SOUTHERN WILLAMETTE VALLEY GROUNDWATER MANAGEMENT AREA ACTION PLAN

UPDATES TO AG SECTIONS ONLY: PLEASE REVIEW THIS DOCUMENT AND COME TO THE MAY 10, 2012 GWMA COMMITTEE MEETING PREPARED TO DISCUSS.

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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.

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~~they may deliver a higher percentage of the applied fertilizer to the target crop.

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.

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~~ a soil amendment at agronomic rates 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.

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.

Agricultural

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.~~,~~ These changes~~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.

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 and very high nitrogen 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. OSU Extension has updated fertilizer guides for many crops grown in the Willamette Valley. Over the last several years, with the loss of field burning as a management tool and a decline in market demand there has been a shift from grass seed to cereal grains, legumes and small seeded crops (clovers). It is important to note that both legumes and clovers are nitrogen-fixing crops.

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 2008~~3~~, Oregon again revised the CAFO program and issued a new CAFO general permit in 2009. ~~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.~~ both state and federal CAFO definitions and regulations. For permit requirements see appendix ??

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.~~While these operations do not require a permit, they are regulated by ODA's Agricultural Water Quality Program, and are prohibited from discharging pollution to surface or groundwater. The Agricultural Water Quality Program regulates all potential agricultural sources of nitrate other than permitted CAFO's. ODA's Water Quality Program responds to water quality concerns or works to prevent and control water pollution with assistance from the Linn, Benton, and Upper Willamette Soil and Water Conservation Districts (SWCD) at the local level. Regulatory oversight is based on a complaint-driven system. Many of the complaints received by the ODA relate to waste from a few animals on small acreages. The complaints are often related to uncovered

manure piles.

Three of ODA's Agricultural Water Quality Areas overlap or fall partially within the geographic boundary of the GWMA including the Middle Willamette, the Upper Willamette/Upper Siuslaw, and the South Santiam. Area Plans for the Management Areas were developed in partnership with ODA, the Local SWCD, and Local Advisory Committees consisting of stakeholders residing in the area. The Area Plans outline voluntary and regulatory mechanisms to help landowners to achieve compliance and for surface and groundwater to meet water quality standards. For more information on the Area Plans and Rules see: http://oregon.gov/ODA/NRD/water_agplans.shtml.

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. Attendees of the 2011 agriculture workgroup supported a repetition of this research to better understand what is happening below the root zone for different cropping and fertilizer application scenarios.

Nutrient and Irrigation Efficiency Management Practice Recommendations

Practice	Resource Concerns Addressed	Benefits to Producer	Costs to Producer
Apply fertilizer at the correct rate and time applications for crop uptake.	Reduces the risk of excess nitrogen in the soil at the end of the growth season.	Precise application saves the producer money in fertilizer costs.	Time related to precision application.
Sample soil prior to fertilizer application to know existing nutrients.	Prevents the application of excess nutrients.	Precise application saves the producer money in fertilizer costs.	Cost of soil sampling and analysis.
Plant winter cover crops to take up excess nitrogen left over after crops are harvested.	Takes up extra nitrogen and limits potential for leaching into ground water.	Stores extra nitrogen in plant matter for later release when cover crop is incorporated into the soil.	Cost of seed and fuel to plant cover crop.
Properly maintain irrigation systems to prevent over-irrigation.	Prevents leaching of excess nitrogen past the root zone.	Uniform irrigation application and save producer money on nitrogen costs.	Replacement nozzles at least every four years is recommended.
Monitor soil water content and adjust irrigation schedules to maintain soil water content in an appropriate range in the root zone.	Prevents over-irrigation and leaching of excess nitrogen past the root zone.	Allows accurate irrigation application and keeps nutrients available to crops.	Soil monitoring equipment and time to evaluate soil water content.
Schedule irrigation applications based on expected evapotranspiration rates.	Prevents over-irrigation and leaching of excess nitrogen past the root zone.	Allows accurate irrigation application and keeps nutrients available to crops.	Time to evaluate expected evapotranspiration rates.

Selker et al, 2004

Confined Animal Feeding Operations (CAFOs)

~~About two percent of the GWMA includes permitted CAFOs.~~ There are currently eight~~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.

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~~, many of the rural homeowners 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

The~~se~~ 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. Regulatory mechanisms are in place through ODA's Agricultural Water Quality Program. Agricultural Water Quality Rules state that agricultural practices cannot pollute waters of the state, including groundwater. The most important objective that is likely to impact groundwater nitrate levels is implementation of Best Management Practices by landowners. Monitoring and research goals are vital to accurately measure how well the Action Plan and Area Plans are~~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.

The following section identifies the objectives, strategies and actions associated with two goals for achieving continued reduction of nitrate inputs from agricultural lands. The GWMA Committee has identified the following as high priority goals, objectives, strategies, and actions with the intent of improving groundwater quality in the GWMA. The GWMA Committee recommends that ODA, DEQ, the Linn, Upper Willamette, and Benton SWCD, watershed councils, and other partners implement these strategies and actions to address groundwater quality. The Committee recognizes that this list is not all-inclusive, that other strategies may also be effective in improving water quality, and that resources may not permit these objectives, strategies, and actions to be completed in the specified timeframes.

Goal 1: Prevent and control pollution of groundwater from agricultural activities and achieve applicable water quality standards that protect beneficial uses through voluntary management actions.

Goal 2: Reduce existing concentrations of nitrate and prevent further contamination from agricultural sources of groundwater in the GWMA. Identify: practices contributing to contamination, best management practices to prevent nitrogen inputs to groundwater, and a schedule for implementation of actions.

Objective 1: Education and Outreach—Organize education and outreach efforts to increase the agricultural community's awareness of groundwater vulnerability and best management practices.

Strategy 1.1 Within the GWMA, coordinate agricultural surface and groundwater pollution control efforts. Coordinate groundwater pollution control efforts among the various agriculture-related organizations and plans in the GWMA.

Actions

- Annually evaluate the Benton, Upper Willamette, and Linn SWCD Scopes of Work to include groundwater quality tasks. These tasks should focus on nitrogen use efficiency, irrigation use efficiency, and manure management.
- During biennial reviews of the South Santiam, Middle Willamette, and Upper Willamette Agricultural Water Quality Management Area Plans, update groundwater quality items in the Goals and Objectives. The Area Plans Goals and Objectives sections should include a focus on nitrogen use efficiency, irrigation efficiency, and manure management.
- Communicate to NRCS local work groups the priority of spending funds on nutrient use efficiency, irrigation efficiency, and manure management within the GWMA.

Strategy 1.2 Organize and deliver workshops and demonstration projects aimed at producers to show BMP implementation and increase BMP adoption. At the workshops, educate producers about groundwater conditions, populations at risk from high nitrate levels, federal assistance programs, and sustainable agriculture opportunities.

Actions

- Each SWCD develop two demonstration projects showcasing successful BMPs and systems.
- Organize one tour (field or virtual) of each demonstration project for agricultural managers and producers. Partner with agribusiness for tours of demo projects.
- Each year partners sponsor two small acreage resource management workshops that provide presentations (either as a stand alone presentation or part of a broader presentation) on surface and groundwater quality issues.
- Include information on sustainable practices, incentive programs, and third-party certification at the workshops. The goal is to attract 100 producers annually to the demonstrations and workshops.

Strategy 1.3 Write and publish articles to promote/improve the agricultural community's awareness of water quality issues in the GWMA.

Actions

- Once per year, provide an update on the status of the GWMA and associated water quality data in the Benton SWCD newsletter. The Linn and Upper Willamette SWCDs do not have a newsletter and therefore, should provide an update to be included in a partner newsletter. This may include OSU Extension for the Linn SWCD and the Farm Service Agency for the Upper Willamette SWCD.
- Publish two media articles or public service announcements per year in the GWMA about successful agricultural resource management practices.

Strategy 1.4 Share information and coordinate with agribusiness, producers, and producer groups to promote practices and conditions that protect and improve water quality.

Actions

- Follow-up meeting with agribusiness field representatives active in the GWMA to review the groundwater nitrate issue and share appropriate outreach materials. This should occur in 2012 and once every three years thereafter. Possible ways to meet with field representatives include:
    - Grower meetings
    - Individual company meetings
    - Oregon Agriculture Chemical and Fertilizer safety training workshops
- 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.
- Make at least 100 contacts (total) with landowners about groundwater quality per year within the areas served by the Benton, Upper Willamette, and Linn SWCDs.
- Provide or develop outreach materials for producers that summarizes practical resource management for groundwater quality.

Objective 2: Resource Management—Implement best management practices in the GWMA to improve groundwater quality.

Strategy 2.1 Work with agricultural producers in the GWMA to implement practices to improve groundwater quality.

Actions

- Provide technical assistance to producers in the GWMA. Each SWCD will have a minimum of 25 contacts with producers within the GWMA annually promoting irrigation efficiency, and nutrient and manure management.
- Promote proper nutrient management, irrigation efficiencies, and manure management to reduce nitrogen loss to groundwater. Each SWCD will work with four producers within the GWMA annually to design and implement best management practices.

Strategy 2.2 Obtain sufficient financial assistance to support technical assistance to producers and implementation of resource management practices.

Actions

- Include tasks in the SWCDs Scopes of Work for technical assistance to producers and to seek funds for implementation of practices related to groundwater quality.
- Communicate to NRCS local work groups the priority of spending funds on nutrient use efficiency, irrigation efficiency, and manure management within the GWMA.
- Include the promotion and support of USDA programs such as the Environmental Quality Incentives Program and the Conservation Reserve Enhancement Program into SWCD work plans and Scopes of Work.
- Seek funds from USDA incentive based cost-share programs to assist producers to implement groundwater protection practices.
- Seed DEQ 319 funds to assist with agricultural on-the-ground projects and management practices that minimize groundwater nitrate pollution.

Strategy 2.3 Develop and target a priority area within the GWMA to evaluate progress related to implementation of the Agricultural Water Quality Plans and GWMA Action Plan. (The purpose of the priority area is to evaluate the area before and after targeting and demonstrate progress. Progress is a measurement of improvement of water quality parameters or surrogates.) As resources and time allows, multiple priority areas will be identified for targeting.

Actions

- Identify a priority area to target education, outreach, and other resources. This area should be identified by July 2012.
- Identify BMPs that will be promoted for improvement of groundwater quality.
- Identify management practices or conditions that assure agricultural contributions of nitrate to groundwater are at acceptable levels.
- Measure soil nitrate levels at enough sites in the priority area to assess potential of nitrate leaching.
- Contact all landowners within the priority area with information on the GWMA and best management practices to reduce nitrate inputs.
- Develop targets and milestones specific to the priority area.
- Implement management practices with all willing landowners in the priority area.

Strategy 2.4 Obtain adequate funding for implementation of desired practices within the priority area.

Actions

- Develop implementation and funding plan for the identified priority area.
- Work with producers in the priority area to determine interest in implementation of specific practices.
- Work with partners to submit funds proposals to cost-share implementation of practices.

Objective 3: Monitoring and Research—Monitor groundwater quality in agricultural areas to evaluate the impacts of agricultural management practices. Research best management practice effectiveness, adoption of best management practices, and priority research needs.

Strategy 3.1 Evaluate current domestic and monitoring wells to determine monitoring needs in agricultural areas.

Actions

- Coordinate with local, state, and federal partners to evaluate current surface and groundwater monitoring network and identify additional monitoring needs. By January 2013.
- Evaluate aquifer characteristics to determine whether the existing monitoring wells provide comprehensive data on nitrate concentrations or if additional wells are necessary to monitor nitrate levels in the GWMA.
- Evaluate LiDAR (light detection and ranging) data to understand connections between wells.

Strategy 3.2 Measure the success of Best Management Practice implementation efforts.

Actions

- Measure producer (within the priority area from Strategy 2.3):
    - Awareness of groundwater quality issues,
    - Level of best management practice implementation,
    - Ease of implementing best management practices, and
    - Barriers to best management practice implementation.
- This measurement should be completed in the spring of 2013 and repeated two years later to determine any changes. Target: 50% of the producers surveyed in 2013 using groundwater protection best management practices as identified by groundwater staff and agricultural partners.

Strategy 3.3 Document groundwater related investigations and violations of Agricultural Water Quality Management Area Rules and CAFO permit conditions within the GWMA.

Actions

- Document the number, issue, validity, and outcome investigations regarding potential violations of Agricultural Water Quality Management Area Rules where the violations could impact groundwater.
- —Document CAFO violations and outcomes.

Strategy 3.4 Research, document and coordinate Best Management Practice effectiveness. Implement priority research identified at February 2010 researchers meeting.

Actions

- Follow-up to the February 2010 researchers meeting to track progress related to identified priority research and funding needs. Research needs identified include:
  - Nitrogen budgets and best management practices for other and nontraditional crops (such as specialty seed crops)
  - Nitrogen mineralization under different crop scenarios
  - Bioreactors on tile lines
  - Time of groundwater travel (data needs improved)
  - No till vs. conventional (Difference in cost and potential leaching)
  - Study nitrate sources and how nitrate moves
  - Impact of tile lines on nitrate concentration and movement
- Maintain a prioritized research plan and identified sources of funding.
- Work with OSU or other partners to design a nitrate leaching study to further characterize potential nitrate leaching from various agricultural sources in the GWMA.
- Implement research to measure best management practice and systems effectiveness and identify factors affecting groundwater nitrate levels from agricultural practices.
- Research and document effectiveness and impacts of specific Best Management Practices on nitrate leaching.

Strategy 3.5 Obtain sufficient funding to support priority research needs.

Actions

- Submit research grant applications to support high priority research needs. Potential grant sources include the DEQ 319 program, ODA's fertilizer research funds, EPA, the USDA, and other agencies and private organizations.

~~**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

ú 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.

ú 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[1] number of new applicants for federal grant and assistance programs increases at least 25 percent within five years after Action Plan approval.
- By[2] 2011, the number of acres enrolled in conservation programs has increased by 20 percent.
- In[3] 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

ú 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.

ú 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[4].

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.

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[5] 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

- ú 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.
- ú 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.
- ú 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
- ú The three actions above should occur during the state 2006-2007 fiscal year.
- ú Implement new research to measure BMP and systems effectiveness and to identify the priority factors affecting groundwater nitrate levels from agricultural practices.
- ú The action above should begin during the state 2007-2008 fiscal year and continue until DEQ rescinds the GWMA declaration.
- ú 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

- ú Measure[6] producer awareness of groundwater quality issues and the level of BMP implementation to create a baseline of BMP use.
- ú Measure the ease of implementing BMPs and barriers to BMP implementation.
- ú Repeat the first and second action measurements every five years.
- ú Publish the findings every five years as part of the DEQ periodic review.
- ú 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[7].

Strategy 5.1 Obtain sufficient funding to support priority research needs.

Actions

- ú 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.
- ú This should begin in the state 2006-2007 fiscal year.
- ú 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

- ú 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.
- ú 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.
- ú 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.
- ú 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[8].
- ú 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.

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~~ Include groundwater quality tasks in the SWCD Scopes of Work. ~~(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
1.2 Organize and deliver workshops and demonstration projects	5) Demonstration projects designed 6) Demonstration projects implemented 7) Tours completed 8) Workshops completed 9) Attendance at tours and workshops	SWCDs, NRCS, ODA, OSU Extension
1.3~~2.1~~ Write and publish articles	4) ~~5)~~ Articles written and published in newsletters and 4) ~~other local media (1+ years)~~	SWCDs, OSU Extension, LCOG
1.4~~2.2~~ Share information and coordinate with agribusiness, producers, and producer groups	10~~6~~) ~~M~~Follow-up meeting with agribusiness field representatives ~~(1 year)~~ 11~~7~~) Establish systems for tracking groundwater quality contacts ~~(1 year)~~ 12~~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~~
2.1 Work with producers to implement practices to	13) Landowners provided with technical assistance 14) Best management practices implemented by landowners	SWCDs, NRCS, OSU extension, ODA

Table 7 – Agriculture Measures of Implementation and Potential Implementing Entities

Strategy	Measures of Implementation	Potential Lead Implementing Entities
improve groundwater quality		
2.2 Obtain financial support for technical assistance and practice implementation	15) Track changes in funding amounts and allocations 16) Landowners signed up for USDA cost-share programs 17) Grant applications submitted and approved for implementation of practices	SWCDs, NRCS, ODA, OSU extension.
2.3 Develop and target priority area to evaluate progress	18) BMPs identified in relation to improvement of groundwater quality 19) Soil nitrate levels in the priority area measured 20) Landowners contacted in the priority area 21) Practices implemented in the priority area	
2.4 Obtain adequate funding for implementation in the priority area	22) Landowners interested in implementation of specific practices 23) Funds proposals submitted	
3.1 ~~Develop a groundwater monitoring plan for agricultural areas~~Evaluate current monitoring to determine needs in 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)~~ 24) Additional monitoring needs identified 25) Aquifer characteristics evaluated	DEQ, ODA, OSU, NRCS, ~~CPRCD,~~ WSCs
3.2 Measure success of BMP implementation efforts	26) Measure baseline of BMP awareness, implementation, ease of implementation, and barriers to implementation 27) Repeat measurement after two years	ODA, SWCDs
3.3~~2~~ Document groundwater-related violations	22) Track the number of groundwater violations and investigations ~~(1+ years)~~	ODA
3.5~~4.1~~ Research and document BMP effectiveness;	23) Meet to update the ~~Create a~~ priority list of ideas to research ~~(1 year)~~ 24) ~~Create a research plan~~Maintain research plan and identified	OSU, ODA, NRCS

Table 7 – Agriculture Measures of Implementation and Potential Implementing Entities

Strategy	Measures of Implementation	Potential Lead Implementing Entities
implement priority research identified in February 2010	sources of funding ~~(2 years)~~ 25) Summary of research findings produced ~~(5+ years)~~	
~~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~~Meet to update the 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~~