

Domestic Wells: Up to 15 domestic wells are included as part of the long-term monitoring program. Wells targeted include those that are located in randomly selected areas, are less than 75 feet deep, and were constructed in the last 20 years. The use of domestic wells has both positive and negative ramifications. As there are no feasible controls for water usage before sampling, there is no easy way to determine which zone(s) of the aquifer the water originated. However, the samples that are taken from domestic wells are reflective of the quality of water that is being consumed by the residents in the area. These wells are also being sampled for nine quarterly monitoring events to establish baseline and DEQ laboratory technicians are collecting and analyzing these samples.

Water samples taken during home sales can provide an estimate of nitrate trends

Supplemental Monitoring Data

Voluntary Neighborhood Networks: The Residential Voluntary Monitoring Network includes up to 125 domestic wells. Samples from these wells will be analyzed by a field method, which has somewhat less Quality Assurance & Quality Control (QA/QC) than a laboratory analyses. Residents collect and analyze these samples on a regular basis as determined by the neighborhood. To increase the QA/QC of the field tests, a few of the Residential Monitoring Network wells aree included in the regular long-term monitoring program. The strength of these field data lies in the sheer number of results.

Public Drinking Water Supply Wells: These wells are tested for nitrate once a year and the results are reported to the Department of Human Services. This information will be included in the evaluation of nitrate concentrations in the Southern Willamette Valley GWMA. Several factors preclude the use of these wells in the quantifiable assessment of the groundwater quality. Many of these wells have long screens and may collect water from multiple zones of the aquifer(s). In addition, these wells are frequently pumped at high rates and there would be no easy way to determine how much each of the various water-producing layers is contributing to the flow.

Real Estate Transfer Data: Every time a property with a domestic well is transferred, the owners are required to test the well for nitrate. This information will be assessed for trends, but will not be used in any quantitative fashion. There is little QA/QC on the collection of these samples, and although there may prove to be interesting trends, these results should be treated as qualitative information.

Statistical Assessment of the Groundwater Data

Data will be statistically analyzed to determine mean, median, standard deviations, and outliers (data points that appear to be inconsistent). Seasonality will be assessed, and the distribution graphed. Other graphical representations that could be useful to the GWMA Committee (box plots, ranked data plots, and others) will also be produced.

Professionals who have experience in environmental assessments indicate there is no completely accurate way to predict what the data will look like before the samples are collected and analyzed. Factors such as whether the data are normally distributed, if there are any non-detects in the data set, the quality of the data, and the extent/effect of seasonality on the well data all have the potential to influence which statistical method is appropriate. Once the baseline (nine quarters) information is available, the appropriate statistical approaches will be more evident.

The GWMA Technical Staff professionals will evaluate all the data, and propose the statistical tests that will be meaningful to the GWMA Committee to determine when the water quality is improving. This proposal will be generated at the first GWMA Committee meeting after the nine quarters of nitrate results have been collected and analyzed.

Table 7 - Agriculture Measures of Implementation and Potential Implementing Entities

Strategy	Measures of Implementation	Potential Lead Implementing Entities
1.1 Coordinate agricultural surface water and groundwater pollution control efforts	1) SWCDs contacted about revising Scopes of Work (1 year) 2) SWCD Scopes of Work revised (2 years) 3) Develop groundwater quality items for the Water Quality Management Area Plans (1 year) 4) Include groundwater quality items during Water Quality Management Area Plans review (2 years)	ODA, SWCDs
2.1 Write and publish articles	5) Articles written and published (1+ years)	SWCDs, OSU Extension, LCOG
2.2 Share information and coordinate with agribusiness, producers, and producer groups	6) Meeting with agribusiness field representatives (1 year) 7) Establish systems for tracking groundwater quality contacts (1 year) 8) Track groundwater quality contacts (2+ years)	SWCDs, ODA, CPRCD, NRCS
2.3 Organize and deliver workshops and demonstration projects	9) Demonstration projects designed (1 year) 10) Demonstration projects implemented (2+ years) 11) Tours offered (2+ years) 12) Workshops offered (2+ years) 13) Track attendance at tours and workshops (2+ years)	SWCDs, OSU Extension, ODA, CPRCD, NRCS
2.4 Hold workshops to educate producers about federal assistance programs	14) Design workshops (1 year) 15) Hold workshops (2+ years) 16) Track producers and number acres enrolled in conservation programs (2+ years)	NRCS, CPRCD, SWCDs, ODA, OSU Extension
3.1 Develop a groundwater monitoring plan for agricultural areas	17) Agreement reached on baseline data collection protocol (1 year) 18) Data collection begins to gather baseline data (1 years) 19) Data compiled into report and updated annually (2+ years) 20) Long-term monitoring plan developed (2 years) 21) Monitoring plan implemented and results presented every two years (3+ years)	DEQ, ODA, OSU, NRCS, CPRCD, WSCs
3.2 Document groundwater-related violations	22) Track the number of groundwater violations (1+ years)	ODA
4.1 Research and document BMP effectiveness	23) Create a priority list of ideas to research (1 year) 24) Create a research plan (2 years) 25) Summary of research findings produced (5+ years)	OSU, ODA, NRCS
4.2 Measure the success of BMP Implementation efforts.	26) Design mechanism to develop baseline of BMP awareness (2 years) 27) Repeat measurement of BMP awareness and report on findings (5+ years)	OSU, ODA, NRCS
5.1 Obtain sufficient funding to support priority research needs	28) Create a priority list of ideas to research (1 year) 29) Grant applications prepared and submitted (1+ years)	OSU, ODA, NRCS
5.2 Obtain sufficient financial assistance	30) Develop baseline understanding of current funding to assist producers in the GWMA (2 years) 31) Track changes in funding amount and allocation (2+ years)	ODA, SWCDs

Table 8 - Residential Measures of Implementation and Potential Implementing Entities

Strategy	Measures of Implementation	Potential Lead Implementing Entities
1.1 Launch public information campaign	1) Average of six contacts/year per GWMA household via newsletters, press releases, displays and posters, etc. (June 2007) 2) Awareness of nitrate issue by 80% of GWMA residents aware of nitrate issues as indicated by random survey (Spring 2009)	OSU Extension, LCOG, or other appropriate groups
1.2 Offer new groundwater education programs focusing on GWMA communities	3) Three well and septic classes per year, serving approximately 100 Residents (ongoing) 4) Outreach at five or more events per year within GWMA counties (ongoing) 5) Partnerships formed with Realtors and health care providers for dissemination of groundwater information (3 years)	OSU Extension, LCOG, GWMA lead agency, or other appropriate groups
1.3 Extend K-12 groundwater education and outreach	6) Contact every school in GWMA; teachers from at least three schools will integrate groundwater activities in curriculum (June 2007) 7) Event participation by students and parents from GWMA schools with drinking water protection plans (June 2007) 8) K-12 students involved in at least three GWMA projects (June 2007) 9) At least one issue of GWMA Teachers' Newsletter available (June 2007)	OSU Extension, GWMA lead agency, or other appropriate groups
1.4 Provide groundwater-friendly lawn and garden information	10) Offer "Water-Friendly Gardening" training to Master Gardeners (annually) 11) At least one demonstration garden (3 years) 12) All retail garden businesses in GWMA contacted (1 year) 13) 80% of all retail garden businesses participating in project (3 years)	OSU Extension, GWMA lead agency, or other appropriate groups
2.1 Establish volunteer well monitoring network	14) Establish volunteer monitoring network of at least 50 residential wells (June 2007) 15) 50% of volunteer monitors have discussed groundwater issues with at least three other households (June 2007)	OSU Extension Well Water Program, Watershed Council
2.2 Establish a site-visit program	16) Partners and funds in place to develop program (1 year) 17) Site visits conducted at 250 GWMA residents (3 years)	OSU Extension, County Env. Health
3.1 Offer educational services to interested local governing bodies	18) Interested local governing bodies have received requested information (1 year)	LCOG or other appropriate groups
3.2 Develop list of possible planning strategies for interested local governing bodies	19) Planning kit available for review (within 1 year following funding) 20) Interested users report that they were adequately involved (6 months after planning kit developed) 21) Interested users received necessary information (2 years after planning kit developed)	LCOG, University of Oregon PPPM Department

Table 8 - Residential Measures of Implementation and Potential Implementing Entities		
Strategy	**Measures of Implementation**	**Potential Lead Implementing Entities**
4.1 Ensure that site-suitable wastewater treatment technologies can be used to reduce nitrate	22) Technical team has made recommendations to DEQ regarding rule changes (within 2 years of Action Plan approval) 23) If deemed necessary, Geographic Rule for GWMA adopted (within 3 years of submitting supporting reports to DEQ)	GWMA lead agency, County Environmental Health
4.2 Provide financial incentives to encourage use of nitrate reducing technologies	24) State Revolving Loan Funds available for septic improvements (1.5 years) 25) Research and report on tax credit viability completed (3 years) 26) At least one septic system in each GWMA county has benefited from incentives (2 years) 27)	GWMA lead agency, County Environmental Health
5.1 Inform residents of the risk of nitrate reaching groundwater via problem wells and assist in resolving any issues	28) 50 landowners with problem wells are identified and have received Well Action Packet (June 2007) 29) 25 residents served by pilot incentives program and program report available (2 years) 30) Sufficient funding to address increased requests for assistance (3 years)	Oregon Water Resources Department, OSU Extension, GWMA lead agency, other appropriate groups
5.2 Provide assistance to help well owners overcome financial barriers	31) Financial assistance available to low-income well owners (1 year) 32) At least 10 wells repaired or decommissioned with financial assistance (2 years)	GWMA lead agency or other appropriate groups

Table 9 – Commercial/Industrial/Municipal Measures of Implementation and Potential Implementing Entities

Strategy	Measures of Implementation	Potential Lead Implementing Entities
1.1 DEQ-regulated point sources should not be permitted to exceed 7.0 mg/L nitrate at the point of compliance.	1) Completed inventory of permitted facilities within GWMA (2 year) 2) Annual documentation of the number of new or renewed Water Quality permits with GWMA concerns addressed by incorporating the compliance limit of 7.0 mg/L nitrate (1+ years)	DEQ, local jurisdictions
1.2 Promotion of alternate treatment technologies for sewerage and land applications	3) Annual documentation of the numbers of wastewater operators and land applicators that received guidance, training, or educational materials (2+ years) 4) A demonstrated increase in the number of facilities using alternative technologies (2 years)	DEQ, local jurisdictions
2.1 Mechanisms for reducing future groundwater impacts from new commercial, industrial or municipal developments with large onsite systems planned to be built in "*high-risk"* areas	5) One or more counties evaluate an overlay zone map (2 years) 6) At least one county has conducted a review of groundwater protection options to apply to new developments (3 years)	Local jurisdictions, LCOG
2.2 Support for the City of Coburg to centralize wastewater treatment.	7) Coburg connected majority of homes and businesses within UGB to a permitted wastewater treatment system by November 2011.	City of Coburg, DEQ/Lead Agency others
3.1 Write and publish articles and brochures	8) Annual status report to GWMAC on Commercial/ Industrial/ Municipal activities (2 years) 9) Two articles published (1+ years) 10) At least one major media coverage event (2 years)	DEQ/Lead Agency, OSU Extension
3.2 Utilize existing forums and create new opportunities to discuss the GWMA and present information on successful approaches	11) GWMA representatives present information about the GWMA at appropriate venues (1+ years) 12) Lead Agency has made at least 100 groundwater quality contacts with Commercial/Industrial/Municipal representatives (Every year)	DEQ/Lead Agency, LCOG
3.3 Provide technical assistance opportunities and coordinate with targeted and interested organizations and property owners.	13) Lead Agency has at least 10 contacts with County Sanitarians, property owners and/or DEQ onsite or land application staff (1 year) 14) Lead Agency documents an increase in the number of grounds maintenance enterprises using fertilizing, watering and mowing techniques to minimize or eliminate groundwater contamination 15) DEQ has provided technical assistance to all bulk fertilizers facilities in the GWMA (2 years)	Counties, DEQ/ Lead Agency, Oregon Wastewater Association (O2WA)
3.4 Recognize those commercial, industrial or municipal entities that set a good precedent	16) Recognition program established and operational (2+ years) 17) Prepare a website to house industry-specific BMP materials and to track progress in specific programs (3 years) 18) At least 50 BMP pamphlets are distributed annually to appropriate Commercial/industrial/ Municipal or grounds maintenance companies	DEQ/Lead Agency, LCOG, O2WA, local jurisdictions

Table 9 – Commercial/Industrial/Municipal Measures of Implementation and Potential Implementing Entities

Strategy	Measures of Implementation	Potential Lead Implementing Entities
4.1 Gather accurate baseline groundwater data	19) Agreement reached on baseline data collection protocol (Dec 2006) 20) Data collection begins to gather baseline data (1 years) 21) Data compiled into report and updated annually (2+ years)	DEQ
4.2 Monitor and evaluate groundwater improvements	22) Long-term monitoring plan developed (June 07) 23) Monitoring plan implemented and results presented every two years (3+ years) 24) Existing Passive Capillary Stations (PCAPS) sampled and new PCAPS installed at existing large onsite facilities	DEQ, ODA, OSU Extension
5.1 Research and document wastewater treatment technologies	25) Literature review of wastewater treatment technologies completed (2 years) 26) Meeting with interested agencies occurs (2 years)	DEQ, O2WA, LCOG, local jurisdictions
6.1 Document and evaluate funding options to support priority research and resource needs. Incorporate the scientific literature review in the process to prioritize research needs	27) Literature review of wastewater treatment technologies completed (1+ years) 28) Funding database prepared and maintained (1+ years) 29) Priority needs identified (2 years)	DEQ, LCOG, OSU

Table 10 - Public Water Supply Measures of Implementation and Potential Implementing Entities

Strategy	Measures of Implementation	Potential Lead Implementing Entities
1.1 Notify local emergency response planners of the locations of the Drinking Water Source Areas	1) One-hundred percent of emergency response planners have been notified (1 year) 2) Water system operators contacted about all emergency situations with potential impacts (2+ years)	Water system operators, local jurisdictions, DHS
1.2 Distribute materials through local planning departments, with permit applications, and at public works offices	3) Four cities and three counties distributing information (1 year) 4) One-hundred percent of new development applicants receive information (2 years)	Local jurisdictions, LCOG
1.3 Erect signs along major roadways	5) Signs installed (2 years) 6) Informational phone number established (2 years) 7) Track the number of calls received (2+ years)	Counties, LCOG, DHS
1.4 Mail a booklet on proper septic system care, maintenance, and inspection to rural residents	8) Mail 1,000 booklets (1 year) 9) An increase in number of inspection and/or pumping requests to local onsite companies (3+ years)	LCOG, local onsite professionals
1.5 Mail letters on recipients location within the Groundwater Management Area	10) Mailings sent to all residents (2 years)	LCOG, DEQ, OSU Extension
2.1 Document all available funding sources to address drinking water protection issues	11) Completion of funding source matrix (1 year) 12) Track number of funding sources identified (1+ years)	LCOG, OSU Extension
2.2 Explore the possibility of holding region-wide free household hazardous waste collection events	13) Increase in the number of events held (2 years) 14) Increase in the number of participants and waste collected (3+ years)	Household waste coordinators, public works staff, DEQ, LCOG
2.3 Institute tax credits for pollution control technologies and alternative treatment septic systems	15) Program proposal to DEQ and state legislature (5 years) 16) Track the number of credits granted (5+ years)	Elected officials, DHS, DEQ
3.1 Develop a format for utility bills to show water conservation equals costs savings	17) Monitor and compare municipal water consumption annually (1+ years)	LCOG, City public works staff, elected officials
3.2 Provide access to water-saving products	18) Programs presented to local jurisdictions (3 years) 19) All four cities and three counties have considered programs (4 years) 20) Track the number of products obtained (5+ years)	Public works departments, water system operators, and public officials
4.1 Establish a region-wide annual awards program	21) Awards program designed and implemented (2 years) 22) Track number of applicants for the award (2+ years)	Business partners, OSU Extension, SWCDs, ODA
4.2 Explore the possibility of extending an auto shop certification program into the Southern Willamette Valley	23) All local auto shops contacted (2 years) 24) Track the number of auto shops participating (3+ years)	Local jurisdictions, LCOG, DEQ
5.1 Form and coordinate a multi-jurisdiction Pollution Prevention team for the Southern Willamette Valley	25) Participation in regional team (2 years) 26) Track financial assistance received (3+ years)	LCOG, DEQ/Lead agency

Table 10 - Public Water Supply Measures of Implementation and Potential Implementing Entities

Strategy	Measures of Implementation	Potential Lead Implementing Entities
5.2 Provide technical assistance and training opportunities to water systems, local government officials, and planning staff	27) Hold training session (2 years) 28) Annual meeting of local public water system operators (2+ years)	DHS, DEQ, LCOG
5.3 Partner with agricultural organizations to offer on-farm assessments	29) Prepare and advertise program (2 years) 30) Track number of assessments completed (3+ years)	SWCDs, OSU Extension
5.4 Establish a business mentoring program	31) Available spill response resources identified and compiled (1 year) 32) Spill response resources distributed to at least 5 small businesses (2 years)	DHS, DEQ
6.1 Work to establish drinking water protection overlays in the 5-year Time-of-Travel zones in the GWMA	33) Information delivered to all local jurisdictions (2 years) 34) Track the number of overlay zones adopted (3+ years)	Water system operators, local jurisdictions, LCOG
6.2 Provide information to staff and local officials about model ordinances	35) Information compiled (1 year) 36) Meetings held to discuss options with all local jurisdictions (2 years)	LCOG, UO PPM Dept.
6.3 Request county and city planning departments notify water system operators of all proposed development actions in the 5-year time-of-travel zones	37) Maps created and planning departments notified (2 years) 38) Track contacts made to water system operators (2+ years)	Water system operators, LCOG, DEQ
7.1 Help the WRD to prioritize enforcement efforts regarding temporary and permanent well abandonment	39) Document the number of wells decommissioned (2+ years)	WRD, water system operators, DHS
7.2 Alert DEQ to the presence of confirmed leaking underground storage tanks (USTs) and USTs of unknown status	40) DEQ program staff contacted (1 year) 41) All leaking USTs removed or replaced (5 years) 42) All “unknown” USTs classified (5 years)	LCOG, water system operators, local jurisdictions
7.3 Notify DOGAMI of the sand and gravel mining operations within Drinking Water Source Areas	43) DOGAMI staff notified (1 year) 44) Track changes made (2+ years)	DHS, DEQ
7.4 Provide ODA with a map of the CAFO’s drinking water source areas	45) Maps created and ODA staff contacted (1 year) 46) All CAFOs contacted and given materials (2 years)	LCOG, DEQ, DHS
7.5 Request that DEQ make the GWMA a priority area	47) Maps created and distributed to agency staff (1 year) 48) Track efforts initiated by DEQ (2+ years)	LCOG, DHS

Table 11: Agriculture Measures of Effectiveness by Year

Ref. #	Agriculture Year 1	Ref. #	Agriculture Year 2
1	▪ SWCDs contacted about revising Scopes of Work	2	▪ SWCD Scopes of Work revised
3	▪ Develop groundwater quality items for the Agriculture Water Quality Management Area Plans	4	▪ Include groundwater quality items during Water Quality Management Area Plans review
5	▪ Articles written and published	8	▪ Track groundwater quality contacts
6	▪ Meeting held with agribusiness field representatives	10	▪ Demonstration projects implemented
7	▪ Establish systems for tracking groundwater quality contacts	11	▪ Tours offered (on-going)
9	▪ Demonstration projects designed	12	▪ Workshops offered (on-going)
14	▪ Design workshops	13	▪ Track attendance at tours and workshops (on-going)
17	▪ Agreement reached on baseline data collection protocol	15	▪ Hold workshops (on-going)
18	▪ Data collection begins to gather baseline data	16	▪ Track producers and number acres enrolled in conservation programs (on-going)
22	▪ Track the number of groundwater violations (on-going)	19	▪ Data compiled into report and updated annually (on-going)
23	▪ Create a priority list of ideas to research	20	▪ Long-term monitoring plan developed
28	▪ Create a priority list of ideas to research	24	▪ Create a research plan
29	▪ Grant applications prepared and submitted (on-going)	26	▪ Design mechanism to develop baseline of BMP awareness
		30	▪ Develop baseline understanding of current funding to assist producers in the GWMA
		31	▪ Track changes in funding amount and allocation (on-going)

Ref. #	Agriculture Year 3	Ref. #	Agriculture Year 4 and Beyond
21	▪ Monitoring plan implemented and results presented every two years (on-going)	25	▪ Summary of research findings produced
		27	▪ Repeat measurement of BMP awareness and report on findings

Table 12: Residential Measures of Effectiveness by Year

Ref. #	Residential Year 1	Ref. #	Residential Year 2
1	▪ Average of six contacts per household via newsletters, press releases, displays and posters, etc.	22	▪ Technical team has made recommendations to DEQ regarding rule changes
3	▪ Three well and septic classes per year (on-going)	24	▪ State Revolving Loan Funds available for septic improvements
4	▪ Outreach at five or more events per year within GWMA counties (on-going)	26	▪ At least one septic system in each GWMA county has benefited from incentives
6	▪ Contact every school in GWMA; teachers from at least three schools will integrate groundwater activities in curriculum (1 year)	28	▪ 25 residents served by pilot incentives program and program report available
7	▪ Event participation by students and parents from GWMA schools with drinking water protection plans	31	▪ At least 10 wells repaired or decommissioned with financial assistance
8	▪ K-12 students involved in at least three GWMA projects		
9	▪ At least one issue of GWMA Teachers' Newsletter available		
10	▪ Offer "Water-Friendly Gardening" training to Master Gardeners (on-going)		
12	▪ All retail garden businesses in GWMA contacted		
14	▪ Establish volunteer monitoring network of at least 50 residential wells		
15	▪ 50% of volunteer monitors have discussed groundwater issues with at least three other households		
16	▪ Partners and funds in place to develop program		
18	▪ Interested local governing bodies have received requested information		
27	▪ 50 landowners with problem wells are identified and have received Well Action Packet		
30	▪ Financial assistance available to low-income well owners		

Ref. #	Residential Year 3	Ref. #	Residential Year 4 and Beyond
2	▪ Awareness of nitrate issue by 80% of GWMA residents aware of nitrate issues as indicated by random survey	20	▪ Interested users report that they were adequately involved
5	▪ Partnerships formed with Realtors and health care providers for dissemination of groundwater information	21	▪ Interested users received necessary information
11	▪ At least one demonstration garden		▪ On-going activities
13	▪ 80% of all retail garden businesses participating in project		
17	▪ Site visits conducted at 250 GWMA residents		
19	▪ Planning kit available for review		
23	▪ If deemed necessary, Geographic Rule for GWMA adopted		
25	▪ Research and report on tax credit viability completed		
29	▪ Sufficient funding to address increased requests for assistance		

Table 13: Commercial/Industrial/Municipal Measures of Effectiveness by Year

Ref. #	Commercial/Industrial/Municipal Year 1	Ref. #	Commercial/Industrial/Municipal Year 2
2	▪ Annual documentation of the number of new or renewed Water Quality permits with GWMA concerns addressed by incorporating the compliance limit of 7.0 mg/L nitrate (on-going)	1	▪ Completed inventory of permitted facilities within GWMA
9	▪ Two articles published (on-going)	3	▪ Annual documentation of the numbers of wastewater operators that received guidance, training, or educational materials (on-going)
11	▪ GWMA representatives present information about the GWMA presented at appropriate venues	4	▪ A demonstrated increase in the number of facilities using alternative technologies
12	▪ Lead Agency has made at least 100 groundwater quality contacts with Commercial/Industrial/Municipal representatives (on-going)	5	▪ One or more counties evaluate an overlay zone map
13	▪ Lead Agency has at least 10 contacts with County Sanitarians, property owners and/or DEQ onsite or land application staff	8	▪ Annual status report to GWMA Committee on Commercial/ Industrial/Municipal activities
14	▪ Lead Agency documents an increase in the number of grounds maintenance enterprises using fertilizing, watering and mowing techniques to minimize or eliminate groundwater contamination	10	▪ At least one major media coverage event
18	▪ At least 50 BMP pamphlets are distributed annually to appropriate Commercial/industrial/ Municipal or grounds maintenance companies	15	▪ DEQ has provided technical assistance to all bulk fertilizers facilities in the GWMA
19		16	▪ Recognition program established and operational
20		21	▪ Data compiled into report and updated annually
22	▪ Agreement reached on baseline data collection protocol	25	▪ Literature review of wastewater treatment technologies complete
27	▪ Data collection begins to gather baseline data	26	▪ Meeting with interested agencies occurs
	▪ Long-term monitoring plan developed	28	▪ Funding database prepared and maintained
	▪ Literature review of wastewater treatment technologies completed	29	▪ Priority needs identified

Ref. #	Commercial/Industrial/Municipal Year 3	Ref. #	Commercial/Industrial/Municipal Year 4 and Beyond
17	▪ Prepare a website to house industry-specific BMP materials and to track progress in specific programs	7	▪ Coburg connected majority of homes and businesses within UGB to a permitted wastewater treatment system by November 2011.
6	▪ At least one county has conducted a review of groundwater protection options to apply to new developments		▪ On-going activities
23	▪ Monitoring plan implemented and results presented every two years		
24	▪ Existing Passive Capillary Stations (PCAPS) sampled and new PCAPS installed at existing large on-site facilities		

Table 14: Public Water Supplies Measures of Effectiveness by Year

Ref. #	Public Water Supplies Year 1	Ref. #	Public Water Supplies Year 2
1	▪ One-hundred percent of emergency response planners have been notified	2	▪ Water system operators contacted about all emergency situations with potential impacts (on-going)
3	▪ Four cities and three counties distributing information	4	▪ One-hundred percent of new development applicants receive information
8	▪ Mail 2,000 booklets	5	▪ Signs installed
11	▪ Completion of funding source matrix	6	▪ Informational phone number established
12	▪ Track number of funding sources identified (on-going)	7	▪ Track the number of calls received (on-going)
17	▪ Monitor and compare municipal water consumption annually	10	▪ Mailings sent to all residents
31	▪ Available spill response resources identified and compiled	13	▪ Increase in the number of events held
35	▪ Information compiled	21	▪ Awards program designed and implemented
40	▪ DEQ program staff contacted	22	▪ Track number of applicants for the award (on-going)
43	▪ Department of Geology and Mining Industries staff notified	23	▪ All local auto shops contacted
45	▪ Maps created and ODA staff contacted	25	▪ Participation in regional team
47	▪ Maps created and distributed to agency staff	27	▪ Hold training session
		28	▪ Annual meeting of local public water system operators (on-going)
		29	▪ Prepare and advertise program
		32	▪ Spill response resources distributed to at least 5 small businesses
		33	▪ Information delivered to all local jurisdictions
		36	▪ Meetings held to discuss options with all local jurisdictions
		37	
		38	▪ Maps created and planning departments notified
		39	▪ Track contacts made to water system operators (on-going)
		44	
		46	▪ Document the number of wells decommissioned (on-going)
		48	
			▪ Track changes made (on-going)
			▪ All CAFOs contacted and given materials
			▪ Track efforts initiated by DEQ (on-going)
Ref. #	**Public Water Supplies Year 3**	**Ref. #**	**Public Water Supplies Year 4 and Beyond**
9	▪ An increase in number of inspection and/or pumping requests to local onsite companies (on-going)	15	▪ Program proposal to DEQ and state legislature
14	▪ Increase in the number of participants and waste collected (on-going)	16	▪ Track the number of credits granted (on-going)
18	▪ Programs presented to local jurisdictions	19	▪ All four cities and three counties have considered programs
24	▪ Track the number of auto shops participating (on-going)	20	
26	▪ Track financial assistance received (on-going)	41	▪ Track the number of products obtained (on-going)
30	▪ Track number of assessments completed (on-going)	42	▪ All leaking underground storage tanks removed or replaced
34	▪ Track the number of overlay zones adopted (on-going)		▪ All “unknown” underground storage tanks classified
			▪ On-going activities

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