Benton County

Groundwater Nitrate Community Action Plan

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Prepared by Benton Conservation District
and
EA Engineering, Science, and Technology, Inc. PBC

On behalf of

Benton County Groundwater Stakeholder Committee

Adopted by:

Benton County Board of County Commissioners

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Chairman Date

Benton-Franklin Health District

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Chairman Date

Benton Conservation District

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Chairman Date

Benton County Groundwater Nitrate Community Action Plan

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Executive Summary

The residents, businesses, and governments of Benton County are stewards of the groundwater resources underlying the County for current and future generations. Concerns over the occurrence of nitrate in County groundwater led to an application for grant funding from the Department of Ecology (Ecology). The grant was used to:

1. Prepare a baseline evaluation of groundwater nitrate conditions in the County.
2. Convene a stakeholder group, henceforth referred to as the Stakeholder Committee, to review these findings and discuss actions that might be implemented to reduce groundwater nitrate concentrations in areas of concern.
3. Prepare an Action Plan to guide local agencies and stakeholder efforts in reducing groundwater nitrate in the future.

As the Action Plan is implemented, it will inform the public and guide their groundwater protection activities focusing on groundwater nitrate. Benton Conservation District (BCD) staff will work with Benton-Franklin Health District (BFHD) staff, the Benton County Commissioners (BCC), and the Stakeholder Committee to coordinate, facilitate, and support implementation of the activities described herein.

Benton County residents recognize that nitrogen sources, like fertilizers, used within the irrigated areas of the county, has likely been the primary contributor of nitrate input into the region's groundwater. Other sources include managed urban and rural landscapes featuring irrigation, animal feeding and husbandry operations, and residential, municipal, and industrial waste water disposal. BCD, BCHD, the County Commissioners, the Stakeholder Committee, and other County stakeholders have agreed that the most effective methods for improving regional groundwater nitrate levels in the County are the following:

- Development of locally-relevant irrigation water management and nutrient management guidelines for fertilizer use and application on agricultural lands and highly managed urban landscapes, including parks.
- Voluntary programs, incentives and education to commercial and non-commercial agriculture producers to encourage implementation of best management practices in irrigation water management and nutrient management.
- Social marketing to facilitate changes in individual behavior to protect groundwater, including public education about drinking water safety and groundwater protection.

This Action Plan, and its referenced supporting documents present: 1) the current understanding of the nature of the groundwater nitrate problem and sources that may contribute nitrate to groundwater in Benton County, 2) recommended management strategies, and 3) a process to implement the strategies and monitor their progress. The Action Plan contains specific goals used to guide the implementation of nitrate management strategies. Monitoring the implementation of Action Plan strategies as well as groundwater quality will be conducted on a regular basis to assess the progress made toward the Action Plan's goals.

GLOSSARY of terms

Abbreviation	Description
AFO	Animal Feeding Operation
bgs	Below ground surface
BMP(s)	Best management practice(s)
CAFO	Concentrated Animal Feeding Operation
CD(s)	Conservation District(s)
CFR	Code of Federal Regulations
CRBG	Columbia River Basalt Group
Dairy NMP	Dairy Nutrient Management Plan
Dryland	Geographical areas without irrigated water systems
Ecology	Washington State Department of Ecology
EPA	United States Environmental Protection Agency
Federal	United States of America Federal Government
ft/d	Feet per day
GIS	Geographic Information System Database
GMA	Growth Management Act
HD(s)	County Health District(s)
ID	Irrigation District
in/hr	Inches per hour
Irrigated Land	Geographical areas with irrigated water systems
IWM	Irrigation Water Management
MCL	Federal EPA maximum contaminant level
MDL	Method detection limit
mg/L	Milligrams per liter equivalent to parts per million
mgd	Million gallons per day
MSL	Mean sea level
MOU	Memorandum of Understanding
NPDES	National Pollutant Discharge Elimination System
NRCS	U. S. Department of Agriculture, Natural Resources Conservation Service
NWIS	The U.S. Geological Survey National Water Information System
ppm	Parts per million = mg/L

POTW	Publicly-Owned Wastewater Treatment Facilities
QAPP	Quality Assurance Project Plan
RCW	Revised Code of Washington
SDWA	Safe Drinking Water Act
SEPA	State Environmental Policy Act
STATSGO	State soil geographic (database)
SWDP	State Waste Discharge Permit
USBR	U. S. Bureau of Reclamation
USGS	United States Geographical Survey
WAC	Washington Administrative Code
WCC	Washington Conservation Commission
WDOH	Washington State Department of Health
WHP	Wellhead Protection Plan
WHPA	Wellhead Protection Plan Area
WRIA	Water Resource Inventory Area
WSDA	Washington State Department of Agriculture
WSU	Washington State University

1.0 Introduction

The residents of Benton County (the County) (**Figure 1**) are stewards of the groundwater resources underlying the county for current and future generations. Groundwater provides most of the potable water used by rural residents. Concerns about groundwater nitrate concentrations above state and federal maximum contaminant level (MCL) of 10 milligrams per liter (mg/L) or parts per million (ppm) brought the citizens of the County together to develop ways to preserve and enhance groundwater quality. Their cooperative effort has resulted in preparation of this document (the Action Plan) to inform and guide county groundwater protection efforts.

1.1 History and Background

Over 20,000 residents, approximately 11% of Benton County's population, live in rural areas. Rural drinking water wells are unregulated and often not tested. Groundwater contamination can happen slowly over decades and remediation can take even longer. Historical groundwater nitrate data was collected in Benton County from the 1970s through 2011 by several agencies, including the Washington State Department of Ecology (Ecology) and the U.S. Geological Survey (USGS). Some domestic wells in Benton County have nitrate levels that exceed the Safe Drinking Water Act and Ecology groundwater standard of 10 mg/L.

Health risks associated with nitrates include methemoglobinemia ("blue baby syndrome"), which reduces the ability of blood cells to carry oxygen. Populations at high risk are infants, pregnant women, and the elderly. Nitrates are colorless, odorless, and tasteless, so the only method of detection is chemical testing. Well testing can serve two functions: to alert residents of health risks and to provide data to characterize groundwater nitrate contamination in Benton County.

Ecology has published several documents describing elevated groundwater nitrate levels in areas of Benton County, including the June 2011 Request for Identification Lower Yakima Valley Groundwater Management Area (LYGWMA). Benton County participated in the formation and early stages of the LYGWMA, but over time developed concerns that the LYGWMA would not be able to adequately deal with the groundwater nitrate issues in Benton County. The LYGWMA only included a small portion of Benton County and as such nitrate concerns in the small sliver of Benton County were overwhelmed by other Yakima County concerns. Benton County Commissioners, BCD, and BFHD realized that it was in the best interest of the residents of Benton County to withdraw from LYGWMA. Ecology released

Benton County from the LYGWMA and expressed sincere interest in seeing Benton County continue discussions regarding nitrate contamination.

Following Benton County's withdrawal from the LYGWMA, and building on earlier Water Resources Inventory Area (WRIA) 31 and LYGWMA efforts, Benton County convened stakeholders to address several specific actions recommended in the WRIA 31 Management Plan with respect to groundwater nitrate issues. These included: (1) the need to inventory nitrate concentrations in all drinking water sources, particularly unregulated single-family exempt wells, in both western and eastern areas of Benton County and in areas of known elevated nitrate in groundwater, (2) voluntary well testing that is confidential and no cost to the well owner, (3) developing a GIS database to manage new and existing groundwater data, and (4) conducting education and outreach to educate the public on proper wellhead protection, groundwater testing and the health risks of high nitrates.

The recently completed Groundwater Characterization Study and this Action Plan is addressing these, and other actions. An inventory was compiled in the Groundwater Nitrate Characterization Study and current and historic nitrate data was compiled into the GIS database. This database has also provided a baseline for the community-wide effort to educate citizens about the sources and risks from groundwater nitrate contamination. This Action Plan calls for ongoing collection of nitrate data to provide basis for scientifically-based adaptive management strategies and continuing public education.

1.2 Scope

The most practical and cost-effective solutions to addressing groundwater nitrate can only be successfully developed and implemented through the active participation of local stakeholders. Recognizing that, BCD received a grant from Ecology to: (1) prepare a baseline evaluation of groundwater nitrate conditions in the County, (2) convene a Stakeholder Committee to review these findings, and (3) prepare an Action Plan (this document) to guide local agencies and stakeholder efforts in reducing groundwater nitrate in the future. The Stakeholder Committee includes participants from agriculture, special-interest groups and the public. BCD facilitated the Stakeholder Committee to adopt recommendations for groundwater nitrate reduction and develop a community response to groundwater nitrates, including the recommendations made in this Action Plan. The Stakeholder Committee's goal for the Action Plan was to develop a community-based effort to reduce nitrate contamination through specific implementation strategies. This Action Plan includes well sampling for public health and scientific purposes, as well as groundwater nitrate characterization and recommendations generated from the stakeholder community.

While Benton County did not petition to form a Groundwater Management Area (GWMA), many of the aspects of the program described in this Action Plan are typical of GWMA processes as described in Revised Code of Washington (RCW) Chapter 90.44.400 through 90.44.440 and WAC 173-100. Benton County's use of GWMA as a general model to improve water issues was supported by local stakeholders and agencies as a preferred alternative over a more formal process. Therefore, this Action Plan generally follows Ecology's GWMA process as it encourages stakeholder engagement and provides local governments with a method to achieve groundwater protection goals. Stakeholder Committee meetings and the characterization report established protocols and guidelines for developing this Action Plan. The guidelines establish a process that allows the planning process to address groundwater issues, concerns, and opportunities from all interested groups and agencies.

After local review and acceptance, this Action Plan will be submitted to BCC, BCD, and BFHD for adoption within their respective agencies. It will then be submitted to Ecology for concurrence. Following that, local and State agencies will work together to derive guidance from this Action Plan when considering actions that may affect its implementation. This Action Plan is not intended to contradict the county plans developed under the Growth Management Act (GMA) or the Voluntary Stewardship Program (VSP), but instead complement them. In addition, while recognizing that other water quality issues are also important to the County, BCC, BCD, BFHD, and the Stakeholder Committee determined that nitrate loading of aquifers was the first critical, scientifically documented, solvable issue for management by the local citizens. For this reason, this Action Plan does not address groundwater constituents other than nitrate.

1.3 Boundaries

This Action Plan is to be implemented in all areas of Benton County exclusive of the U.S. Department of Energy Hanford Site (**Figure 1**). As is described in the Nitrate Characterization Study, Benton County is subdivided into six subareas, designated Prosser, Benton City-Kiona, Richland Wye, Finley, Badger Coulee, and Horse Heaven Hills (**Figure 1**), to describe the different source and hydrogeologic conditions that effect groundwater nitrate occurrence and concentrations.

1.4 Plan Development Approach – A Local Effort

Nitrate loading to groundwater in the County comes primarily from a variety of non-point sources (meaning any source of water pollution not attributable to a specific location or practice as defined in section 502(14) of the Clean Water Act). Enforcement of additional State or local regulations to control

these non-point sources of nitrate would likely be cost prohibitive and unlikely to achieve success. Effecting real change in behavior to protect natural resources is most efficiently achieved through voluntary incentives and education. The Safe Drinking Water Act stipulates that if an imminent health threat to groundwater exists, and local entities are not acting to correct the situation, EPA can issue orders and injunctions to remedy the problem. Without a documented, concerted effort to reduce nitrate contamination of Benton County's groundwater, the community is vulnerable to this type of top-down restrictive management. Implementing this Action Plan will validate this community planning process to address the groundwater nitrate issue in Benton County.

Local leaders have determined that sustainable groundwater protection will be achieved now and in the future when residents understand, and accept the need to change attitudes and practices. Changes in attitudes and practices by residents are most likely to be attained by maximizing public participation in developing and implementing the recommendations presented in this Action Plan. Therefore, effective implementation of this locally developed Action Plan will be proactive, voluntary and locally-driven.

2.0 Goals, Objectives, and Measures of Success

The goals of the Action Plan are as follows:

1. *Provide guidance to stakeholders to address current and future drinking water, agricultural, and industrial needs as it relates to nitrate in groundwater.*
2. *Develop and encourage implementing a series of coordinated BMPs designed to reduce nitrate off site migration and deep percolation, including but not limited to the promotion of agronomic application of organic and inorganic fertilizers and the efficient application of irrigation water for both agriculture and non-agriculture activities.*
3. *Collect and incorporate existing nitrate groundwater data into a shared data management system to be used to improve understanding of the extent of nitrate levels in groundwater within the County.*
4. *Participate in and/or establish a long-term groundwater quality and quantity monitoring program, including an area-wide ambient groundwater monitoring system and a more targeted monitoring system for those areas of very high nitrate concentrations by which to monitor the progress of new and improved BMPs.*
5. *Establish educational programs for promoting the protection of groundwater quality, and provide continuing forum open to County residents to discuss cooperative methods toward continued improvement of groundwater quality.*

To meet these goals this Action Plan describes the four groups of objectives, including: (1) Groundwater Quality, (2) Public Information and Education, (3) Research and Implementation, and (4) Continued Monitoring. These are further described in the following pages.

2.1 Groundwater Quality Objectives

The Stakeholder Committee has collectively developed and adopted the following groundwater quality objective to guide them in focusing the efforts of projects, data collection, and technical analyses:

> *The groundwater quality objective embodied in this Action Plan is to reduce nitrate concentrations in the groundwater of Benton County.*

To meet the groundwater quality objective this Action Plan focuses on best management practices (BMPs) designed to reduce source loading and groundwater nitrate concentrations, tailored to the specific

hydrogeologic geologic conditions of the area. Activities directed towards addressing the Groundwater Quality objective should consider the following:

- They should be achievable given the available data and current level of understanding of occurrence and movement of nitrate in area groundwater.
- They are inclusive of various goals expressed by the stakeholders and agencies.
- They are cost effective because it directs resources where they are most needed.
- It is progressive because it rejects the status quo for nitrate levels in County groundwater.
- Where appropriate, given site-specific hydrogeologic and potential nitrate sources, it helps define specific indicators, such as reduced nitrate concentrations in selected wells over a stated time period, to measure success.
- At the same time, it does not limit project success only to specific numerical thresholds, recognizing that nitrate travel times in some areas with relatively high groundwater nitrate levels cannot be reduced within a specific time frame.
- It will also recognize that any specified time frame must be tied to nitrate travel times in soil and groundwater, which are expected to be highly variable across the County due to varying hydrogeologic conditions, soil types, and land use.

2.2 Public Information and Education Objectives

Public information and education objectives will focus on:

Maintaining previous education and public information activities, and implementing new ones.

Public information and education activities should generally:

- Increase public awareness to support the implementation of this Action Plan.
- Improve public knowledge of the occurrence, causes, and possible mitigation activities for groundwater nitrate, and potential health impacts of nitrate in groundwater.
- Facilitate voluntary implementation of recommended strategies to reduce nitrate levels in County groundwater.

2.3 Research and Implementation Objectives

Research and implementation objectives described in this Action Plan will focus on activities that support Stakeholder Committee efforts, including:

Achieving both short-term and long-term reductions in nitrate loading and/or groundwater nitrate concentrations.

With respect to projects designed to meet research objectives they should:

- Increase knowledge regarding more efficient and effective uses of irrigation water and nitrogen fertilizers under the unique environmental conditions that exist in the Benton County.
- Support meeting other Benton County objectives for groundwater protection.

It is the intent that this research will not duplicate work that has already been accomplished by other entities. When appropriate, such research will be conducted by or with the assistance and cooperation of institutions such as WSU, NRCS, WSDA, and others. Examples of the work the Stakeholder Committee could consider include:

- Promote the use of nutrient and irrigation water management guidelines and tools for commercial agriculture and urban landscapes.
- Promote deep soil testing as a land manager education tool.
- Assist in the development of Nutrient Management Plans for livestock facilities.
- Educate/inform growers of the importance of recognizing and crediting the different sources of nitrogen that crops may use beneficially.
- Provide education on the current state and results of better nitrate management.
- Assist in providing tools and services that will provide data for irrigation water management.
- Encourage conversion to more efficient irrigation systems because efficient irrigation limits nitrate migration to groundwater.
- Identify and evaluate tools to measure nitrogen leaching in real-time.

2.4 Monitoring Objectives

Recommended monitoring objectives were described in the Groundwater Nitrate Characterization Study, and monitoring implemented as a result of this Action Plan will:

Produce scientific data for use in defining the results of source and groundwater nitrate mitigation efforts.

The Groundwater Nitrate Characterization Report defined the three-dimensional distribution of groundwater nitrate concentrations in the County and evaluated potential major causes and controls to nitrate concentrations in groundwater in the County. Continued groundwater monitoring efforts should:

- Develop a long-term monitoring plan to track nitrate concentration trends.Assess BMP effectiveness on a sub-watershed basis.
- Identify County-wide groundwater nitrate concentration trends and their effect on the availability of clean drinking water.
- Continue groundwater sampling to monitor the groundwater nitrate concentrations and identify trends. Sampling would be annual or biennial depending on funding availability.
- Update groundwater trends with every sampling event to discern and possibly mitigate problem areas as soon as possible.
- Develop an adaptable monitoring schedule that can be updated to accommodate field conditions and trends when they become more established.
- Increase sample density as able, especially in areas with low sample density such as the Horse Heaven Hills, so the extent of High Nitrate and Elevated Nitrate areas can be better understood and addressed accordingly.
- Prioritize groundwater monitoring plan components and frequency depending upon available funding.

Future activities could include an annual or biennial well sampling program (based on available funding and Stakeholder Committee priorities), nitrate concentration trend analysis, BMP effectiveness monitoring, drinking water monitoring, and further refinement of describing the distribution of nitrate in the County. Other projects may be proposed in the future to address issues as they arise.

2.5 Measures of Success

The success of activities described in this Action Plan goals will be evaluated by the Stakeholder Committee in association with BCD, BFHD, and other entities using various indicator measures. Examples of these include, but are not limited to:

1. *Adoption/Implementation of BMPs.* Adoption and implementation of BMPs is the first steps toward helping reduce groundwater nitrate levels over time. These could be tracked via outreach, voluntary stakeholder reporting, and BCD's normal activities.

2. *Trends in Nitrate Levels in Wells*. The long-term success of this Plan could, in part, be determined by observed decreases in groundwater nitrate levels across the county. Strategies to periodically monitor, analyze, and report groundwater nitrate concentrations and nitrate deep migration could be employed to evaluate project progress.
3. *Trends in the Level of Public Awareness of Nitrate Concentrations in Their Drinking Water and Health Implications of High Nitrate Levels in Ground Water*. Public information and education projects will facilitate the continued adoption and implementation of BMPs and will strive to foster and maintain a high level of public participation in Plan projects. Generally these will be measured via the tracking of such things as the number of workshops, public appearances, press releases, educational events, website hits, facebook comments, BCD cost-share applications & projects, NRCS cost-share on nitrate-related BMPs, Health District referrals, and requests to BCD for free well testing.

Tracking these measures, and others developed on a project specific basis, will help stakeholders focus their resources in geographical areas and on projects that are most likely to achieve the program goals. Results of the analysis will be presented in periodic progress reports as described elsewhere in this document. BCD, BFHD, and the County Commissioners recognize that successful implementation of the Action Plan requires local citizen participation with support from cooperating State and Federal agencies. This support should include funding, which at a minimum will be needed to prepare progress reports.

3.0 Action Plan Development, Review, and Revisions Oversight

This Action Plan is built on the findings described in the Groundwater Nitrate Characterization Report and from information gathered from experienced stakeholders knowledgeable about their respective technical industries and communities. The Stakeholder Committee spent many volunteer hours discussing, refining, and contributing the many ideas included in the Action Plan. This Action Plan also benefited immensely from contributions made by many staff of local agencies and the funding support of Ecology. Ecology was instrumental in getting the project started and maintaining these efforts. BCD, BFHD, and Benton County Commissioners wish to thank all participants, interested citizens, industry experts, and agency technical support members whose experience and knowledge were pivotal to development of the Action Plan. Their cooperation, commitment, dedication, and perseverance in this effort have been invaluable to its completion.

BCD provided the primary oversight mechanism for consistent and accurate presentation of this Action Plan and it will be the primary local group that will remain actively engaged with the participating local stakeholders and State agencies. BCD will also be the primary vehicle to conduct periodic future review and authorize revisions to the Plan. The Stakeholder Committee, with facilitation by BCD, will act as the primary forum for consideration and discussion of issues as they emerge.

The Action Plan is written in a level of language to allow its use by a wide range of local citizens and other interested groups. It is understood that parts of the Action Plan may not be as easily readable by everyone as it was sometimes necessary to employ scientific terminology to accurately document conditions, or to describe a sensitive viewpoint. It is hoped that local citizens or interested groups will seek further explanation from BCD or their colleagues if needed. The contents of this document are organized to make their reference and review efficient for the local citizens and other reviewers.

Action Plan implementation will begin after its adoption by the Stakeholder Committee. However, early implementation of many initiatives and projects has already begun. These projects will continue and may be augmented with additional projects and expanded scope. Continued funding is necessary to completely implement and monitor the Action Plan.

4.0 Complementary Projects

In addition to activities described in Section 6 of this Action Plan, other activities effecting groundwater are ongoing concurrently, including the Voluntary Stewardship Program and Columbia-Snake River Irrigators Association Conservation Operations & Management (O&M) BMP program. These two efforts are summarized below.

4.1 Voluntary Stewardship Program

Under the State Growth Management Act, counties must protect critical areas which include wildlife habitat and conservation areas, wetlands, floodplains, geologically hazardous areas, and critical aquifer recharge areas. The Voluntary Stewardship Program (VSP) allows agricultural producers to protect these critical areas on a voluntary basis as long as the functions and values of these critical areas are protected on a County wide basis. The activities within this Plan and the VSP Workplan will help achieve the protection goals for critical aquifer recharge areas and groundwater in Benton County.

All lands classified as having moderate to high susceptibility are designated as critical aquifer recharge areas. Critical aquifer recharge areas in Benton County include:

(1) Areas with high susceptibility:

(i) All floodplains and floodways for all rivers, creeks and wetlands mapped by local, state, and federal agencies; or

(ii) Areas of high groundwater identified by the Benton-Franklin Health District where there exists inadequate depth to groundwater for the placement of a waste drainfield.

(2) Areas with moderate susceptibility:

(i) Any areas with both of the following characteristics: Hydrologic A soils as identified in the Natural Resource Conservation Service Benton County Soil Survey and irrigated lands;

(ii) Designated wellhead protection areas. Includes Group A public water supply wells and those Group B wells with a wellhead protection plan filed with the Benton Franklin Health District;

(iii) Areas within one hundred (100) feet of all irrigation district main canals (one hundred (100) feet from edge of canal); or

(iv) Areas with alluvial soils.

4.2 CSRIA Conservation O&M Irrigation BMP Program

The Columbia-Snake River Irrigators Association (CSRIA) Conservation O&M Irrigation BMP Program is part of the larger Voluntary Regional Agreement established under RCW 90.90 between CSRIA and the Department of Ecology. The BMP program provides for a mechanism to document and certify that irrigators (whether large, small, or urban), are meeting the minimum requirements of implementing Irrigation Best Management Practices. While this program was developed to address water quantity issues, the same BMP's also help reduce the leaching of nitrogen caused by excess irrigation applications.

5.0 Groundwater Characterization

This section provides a summary of Benton County hydrogeologic setting, groundwater nitrate occurrence and extent, and potential sources. This discussion is drawn from the Groundwater Nitrate Study to which the reader is referred for additional details.

5.1 Hydrogeologic Setting

Benton County is in the central portion of the Columbia River flood basalt province. The province comprises continental flood basalt flows collectively known as the Columbia River Basalt Group (CRBG), thin interbedded continental sedimentary units known as the Ellensburg Formation, and a thin discontinuous sequence of continental sedimentary units overlying the CRBG alternatively referred to as suprabasalt sediments or alluvial sediments. The youngest strata in Benton County consist of a thin sequence of generally discontinuous continental sedimentary units deposited following the emplacement of the underlying CRBG. Based on surface geologic mapping in Benton County, suprabasalt sediment strata (also referred to as alluvial sediments) include recent wind-blown silt and sand, Quaternary alluvium, Pleistocene cataclysmic flood deposits, Pleistocene loess, and the Mio-Pliocene Ringold Formation and associated unnamed caliches.

The primary groundwater systems underlying Benton County are found within the alluvial sediments overlying the CRBG and within the CRBG. The CRBG aquifer system also is commonly subdivided into systems hosted primarily by the Saddle Mountains Basalt, the Wanapum Basalt and the Grande Ronde Basalt. Further subdivisions of these basalt aquifer systems have also been suggested, such as the upper (Priest Rapids and Roza) and lower (Frenchman Springs) Wanapum. In the Benton County region Ecology Central Region Office also subdivides the Saddle Mountains Basalt into an upper and lower aquifer unit for water rights management.

5.2 Groundwater Quality (Historic and Current)

Although the historic data has a large temporal spread some general behaviors of nitrate in groundwater are observed. The shallower water producing units, the alluvium and the shallow basalt, have the highest measured nitrate effects. In deeper water producing intervals nitrate concentrations are generally less than the shallower intervals.

Nitrate groundwater concentrations are highest in areas with irrigation, both agricultural and urban landscaping, especially in areas where irrigation is known to have been occurring for a long period.

Higher nitrate concentrations in the shallower water producing zones are expected since the nitrate sources in Benton County are associated with surface activities. The presence of nitrate in some wells open to deeper units, the intermediate and shallow basalt, and not others suggests localized migration may occur through natural pathways such as open fractures and faults and artificial pathways such as unsealed wells and/or wells screened through multiple units.

In 2015 and 2016, and continuing into 2017, BCD sampled many wells to get a more up-to-date picture of groundwater nitrate conditions. Water quality samples from most of these wells show *anthropogenic* effects, defined as nitrate concentrations between 1.0 and 10.0 mg/L. The second largest group of sampled wells show *background* nitrate concentrations, defined as nitrate concentrations less than 1 mg/L. The third largest group of recently sampled wells display *elevated* nitrate and the smallest group of wells display *high* nitrate concentrations, defined as having nitrate concentrations of 10 to 20 mg/L and over 20 mg/L, respectively. With respect to specific areas in Benton County:

- Prosser: Of the 41 sampled wells in the Prosser area, 24% of them display *background* levels of nitrate (less than mg/L), 59 % of them display nitrate concentrations indicative of *anthropogenic* effects (nitrate ranging from 1 to less than 10 mg/L), 15% of them display *elevated* effects, and 2% of them contain *high* nitrate.
- Benton City-Kiona: There are 26 sampled wells in the Benton City-Kiona area. Of these, 19% of them are at *background* levels, 73% display concentrations indicative of *anthropogenic* effects, 4% are *elevated*, and 4% are at *high* nitrate levels.
- Richland Wye: There are 30 sampled wells in the Richland Wye area. Of these, 47% of them are at *background*, 37% concentrations were at *anthropogenic* levels, 13% of them are *elevated*, and 3% are *high*.
- Finley: There are 81 sampled wells in the Finley area. Of those, 20% are at *background* levels, 65% are at *anthropogenic* levels, 12% are *elevated*, and 3% contained *high* nitrate levels.
- Badger Coulee area: There are 25 sampled wells in the Badger Coulee area. Of these 12% are at *background*, 52% are at *anthropogenic* levels, 20% are *elevated*, and 16% contain *high* nitrate.
- Horse Heaven Hills: There are 25 sampled wells in the Horse Heaven Hills area. Of these 36% are at *background*, 20% are at *anthropogenic* levels, 20% are *elevated*, and 28% are *high* nitrate.

5.3 County Wide Nitrate-Nitrogen Sources and Budget

This section summarizes a basic understanding of nitrate sources and budget in the County.

5.3.1 Sources

The primary potential sources of nitrogen, and by association nitrate, in Benton County are livestock agriculture, agricultural fertilization activities, urban wastewater, septic systems, residential landscape fertilization, and urban landscape fertilization practices such as large area commercial landscaping including golf courses and parks. Of these, crop agriculture generally covers the largest area and likely contributes the largest amount of nitrogen. Croplands generally receive nitrogen from multiple inputs, including synthetic fertilizer, compost, solid and liquid animal manure, wastewater treatment plant and food processor effluent, wastewater treatment plant biosolids, atmospheric deposition, and nitrate in irrigation water sources. Animal agricultural facilities and areas of high-density residential landscape, irrigation and septic systems may, at least locally, form elevated nitrogen sources. Natural sources may also contribute a small amount of nitrogen. **Figure 2** shows areas in Benton County dominated by these different land uses.

In Benton County, irrigated farming is most common in the Yakima River Valley and adjacent to the Columbia River in the eastern and southern portions of the County (**Figure 2**). The primary source of water for these irrigated areas is surface water drawn from these two rivers and delivered via pipelines and canals. A small area of irrigated farming also occurs in the northwest part of Benton County where the water source is basalt aquifer pumping. Nitrate concentrations are generally expected to be elevated in these irrigated areas because irrigation seepage water moving out of the root zone to depth will carry nitrate with it. Dryland (non-irrigated) agriculture is most common on the Horse Heaven Hills in the south-central County (**Figure 2**). These areas receive little or no artificial irrigation. Consequently, movement of water, and nitrate in solution, to depth is slow and groundwater nitrate concentrations are expected to be lower than in irrigated areas.

The presence of irrigation canals in irrigated areas have the potential to seasonally effect groundwater nitrate concentrations. Leaking irrigation canals can lower nitrate concentrations via dilution of the effected groundwater. Where this occurs one will commonly see decreased groundwater nitrate concentrations during the irrigation season. After the irrigation season ends, nitrate concentrations will then increase as the diluting effect of canal leakage is removed. In dryland areas, elevated shallow groundwater nitrate is occasionally encountered because of the lack of irrigation dilution. **Figure 2** shows the locations of the primary irrigation canals servicing Benton County.

More localized and/or high density land uses that are potential sources of elevated groundwater nitrate include: animal agriculture activities associated with concentrated feeding operations, dairies and their

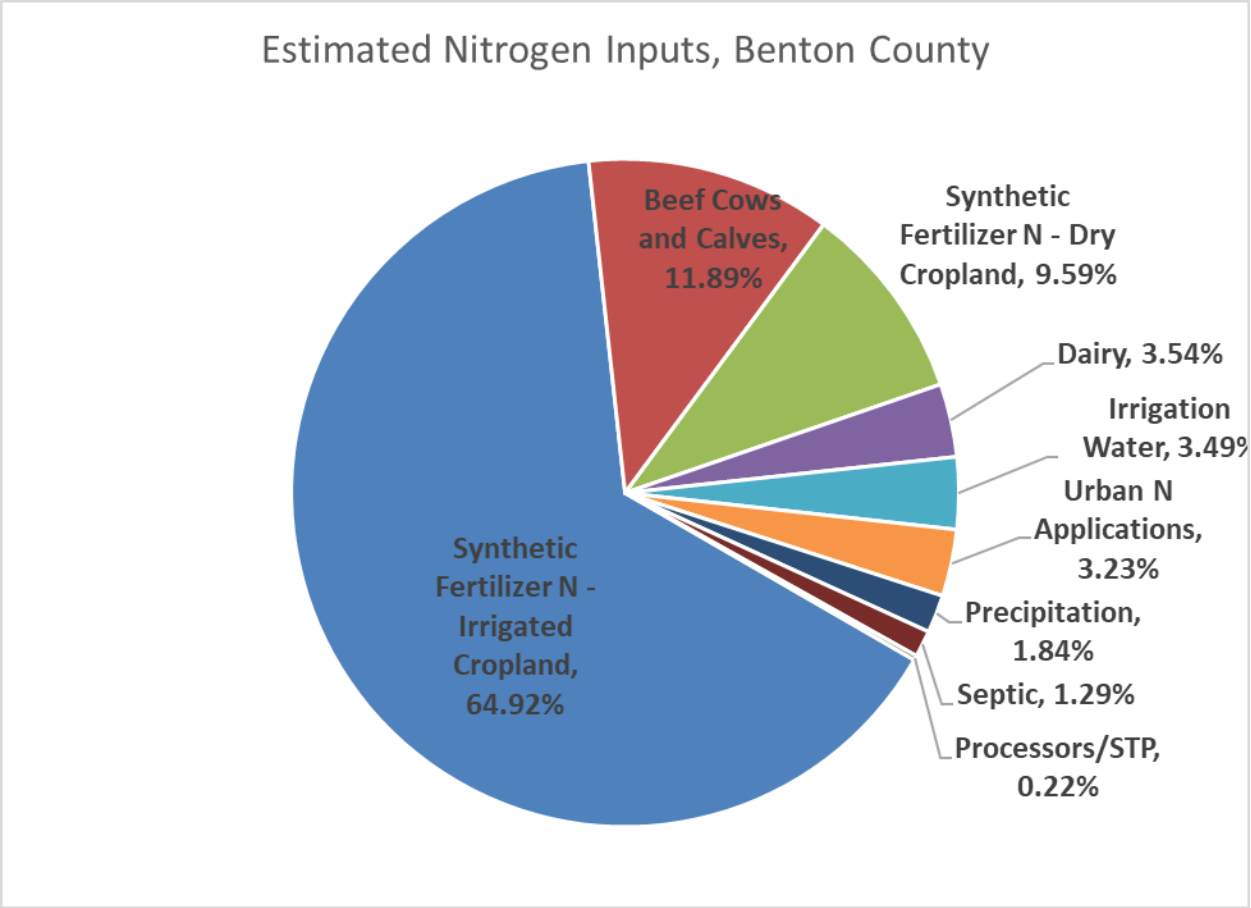
associated manure storage facilities, wastewater percolation at municipal wastewater treatment plants and food processors, septic system drainfields (onsite sewage systems), leaky urban sewer lines, lawns, parks, golf courses, and dry wells or percolation basins that collect contaminated stormwater runoff. Five (5) animal agricultural facilities operate in Benton County, their locations are shown on **Figure 2**. The other generally localized potential nitrate sources are most prevalent in urban growth areas associated with Benton County's towns, cities, and rural residential developments. The locations of these areas also are shown on **Figure 2**.

Potential natural sources of nitrate in groundwater include geologic minerals and atmospheric sources (nitrate and ammonia suspended in air and nitrate generated during lightning). However, the amount of nitrate in groundwater that may be attributed to natural sources is negligible compared with the anthropogenic sources, especially the amounts applied to crops.

Several land use types have the potential to contribute nitrate to groundwater, including, irrigated and dryland agriculture, areas with dense rural residential development but without sewage services, high density rural residential and urban areas with extensive irrigated landscaping, and confined animal feeding operations and/or dairies. The higher nitrate concentrations are predominantly detected in shallow wells penetrating the suprabasalt or the shallow basalt aquifers, and not generally detected in deeper basalt aquifers in Benton County. This finding suggests that the source of nitrate loading is percolation from the surface. These sources may have a significant localized impact, which would be most prevalent in urban growth areas within Benton County. Incidental leakage of nitrate may also occur directly via poorly constructed wells or from the lack of or failure of backflow prevention devices on wells.

5.3.2 County Nitrogen Loading Estimates

A simplified nitrogen loading budget for Benton County was prepared by BCD. The budget is not an attempt to indicate the source of nitrate in Benton County groundwater or draw conclusions about the source of nitrate in any specific well/s and cannot and should not be used for those purposes. Rather, the budget should be viewed as a starting place for discussion on the various source's potential to enter the groundwater system and what can be done to minimize the source's entry into the groundwater. Nitrate movement through the groundwater into a specific well is a very complex process. Much more detailed investigations would need to occur to identify the nitrate sources in individual wells.


Estimated Nitrogen Inputs, Benton County
Beef Cows and Calves, 11.89%
Synthetic Fertilizer N - Dry Cropland, 9.59%
Dairy, 3.54%
Irrigation Water, 3.49%
Urban N Applications, 3.23%
Precipitation, 1.84%
Septic, 1.29%
Processors/STP, 0.22%
Synthetic Fertilizer N - Irrigated Cropland, 64.92%

6.0 Action Plan Stewards and Responsibility

This section reviews the basic responsibilities of Action Plan proponents, how decisions will get made during implementation, and the role of other entities in Action Plan implementation.

6.1 BCD, BFHD, County Commissioners, and Stakeholder Committee

BCD, BFHD, and the County Commissioners in consultation with the Stakeholder Committee, are the primary entities responsible for Action Plan implementation. Given that, it is anticipated that BCD, BFHD, the County Commissioners, and the Stakeholder Committee will work together, and with others as Action Plan Stewards in a cooperative process to guide implementation of projects that address the goals and objectives of this Action Plan. Action Plan Stewards can include any entity/group implementing a project having, at least in part, an objective addressing groundwater nitrate reduction/mitigation in Benton County. Generally, Action Plan Stewards could include individual landowners, municipalities, BCD, BFHD, a County entity, the Stakeholder Committee and/or any group/entity trying to implement the broad goals of this Action Plan. Action Plan Stewards would approach BCD, BFHD, the County Commissioners and/or the Stakeholder Committee to review and comment on their proposed project. The purpose of this review and comment is to identify how the proposed project fits into the Action Plan, and provide feedback to an Action Plan Steward on how their project fits into the overall goals of the Action Plan.

BCD, BFHD, the County Commissioners, and the Stakeholder Committee may offer support to Action Plan Stewards as appropriate, and within the scope of overall Action Plan implementation. Examples of this support include the following:

- BCD implements on the ground projects that can directly reduce nitrogen loading to groundwater. Activities such as nutrient management, irrigation water management, waste storage facilities, and cover crops are common practices promoted by BCD. BCD may provide both technical and financial assistance to Action Plan Stewards to promote best management practices. In addition, BCD has water quality monitoring staff that conducts well sampling as well as surface water sampling activities.
- BFHD provides public health education about drinking water quality. They regularly conduct drinking water screening events where residents can bring in a water sample and have it tested for nitrates. They operate a water sampling laboratory where a more rigorous analysis for nitrates can be performed. BFHD also is responsible for solid waste management in the county as well as

on-site sewage treatment plants (i.e. septic tanks). Other potential support may include: (1) development and distribution of strategic public messages through media outlets to residents of the County to improve public awareness of groundwater nitrates, their potential sources and associated health risks, recommended well testing schedules, and safe well and septic system operation and maintenance; (2) advertising community water screening events, and explain the groundwater nitrate characterization program with updates throughout the project; and (3) developing mailing list that target properties in areas with known or suspected high-level groundwater nitrates.

- The Benton County Planning Department has oversight of the Growth Management Act (GMA) which ties into the Voluntary Stewardship Program. Critical aquifer recharge areas must be protected under GMA through either development regulations or voluntary activities where agricultural activities intersect the critical areas.
- Stakeholder Committee Members and other Action Plan Stewards often implement activities that fall within the goals and objectives of this Plan. These efforts should be formally recognized as contributing to the protection of Benton County groundwaters.

6.2 Decision Making

As noted above decision making related to implementation of the Action Plan is envisioned to be a cooperative process. Examples of anticipated Action Plan implementation decision making could generally include the following:

- **Plan Implementation**: Action Plan Stewards, in consultation with the Stakeholder Committee, will review and authorize implementation projects. Typically, a proposal describing the goals, objectives, technical and project management approaches, staffing needs, anticipated budget requirements, and completion schedules will be submitted to the affected and implementing group/entity for approval. The Action Plan Steward will then work with the affected group/entity on project implementation and work with the Stakeholder Committee to fold project outcomes into the overall Action Plan framework.
- **Contracts**: If contracting is needed for implementing an approved project, the Action Plan Steward will work with effected groups/entities to approve contracts. Contract oversight will be determined on a case-by-case basis by the project sponsor, effect group/entity, and others, such as BCD, BFHD, and the County Commissioners, as appropriate.

- **Major Budget Expenditures**: Budget expenditures will be determined on a project specific basis by the Action Plan Steward, effected group/entity, and/or others as required by a specific contract.
- **Personnel Changes**: These will be made on a case-by-case basis by the project sponsor, effected group/entity, and/or others, as appropriate.
- **Major Press Releases**: Action Plan Stewards are encouraged to work with affected groups/entities, BCD, BFHD, the County Commissioners, and the Stakeholder Committee in the release of press briefings so that their role in Action Plan Implementation can be identified and explained.

6.3 Other Governmental Entities

Several state entities also have expertise, technical resources, and regulatory roles that may come into play during Plan implementation, as follows:

- Ecology has the primary state role in enforcing water quality standards. Ecology also provides informational resources on the nature and risk of nitrate contamination in drinking water. Ecology will also make data developed by this Project available to the public through its online database tools.
- The Department of Health (DOH) has the primary state role in enforcing clean drinking water quality standards for public water supply systems. DOH also provides informational and technical resources on the nature and risk of nitrate contamination in drinking water.
- The Department of Agriculture (WSDA) coupled with the Washington State University Extension (WSU Extension) has a variety of technical and informational resources useful for managing nitrate-nitrogen on agricultural lands.
- Product Commodity Commissions.

Three federal agencies could play some role in plan implementation, as follows:

- The Environmental Protection Agency (EPA) has a primary role in setting clean water and drinking water quality standards, in cooperation with Washington Department of Ecology. The EPA also provides informational and technical resources on the nature and risk of nitrate contamination in drinking water.

- The U.S. Geological Survey (USGS) has a wide range of scientific and technical resources available for state and local agencies, and residents. USGS resources may also be helpful for the Stakeholder Committee and others in understanding data collected during Plan implementation.
- The U.S. Bureau of Reclamation (USBR) has been a key player in the development of much the irrigation canal infrastructure used to deliver water to irrigators. In that role USBR has irrigation water management resources and expertise it can provide to irrigators.

6.4 Non-Governmental Entities

Non-governmental entities, including the citizens and businesses in the County will have an indispensable role in implementing Plan activities and projects. In many cases, they will be the primary on-the-ground actors that are trying to contribute to the reduction of groundwater nitrate through their own daily actions. These entities or groups include individual septic system owners, agricultural producers (row crop, orchards, vineyards, livestock, etc.), urban irrigators (home owners, parks, golf courses, etc.), landscaping companies, sprayfield operators and land applicators, public water supply systems, and individual well owners. Each group will have activities to implement, ranging from use of nitrate as fertilizer and on-the-ground application (contaminant reduction) to delivery of drinking water (source water protection and treatment).

7.0 Implementation Activities

This section summarizes examples of activities/projects – including education and outreach – that might be implemented to achieve Action Plan Goals. Such activities/projects are designed to reduce nitrate loading and/or reduce groundwater nitrate concentrations. Basic implementation activities include those associated with the following:

- Irrigation Water Management.
- Nutrient Management.
- Urban and Rural Residential Water and Fertilizer Management.
- Sprayfield and Wastewater Management.
- Well Management.
- Aquifer Management.

Implementation activities associated with these are explored below, monitoring activities are summarized in the Section 8.0.

7.1 Irrigation Water Management

In irrigated portions of the County, only minimal progress can be made toward groundwater protection without effective irrigation water management. Nitrate moves from the surface through the soil profile to the groundwater table only if carried or transported by water. Even minimal applications of nitrogen may travel to groundwater if enough water is applied, whether from precipitation or irrigation, to move it past plant roots faster than the plant can use it. Estimated nutrient and fertilizer guidelines will be largely ineffective if the transport of nitrate to the water table by irrigation water is not also simultaneously minimized.

Examples of some of the conditions that may lead to over-application of water and nitrogen migration into groundwater include:

- Uncertainty about the actual amount of water available to the crop.
- Uncertainty about the timing and amount of irrigation water needed by crops.
- Factors limiting crop growth such as insect damage, disease, crop injury, inadequate field preparation, inadequate precipitation, or inadequate irrigation water management, which may cause applied water to not be fully utilized.

- Inaccurate application of irrigation water by improperly designed, maintained or operated systems.
- Uncertainty about timing and requirements for salt leaching required to maintain soil productivity.

To help irrigators better manage water use, and mitigate for conditions such as those noted above, BCD has developed a set of irrigation water management guidelines based on NRCS guidelines (NRCS 1992a). These guidelines, which could be part of a future Benton County groundwater nitrate management projects, include the following main elements:

- Irrigation water management requires soil moisture monitoring and irrigation water scheduling based on crop need and weather conditions. Moisture monitoring reduces uncertainty regarding the actual amount of water available to the crop. Monitoring can be done using soil probes with simple tools such as tensiometers and electric resistance blocks, or high-priced systems with computer-linked soil probes.
- Management practices that minimize the movement of nitrogen below the "effective" root zone are emphasized. This includes the recognition that the effective root zone varies by crop and is often shallower under irrigation than dryland production.
- Salt leaching events should be scheduled to minimize deep migration of nitrate and should be scheduled based on laboratory testing or field observations of salt buildup.

Additional water management activities that may be useful in future potential Benton County groundwater nitrate mitigation activities include the following:

- Promote soil testing for nitrate through implementation of deep soil sampling educational programs and purchase of deep soil sampling equipment for use by growers and others. Deep soil testing is an educational tool that allows growers to evaluate where nitrate is present in the soil profile. However, the cost of the sampling equipment may be prohibitive to many growers.
- Promote irrigation water management plans and implementation by all effective means such as cost share programs.
- Identify sources and help distribute readily available technical services and data necessary for site-specific irrigation water management plans. Public sources of services and data include the Bureau of Reclamation Agri-Met and the WSU AgWeatherNet systems weather stations. Some individual growers and agri-businesses have set up their own weather stations for private use.

- Encourage growers to convert to more efficient irrigation systems. Conversion from rill irrigation to sprinkler methods of irrigation has been credited with an increase in irrigation efficiency.
- Continue to refine systems of scheduling for wheel-line and hand-line irrigation on those fields where the typical set lengths of 12 or 24 hours apply irrigation water more than the water holding capacity of the soil.
- Schedule maintenance leaching to minimize groundwater impact.
- Promote cropping systems to manage nitrate movement. These systems may include the use of second crops, cover crops, and deep-rooted crops to recover and/or store nitrogen that would otherwise pass the crop root zone.

7.2 Nutrient Management

Management of nutrients is often achieved by application at agronomic rates. The NRCS defines agronomic rate as *"The rate of nutrient addition required to reach a realistic crop yield goal for soil, climatic and management conditions"* (NRCS 1992a). Environmental problems begin when the nitrogen application rate, timing, and placement are not appropriate. Excess nitrogen, when transformed into nitrate, may migrate below the root zone toward groundwater under the following conditions:

- Nitrogen may be applied at rates greater than crops can use when uncertainty exists about the actual amount of nitrogen available to the crop. The uncertainty is created when the various sources of available nitrogen that may supply part of the crop's nitrogen need are not accounted for. These sources include residual nitrogen in the soil, nitrate in irrigation water, and organic sources of nitrate such as manure and crop residual.
- The irrigation water application schedule may not be balanced with crop needs. If excess water is applied or the timing of water application does not coincide with plant needs, irrigation water may carry water-soluble nitrate out of the crop root zone. The grower may then choose to apply more nitrogen to meet plant needs.
- Applied nitrogen may not be fully utilized if other factors are limiting crop growth. These factors may include lack of adequate rainfall (in dryland areas), insect damage, disease and other crop injuries, inadequate field preparation, deficiencies in availability of other plant nutrients, and others.
- Unrealistically high crop yield goals may lead some growers to over-apply nitrogen. The most economically-desirable yield is not always the maximum yield.

The WSU fertilizer guide is a primary source of nutrient guidelines currently in use by growers in Washington. This guide provides recommendations that growers can use to better manage their nutrient use. Examples of the types of activities described in the fertilizer guide that could form the basis for future Benton County groundwater nitrate management projects include the following:

- Increased focus on fertilizer placement, timing of application, and realistic crop yield goals.
- Implement procedures for crediting the various sources of nitrate including inorganic fertilizers, organic sources, residual soil nitrogen, and irrigation water.
- Conduct soil and tissue sampling to reduce uncertainty about crop nutrient needs.
- Encourage efficient use of irrigation systems and uniform application of irrigation water for all crops.
- Develop management practices for all crops in the rotation and not focus on one crop.

7.3 Urban and Rural Residential Water and Fertilizer Management

Urban and Rural Residential water and fertilizer management actions need to identify and develop management strategies addressing nitrate contribution to groundwater associated with urban and rural fertilizer use, septic systems, wellhead protection, abandoned wells, well construction, and land development. The goal is to define strategies to protect public health relative to groundwater nitrate through public education. Stakeholder Committee participants advocate disseminating information to the public about drinking water safety and investigating and protecting the groundwater resource. Examples of the types of activities that might be implemented to achieve this sections goals include the following:

- Sponsor projects to obtain new and/or evaluate existing data on effects of groundwater nitrate levels on public health and the significance of residential sources of nitrate to groundwater.
- Help inform and educate the public regarding the effects of groundwater nitrate levels on public health and methods to minimize nitrate loading to groundwater by residential activities.
- Share resources with and support activities of other communities to achieve groundwater protection goals, objectives and activities.

A wide variety of activities in the urban and rural environment may contribute to nitrate to groundwater. Examples of these, and possible implementation actions that may be conducted, are summarized in the following pages for a range of urban and rural residential situations.

7.3.1 Septic Systems

An average of approximately 32 pounds of total nitrogen per household per year is typically discharged to residential septic systems which consistently remove approximately half of this nitrogen through denitrification (WDOH 1995). Given these basic operating constraints, the best ways to manage total septic system nitrogen loading to groundwater is by: (1) properly constructing and maintaining these systems and (2) limiting the density of rural homes with septic systems. One way to limit density, especially in areas peripheral to urban environments served by municipal sewage systems, would be for future projects to look at the potential for expanding these municipal systems to further reduce rural residential septic discharges to groundwater. Resources are available to septic system owners from the different entities that permit and oversee septic systems, including the local health department for systems under 3,500 gallons per day, the WDOH for systems handling 3,500 to 100,000 gallons per day, and by Ecology for systems over 100,000 gallons per day.

7.3.2 Fertilizer Use on Residential Lawns

The WSU Master Gardener program provides guidance for residential use of fertilizer, and identifies important factors related to poor management, including:

- Lack of instructions for a product acquired in bulk.
- Instructions may not be read, understood, or followed by the purchaser/user.
- Fertilizer may be used to correct lawn problems that are unrelated to soil fertility.
- Over application of irrigation water on residential lawns.

A lack of easily accessible information and public apathy is one of the main barriers changing the residential use of fertilizers to reduce groundwater nitrate sources. To better address this, potential implementation activities should:

- Encourage use of resources such as the WSU Master Gardener program and its recommended fertilization and irrigation water application methods by Benton County residents.
- Help develop educational materials and encourage point-of-purchase distribution of these materials to homeowners.

7.3.3 Nitrate Management on Noncommercial Farms and Ranches

The owners of noncommercial farms and ranches, such as "hobby" farmers, may lack a background in crop or pasture management and are often unaware of recommendations for fertilizer use and livestock waste management. These small operations could present a growing potential as a nitrogen source as their density grows near urban areas. Compared to commercial growers, these property owners may not face economic constraints that serve as a limiting factor on fertilizer use. Educational materials are available from sources such as the WSU Cooperative Extension service and the CDs. Clubs and service organizations, including 4-H programs, also serve as existing avenues to distribute information.

Implementation actions that could be used to reduce the potential effects of noncommercial farm and ranch operations on groundwater nitrate include the following:

- Increase awareness of noncommercial owners of their responsibility to protect groundwater quality through proper management of fertilizer and irrigation water.
- Encourage organizations such as the WSU Cooperative Extension and the CDs to increase technical services to the noncommercial farms within their service areas.
- Encourage property owners to perform soil nitrate testing and irrigation water management as important aspects of fertilizer management on noncommercial farms and for landscape, lawn, pasture and crop maintenance.

7.3.4 Wellhead Protection Planning Private Domestic and Group B Wells

Residents drawing water from individual domestic wells may be at a disadvantage regarding knowledge of actual nitrate levels in their groundwater. There is no regulatory requirement for routine well water testing of private domestic wells. Additionally, the cost of regular testing may force some homeowners in Benton County to not test their water quality. The Group B public water systems are required to monitor water quality for nitrate annually. The laboratory automatically sends the water testing results to the WDOH and the local HDs. These systems serve two to 14 connections with fewer than 25 customers. While not subject to the federal Safe Drinking Water Act, these systems are governed by State regulations (WAC 246-291). Group B systems are regulated, but the regulations are not enforced consistently. Domestic wells and Group B systems are often found in proximity to agricultural land use, a contributing source of nitrate in groundwater.

The Stakeholder Committee recommends that the individual well owner and Group B systems be the focus of the following public education/information activities:

- Encourage homeowner compliance with county ordinances and State law requiring 100 feet between wells and sources of contamination.
- Encourage homeowner implementation of practices to protect their source drinking water, and recommend self-assessment tools for private wellhead protection.
- Promote the availability of accessible, inexpensive water testing to homeowners.
- Encourage the wider dissemination of water testing guidelines, reference materials, and assessment tools, such as Farm*A*Syst/Home*A*Syst, by local agencies and homeowner associations.
- Distribute guides, wellhead protection strategies, and reference materials to landscape contractors, realtors, and land use planners.
- Implement a program of onsite assistance to water users with elevated nitrate levels. The program may include assisting with sanitary surveys and providing information about corrective alternatives. Corrective alternatives may include well repair, connection to a public supply, water treatment options, and use of bottled water.
- Conduct a professional sanitary survey where the well is affected by high nitrate levels indicating a possible health risk. Sanitary surveys may identify possible sources of nitrate, verify the presence of sanitary seals and absence of cross-connections, and assess other safety factors. Information on options should be provided to well owners when drinking water fails to meet water quality standards.
- Encourage the installation of backflow prevention devices in accordance with the Uniform Plumbing Code, if a domestic well supplies a residential irrigation system.

7.3.5 Public Information and Education Program

The public will benefit from an increased awareness of the vulnerability of their groundwater as a drinking water source and the role they can play in protecting it. Potential public information and education implementation projects could include the following:

- Prioritize the messages it sends to the public regarding drinking water safety such as facts about potential health risk from consumption of nitrate-containing groundwater, the concept that nitrate is an indicator of source water vulnerability, practices that contribute to groundwater degradation, and the responsibility of all residents in protecting our drinking water supply.
- Create and maintain (or subscribe to) a directory of resources on drinking water safety and make this readily available to the public through public information distribution efforts.

- Encourage the allocation of local, State and federal funding to local governmental entities, or the private sector to meet continuing public education needs on nitrate-related drinking water safety issues.
- Support local efforts to encourage homeowners to purchase, install, maintain, and test backflow prevention devices as required by their public water supply and/or in accordance with the Uniform Plumbing Code.

7.4 Sprayfield and Wastewater Management

In much of the region the use of sprayfields to dispose of treated industrial and municipal waste water is a common practice. However, in Benton County sprayfields are relatively rare as most industrial and municipal waste water is disposed of via treatment systems that are permitted by Ecology and meet NPDES discharge standards. Given that, in the event sprayfields need to be addressed in a future project, potential activities that might be considered under the Action Plan include the following:

- Develop means by which constituency groups can have access to the information they need to meet or exceed permit requirements.
- Sponsor projects to evaluate and demonstrate innovative water and nitrate reuse and recovery options of interest to the constituency groups.
- Help inform the public about the Stakeholder Committee's efforts to maintain the delicate balance between environmental protection and resource utilization for the economic health of the region.
- Share information in a regional network to help the constituency groups understand regulations and facilitate discussions with Ecology on uniform and practicable implementation of regulatory action.
- Voluntarily adopt the activities and practices that meet or exceed the requirements of their permit. This Community Action Plan does not recommend specific monitoring and reporting on the status of adoption of the recommended practices since these are required components of wastewater discharge permits issued by Ecology for these facilities.
- Support projects demonstrating innovative land treatment practices using new irrigation and cropping system combinations. It is possible that the seasonal consumptive use of water and nutrients may be extended with the inclusion of cropping systems designed to recover nitrate, especially rotations including deep-rooted and cool season crops.

7.5 Well Management

A Statewide regulatory program of testing and licensing exists for well drillers, but onsite inspection is not conducted. The State previously had a well inspection delegation program whereby the local HDs would inspect well installation. Most homeowners cannot assess whether their wells have been installed to minimum standards. Examples of some projects that might be implemented include the following:

- Develop informational material on the importance of well installation inspection and inspection options available to homeowners and explore methods to effectively distribute them to homeowners.
- Encourage local BFHD, planning departments, developers and real estate agents to inform the public about safe well installation.
- Encourage voluntary industry self-assessment through the Well Drillers Association and other trade associations.
- Consider methods to identify to the public well drillers who have demonstrated adherence to minimum construction standards. Inform the public that Ecology holds records of complaints or enforcement.
- Encourage Ecology to continue the well inspection delegation program. Encourage the legislature to reauthorize funds for this program
- Develop information to explain the importance of proper decommissioning of abandoned or unused wells. Safe decommissioning of unused or abandoned wells eliminates both the physical surface hazard and the potential for aquifer contamination posed by open wells. Ecology has established specific procedures for proper well decommissioning (WAC 173-160).

7.6 Aquifer Management (Managed Aquifer Recharge, or MAR)

At its simplest***, Managed Aquifer Recharge (MAR) is a practice that uses subsurface storage to shift the timing of water availability and/or influence water quality***. It can be used as a load-leveling tool in industrial settings, a water quality management tool, and an ecosystem enhancement strategy. When water is available, it is captured, treated (if needed), stored in an aquifer, and actively or passively recovered for future use when supplies are physically limited or administratively unavailable. ***Most often, MAR involves using available wet-season water and storing it for dry-season use.*** That can mean tapping un-used water treatment system capacity, available surface water, or even groundwater for aquifer exchange when wells are not in-use.

Examples of potential MAR projects that might be used in Benton County to mitigate for groundwater nitrate include the following:

- Store potable water in the basalt aquifer system for later recovery and delivery to supply potable water needs in portions of the County with elevated groundwater nitrate. Such a project would likely be done in partnership with municipal water suppliers, such as Kennewick which currently owns and operates a potable water MAR system. These suppliers are generally the only entities in the County that produce potable water for large systems. A project such as this would replace nitrate-bearing water supplies with clean water supplies.
- Work with a municipal potable water supplier to inject potable water into a contaminated aquifer to displace nitrate-bearing water with clean water, and/or dilute groundwater nitrate concentrations to acceptable levels. Although no such project is currently underway in the area, the City of West Richland is contemplating such a system, and the City of Meridian, Idaho has tested one.
- Infiltration projects may also be used to mitigate for elevated groundwater nitrate. Although no such project is currently active in Benton County, in Walla Walla County infiltration of river water has been shown to reduce nitrate concentrations in groundwater.

The primary constraints on all MAR projects is physical access (pipes and pumps) and legal access (water rights) to clean water. Future work on this topic, if implemented, need to address these access issues prior to spending any funds on project construction.

7.7 Current and Potential Funding Sources

Benton-Franklin Health District (BFHD)

The Benton-Franklin Health District currently funds services that provides public health education about drinking water quality. They regularly conduct drinking water screening events where residents can bring in a water sample and have it tested for nitrates. They operate a water sampling laboratory where a more rigorous analysis for nitrates can be performed. BFHD also is responsible for solid waste management in the county as well as on-site sewage treatment plants (i.e. septic tanks). Additional outside funding for BFHD could augment and bolster their current programs or provide the opportunity to add new services.

Benton Conservation District (BCD)

BCD provides technical assistance and cost-share for on the ground projects that can directly reduce nitrogen loading to groundwater. Activities such as nutrient management, irrigation water management, waste storage facilities, and cover crops are common practices promoted and funded by BCD. Additional outside funding for BCD could augment and bolster their current programs or provide the opportunity to add new services.

Benton County

The Voluntary Steward Program (VSP) is currently seeking projects to fund within the critical aquifer recharge areas in Benton County. These projects would protect water quality or enhance water availability where there is an intersect between agricultural activities and the critical aquifer recharge areas. Funding for VSP is provided by the Washington State Legislature and has the opportunity to be re-issued when the State develops its next biennium budget.

Department of Ecology

The Department of Ecology has several grant programs that potentially could be used to fund some of the activities identified in this plan. The Water Quality Combined Financial Assistance Program funds activities such as BMP implementation, water quality testing, and public education.

Yakima Basin Integrated Plan funding could also potentially be utilized for funding projects such as Managed Aquifer Recharge projects with a dual goal of diluting nitrate concentrations in drinking water and providing additional water supplies.

United States Geologic Survey (USGS)

The USGS can enter into Joint Funding Agreements to conduct studies, investigations, or conduct water quality monitoring. However, matching funds must be obtained for these agreements.

Private Land Managers

Private land managers can and do provide significant funding annually to conduct activities protective of water quality. These activities regularly include irrigation water management and nutrient management programs. BCD estimates that agricultural land managers expend more than $1,000,000 annually on just irrigation water management programs. Outside funding for land managers could augment and

bolster their current management programs by adding additional acreage to their programs or provide the opportunity to research cutting edge technology to reduce nitrate loading.

Other Grant Programs or Funding Sources

Other sources such as private foundations, USDA NRCS programs, WSU Extension, WSDA, or USDA Agricultural Research Service may provide projects, services, or funds to assist with implementation of components of this plan.

8.0 MONITORING

Activities to monitor the progress of recommended management strategies are presented in the following section. Project specific monitoring plans would be developed by project sponsors and/or implementing groups/entities as needed to describe the monitoring process, data collection and analysis, and the ways to measure potential project success.

8.1 Irrigation Water and Nutrient Management Monitoring

Activities to monitor the effects of irrigation water and nutrient management implementation projects would focus on the collection of scientific and engineering data directly related to a specific project. These could include the following, depending on the specific project:

- Acreage, or number of facilities, on which agricultural BMPs have been implemented.
- Number of growers or operators implementing BMPs.
- Amount of cost-share dollars used by growers/operators to implement BMPs.
- Field sampling and testing.

Information on these items could be obtained from Cost Share Programs implemented by BCD, CSRIA Conservation O&M certifications by BCD, and the VSP participation and projects tracking. BCD will compile a GIS database that will track best management practices improve groundwater conditions in Benton County.

8.2 Urban and Rural Monitoring

Examples of monitoring activities that could track the progress of recommended urban and rural water and nutrient management strategies are listed below. Monitoring data and information could be collected by a project sponsor, or other designated entity, and evaluated on a periodic basis with the results included as part of a periodic reporting and updates. Examples include the following:

- Documenting the implementation of recommend voluntary BMPs for Managed Recreation Areas, including regularly soliciting information regarding implementation of the recommended BMPs from the managed recreation areas such as golf courses, parks, school fields, etc.
- Documenting Public Information and Education Program products, including but not limited to the number of workshops, press releases, media stories and education events.

8.3 Sprayfield and Wastewater Monitoring

Procedures to monitor the progress of the sprayfield and wastewater management strategies are presented below. The data and information collected will be periodically evaluated by BCD. Monitoring activities may include:

- Form a regional information-sharing group.
- Recommend Activities and Practices to Meet or Exceed Permit Requirements. Ecology permits require routine monitoring and reporting on the status of sprayfield operations.
- Document Public Information and Education Program products, including but not limited to the number of workshops, press releases, media stories and educational events.

8.4 Groundwater Monitoring

Groundwater monitoring activities will continue to support the nitrate management strategies described in this Plan. The groundwater monitoring effort will provide much of the data needed to show the effects of the different strategies on groundwater quality. Groundwater monitoring activities, building on the work done earlier for the characterization phase of the Project, include the following:

- Collect well sampling data from approximately 200 volunteer residents/wells across Benton County, focusing to the extent possible on those who previously participated in the characterization effort.
- Follow the guidelines developed in the characterization QAPP for all well sampling.
- Submit all monitoring data to Ecology using the Environmental Information Management (EIM) system annually.
- Provide nitrate analysis results to participating residents and landowners as an additional educational effort.

Ongoing groundwater monitoring results will be combined with the data described in the Benton County Groundwater Nitrate Characterization Report to update conditions previously seen in the County, review changes in groundwater nitrate concentrations, and work with stakeholders to continue to make improvements in activities that reduce groundwater nitrate.

Figure 1 – Location Map

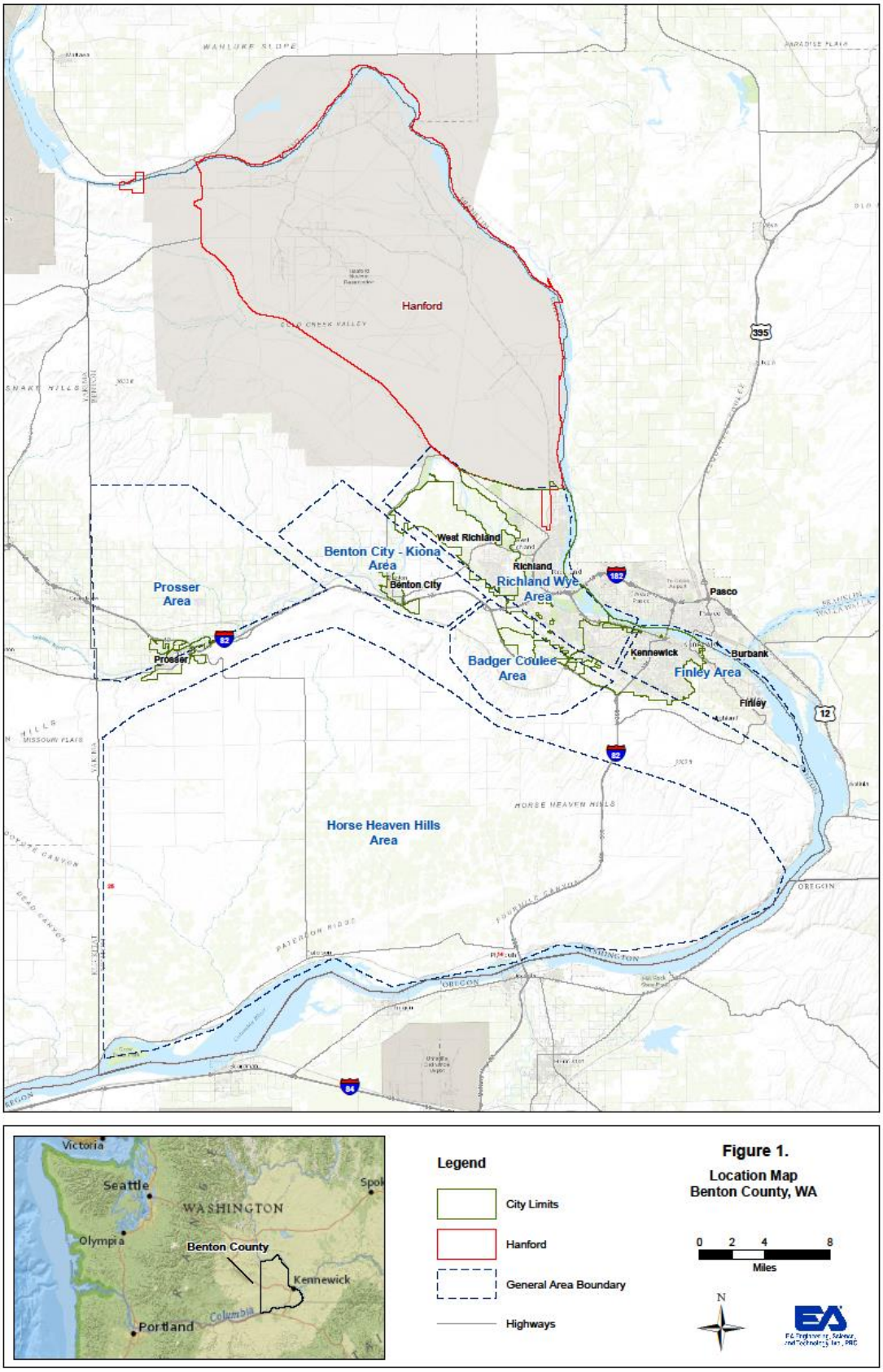


Figure 2 – Land Use