NRCS National Water Quality Initiative (NWQI)
Watershed Assessment:

Fishtrap Creek Watershed

Prepared By:
Whatcom Conservation District
Lynden, WA

December 2020

Whatcom CONSERVATION DISTRICT

NRCS
Natural Resources Conservation Service

TABLE OF CONTENTS

TABLES AND FIGURES

OVERVIEW

The following document contains a watershed assessment completed for the Fishtrap Creek Watershed (HUC 171100040502) located in Whatcom County, Washington and nested within the larger Nooksack River Watershed Basin (HUC 17110004). This watershed assessment was conducted as part of the Natural Resource Conservation Service (NRCS) National Water Quality Initiative (NWQI) and is an exercise in characterizing and identifying the land characteristics and uses, or "critical source areas", that have the greatest potential for nutrient (nitrogen and phosphorous), sediment, and/or pathogen impacts to surface water quality. This assessment process also includes an outreach strategy that identifies barriers, opportunities, and conservation management practices that can be implemented to reduce those identified impacts.

The watershed assessment and outreach components follow the NRCS 9 Steps of Planning:

1. Identifying the pollutants of concern in the watershed.
2. Determining the water quality objectives of the watershed.
3. Inventory resources by collecting watershed data.
4. Analyze the data via modeling to identify critical source areas.
5. Formulate alternatives by suggesting various conservation practices.
6. Evaluate/model the impact of different conservation practices on water quality pollutants.
7. Work with partners on plans of action for the watershed.
8. Implement the Outreach and Implementation Plan in the watershed.
9. Evaluate the effectiveness of the plan and adapt as necessary to achieve water quality goals.

This assessment addresses steps 1-5 of the planning process outlined above. It is suggested that steps 6-8 should be evaluated next and carried out via the Outreach and Implementation Plan, with step 9 being a long-term objective of the project to be conducted by local partners indelibly.

For more detail on the general process for development of a watershed assessment plan, see the NRCS National Planning Procedures Handbook (NPPH), Subpart F: Areawide Conservation Planning (NPPH Part 600.50 B. (2)).

For more information about this report, please contact primary authors:

- Nichole Embertson, Ph.D., Science and Planning Coordinator
- Meagan Harris, M.S., Water Quality Data Coordinator
- Aneka Sweeney, M.Ed., Education and Outreach Coordinator

Other contributing authors:

- Scarlett Graham, M.S., Research Specialist
- Kyle Cassady, Resource Technician
- Andrew Phay, GIS Specialist

Whatcom Conservation District
6975 Hannegan Rd, Lynden, WA 98229
P: (360) 526-2381

Written in collaboration with local and Washington State NRCS.
USDA - Natural Resources Conservation Service
316 W. Boone Ave., Suite 450, Spokane, WA 99201-2348
P: (509) 323-2900

1. BACKGROUND AND PURPOSE

1.1 Background

This watershed assessment plan was developed in collaboration with Washington NRCS to identify critical source areas for strategic implementation of land conservation practices for surface water quality. Past and current conservation practice and plan implementation has been based on landowner engagement, opportunity, and/or regulatory response. A critical, watershed level evaluation has not been performed to create a targeted and strategic outreach effort to focus on high risk land uses for water quality. This watershed assessment provided a means to identify critical terrain features as well as all land uses on a HUC-12 watershed level, potential pollution from nitrogen, phosphorous, sediment, and pathogens to surface waters, and the relative effectiveness of different conservation practices to effect water quality improvement. The results of the watershed assessment will be used to implement a focused and engaged watershed outreach plan to connect land users to available programs, practices, and materials, and/or guide the adoption or revision of current programs to better reach end users.

The Nooksack Watershed in Whatcom County, Washington (Figure 1) is home to a strong agricultural economy, residential communities, rural landowners, commercial business, productive forest and natural habitats, and valuable natural resources. However, with so many diverse and demanding land uses, the watershed has also seen an impact to environmental resources such as water quality. The primary artery through this diverse landscape is the Nooksack River which originates from mountain glaciers and natural headwater lands and meanders through the County on its 75-mile journey to Portage and Bellingham Bays in the Puget Sound (Figure 1). At its deposition point in Portage Bay is a recreational, commercial, and tribal shellfish industry that is dependent on clean waters for production. Unfortunately, the Nooksack River had a TMDL instated in 2000 for fecal coliform (pathogens), and has roughly 53 303(d) listed segments in the Nooksack watershed for pathogens, ammonia, low dissolved oxygen, and/or temperature, many of which have seasonal high pollutant levels. The persistent high levels of pollutants, particularly fecal coliform, is reflected in the on-going seasonal closures of the shellfish beds in Portage Bay. These closures impact not only the economics of the downstream aquafarmers, but also the tribal harvest that occurs year-round for subsistence and ceremonial purposes. The loss in harvest and change in timing of collection, has greatly impacted the social structure and community dynamics of these populations.

The Nooksack Watershed TMDL (Joy, 2000; Hood, 2002) addresses potential impairments on 18 waterbodies in the Nooksack watershed that contribute to loading in the Nooksack River, including Fishtrap Creek and four contributing waterbodies: Bender Road Ditch, Depot Road Ditch, Benson Road Ditch, and Double Ditch Drain. Fishtrap Creek is also managed for its 303(d) pollutant listings (pH, low dissolved oxygen, bacteria, and temperature), and the lower reaches of Fishtrap Creek (within and below the city of Lynden) are listed as waters of concern (category 2) for the organochloride pesticides.

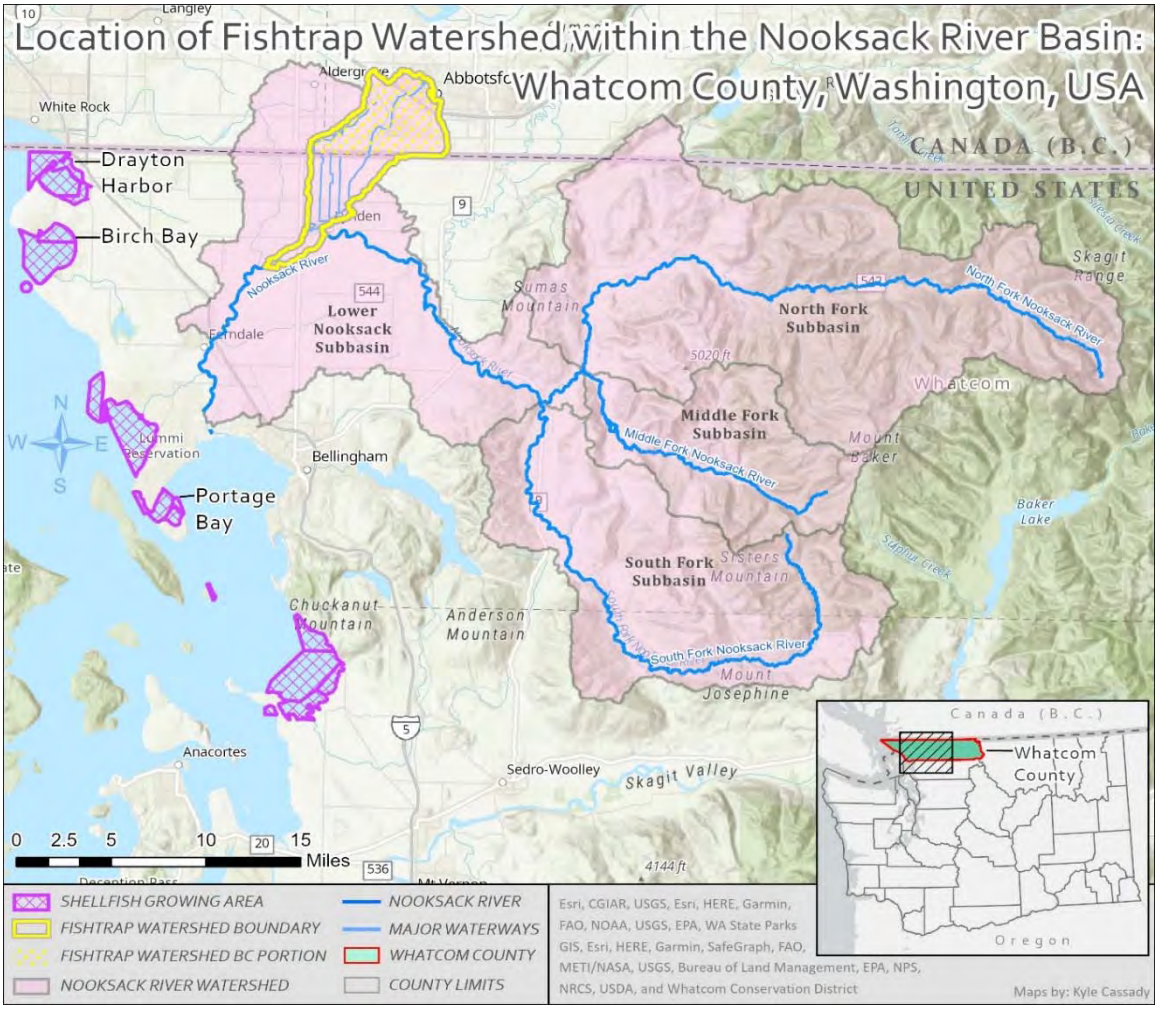

Figure 1. Location of the Fishtrap Creek Watershed within the larger Nooksack River Watershed basin; Whatcom County, WA, USA.

1.2 Location of the Watershed Assessment Area

The Fishtrap Creek Watershed (HUC 171100040502) is located within the greater Nooksack River Basin (HUC 17110004) in Whatcom County, Washington (Figure 1). It also falls within the Water Resource Inventory Area (WRIA) 01. A comprehensive description of the Nooksack watershed and WRIA 1 is included in the Puget Sound Partnership's *2014/2015 Action Agenda for Puget Sound, Section 4* (Puget Sound Partnership, 2014).

The Fishtrap Creek Watershed is 35.9 square miles (23,010 acres), with 14.4 square miles (9,220 acres) in WA and 21.5 square miles (55.7 square km) in British Columbia (BC), Canada (Figure 1). This watershed is one of two HUC-12 watersheds in the Nooksack River Basin that originate in Canada. Fishtrap Creek Watershed has mixed land use, a high level of stakeholder engagement, and a history of water quality concerns, monitoring, and pollution source correction work.

The City of Lynden falls largely within the Fishtrap Creek Watershed (Figure 2). Special Districts including the North Lynden Watershed Improvement District (NLWID) overlaps the watershed, as does the Consolidated Diking Improvement District (CDID) #1 (Figure 2).

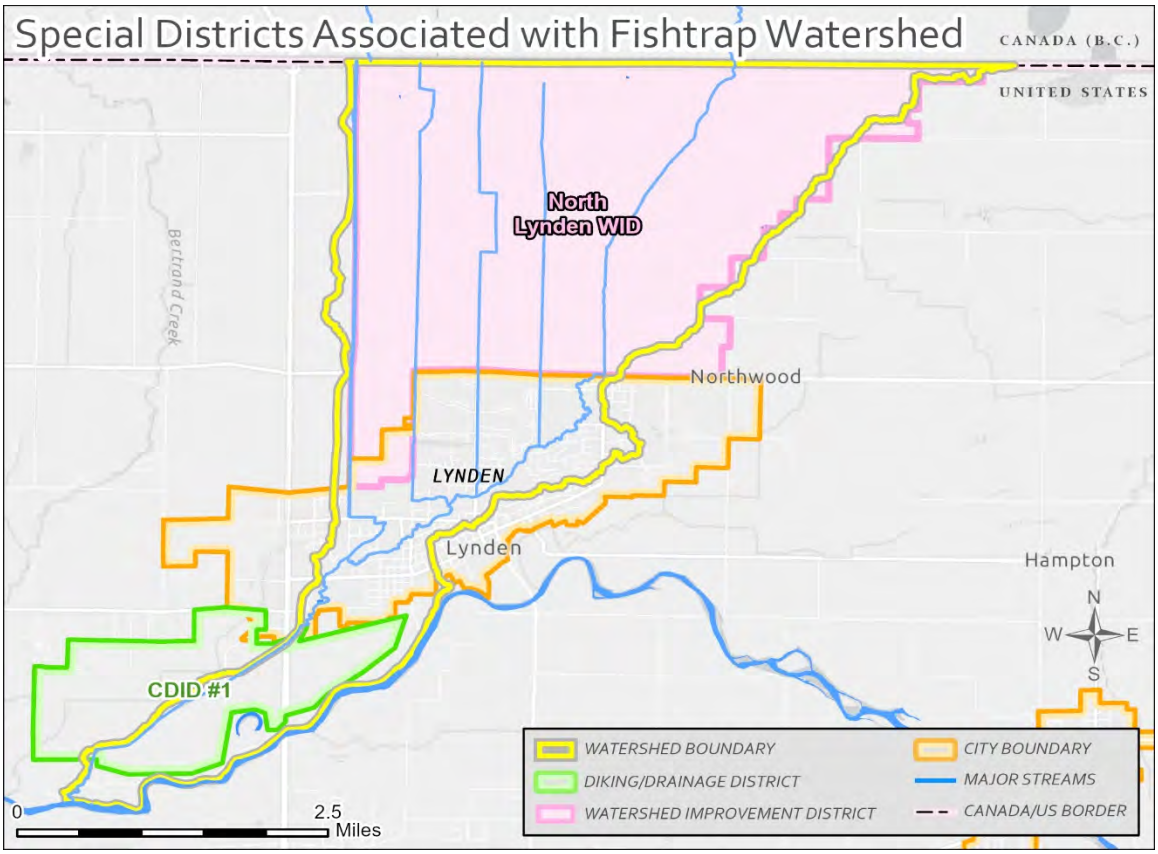

Figure 2. Special Districts associated with Fishtrap Watershed. DD=Diking district; DID=Drainage improvement district; CDID=Consolidated drainage improvement district.

1.3 Water Quality Resource Concerns

Based on local resource concerns, the following pollutants were chosen for evaluation in this assessment: sediment, nutrients (nitrogen and phosphorous), and pathogens. Project-driven surface water quality monitoring of sediment and nutrients has taken place in the Nooksack Basin and Fishtrap Creek Watershed since 1997. Regular sampling of surface water quality pathogens, measured as fecal coliform and *Escherichia coli* (*E. coli*), has also been occurring since 1997. Land use would indicate that all four pollutants are potential threats to water quality within the watershed.

Washington State Surface Water Quality Criteria

Table 1 summarizes surface water quality criteria for Washington State for the pollutants of concern in this assessment. These criteria are established under WAC 173-201A-200 (fresh water designated uses and criteria). More information can be found at http://www.ecy.wa.gov/programs/wq/swqs/criteria.html. Full text of Chapter 173-201A WAC is available at http://apps.leg.wa.gov/WAC/default.aspx?cite=173-201a&full=true.

Table 1. Surface water quality criteria for Washington State for the pollutants (or parameters) of concern in this assessment.

Parameter	Measured as	Surface Water Criteria for Freshwater
Total Suspended Solids	Total Suspended Solids (mg/L)	No defined criteria for rivers and streams.
	Turbidity (NTU)	Turbidity criteria are defined as percent saturation (percent increase over background).
Nitrogen	mg/L	No defined criteria for rivers and streams.
Phosphorus	mg/L	No defined criteria for rivers and streams.
Pathogens	Fecal coliform (#/100 ml) *	Geometric mean: 100 #/100ml 90th percentile: 200 #/100 ml
	E. coli (#/100 ml) *	Geometric mean: 100 #/100ml 90th percentile: 320 #/100 ml

*Washington State fecal coliform surface water criteria for recreation were replaced with *E. coli* criteria in 2019. The fecal coliform values in this table, while no longer the approved state criteria, are still being used by natural resource managers to track changes in pathogens over time, especially in areas with established fecal coliform criteria for marine waters under the National Shellfish Sanitation Program.

303(d) Assessed Waters

The upper portion of Fishtrap Creek (upstream of the City of Lynden) is a 303(d) listed stream reach for pH, low dissolved oxygen, bacteria, and temperature. The lower reaches of Fishtrap Creek (within and below the city of Lynden) are also listed as waters of concern (category 2) for the organochlorides Dieldrin, Chlorpyrifos, 4'4 DDE, Alpha-BHC, and Hexachlorocyclohexane. Four ditches contributing water to Fishtrap Creek are categorized as 303d listed waters: Bender Road ditch, Depot Road Ditch, Benson Road Ditch, and Double Ditch Drain (Pepin Creek).

Lower Nooksack River Basin Bacteria TMDL

Following the Nooksack River basin bacteria total maximum daily load (TMDL) evaluation (Joy 2000), Ecology published specific water quality targets for bacteria in the Mainstem Nooksack River and its lowland tributaries (Hood, 2002). These TMDL targets for Fishtrap Creek are 39 #/ 100 ml fecal coliform. The TMDL implementation plan also sets load allocation targets for Fishtrap Creek and the four contributing 303d-listed ditches- Bender Road ditch, Depot Road Ditch, Benson Road Ditch, and Double Ditch Drain- based on relative flow (Table 2).

Table 2. Total Maximum daily load allocations for fecal coliform bacteria for Fishtrap Creek and sub-tributaries.

Tributary or Sub-Tributary	**Target Geometric Mean** (#/100 ml)	**Load Allocation** (average annual CFS*#/100 ml)
Fishtrap Creek	39	16,189
Double Ditch Drain	39	2595
Benson Road Ditch	39	792
Depot Road Ditch	39	1011
Bender Road Ditch	39	667

Whatcom Clean Water Program Focus Area

In early 2015, Fishtrap Creek Watershed was identified as a focus area by Whatcom County's Pollution Identification and Correction (PIC) program, a partner in the Whatcom Clean Water Program (WCWP). The designation as a WCWP focus area led to an increase in the frequency and coverage of bacteria monitoring within the watershed (25 sites sampled weekly for fecal coliform for 3 years), as well as specific landowner outreach to residents of the watershed. Additionally, this focus area designation increased the collaborative work between the WCWP, the City of Lynden, and the North Lynden Watershed Improvement District (WID) to find and correct sources of bacteria within the watershed.

1.4 Opportunities and Goals for Water Quality

The Fishtrap Watershed is reflective of the greater Whatcom County in its diverse land uses with agriculture being the primary land use (75% by acreage of crop land and farmsteads), followed by developed areas (20% by acreage of commercial, industrial, and residential), and about 5% of the watershed in natural spaces (forest, wetlands, riparian/vegetated streambank, water). The agricultural sector is serviced by a variety of agencies and organizations including the Whatcom Conservation District (WCD) and NRCS who provide non-regulatory technical assistance in conservation planning and conservation practice implementation. Whatcom County Public Works (WCPW) provides outreach to agricultural and non-agricultural land users. Other agencies such as the Washington State Department of Agriculture (WSDA), Washington Department of Ecology (Ecology), and Whatcom County Planning Development and Services (PDS) are the primary regulators for the dairy (WSDA) and non-dairy agriculture sectors (Ecology, PDS). Whatcom County PDS, Washington Department of Health (WA DOH), and Ecology also interact in non-agricultural land use in a regulatory context. A variety of other groups interact with landowners around water quality issues for education, outreach, awareness, services, and more.

Special districts offer partnership opportunities in Fishtrap Creek Watershed, especially the North Lynden Watershed Improvement District (WID), which is active in the watershed, and Consolidated Diking Improvement District (CDID) #1. WID and CDID boundaries are shown in Figure 2.

1.5 NRCS's Partnership in Reaching Goals

Local NRCS is committed to helping the watershed meet its water quality goals. NRCS actively works with Whatcom Conservation District through planning and implementation and has provided assistance to farmers in the watershed via programs such as EQIP. This work follows the NRCS 9 Steps of Planning and other guidelines outlined in the NRCS National Planning Procedures Handbook (NPPH) (NRCS, 2013).

There are currently two NRCS conservation planners in the Everson Field Office to assist with landowner engagement in the Fishtrap Creek Watershed. However, it would be beneficial to have an additional field office engineer and/or planning specialist in the office to assist with and carry out recommendations based on this assessment and outreach plan.

2. WATERSHED CHARACTERIZATION

2.1 Watershed Location

See Section 1.2, Figure 1 for more information about the location of Fishtrap Creek watershed.

2.2 Local Climate Overview

Located in northwest Washington, the Nooksack Basin and Fishtrap Creek Watershed receives 47 inches of precipitation as rainfall annually, with a variation from 28 to 61 inches (Figure 3 and 4). The majority of precipitation (82%) falls October-May, while the summer months, June-September, receive less than 20% of the annual rainfall (Clearbrook Station https://wrcc.dri.edu).

The Washington State University (WSU) recently (2019) installed an AgWeatherNet weather station within the watershed (Lynden N; Tier 2). Data can be accessed at www.weather.wsu.edu.

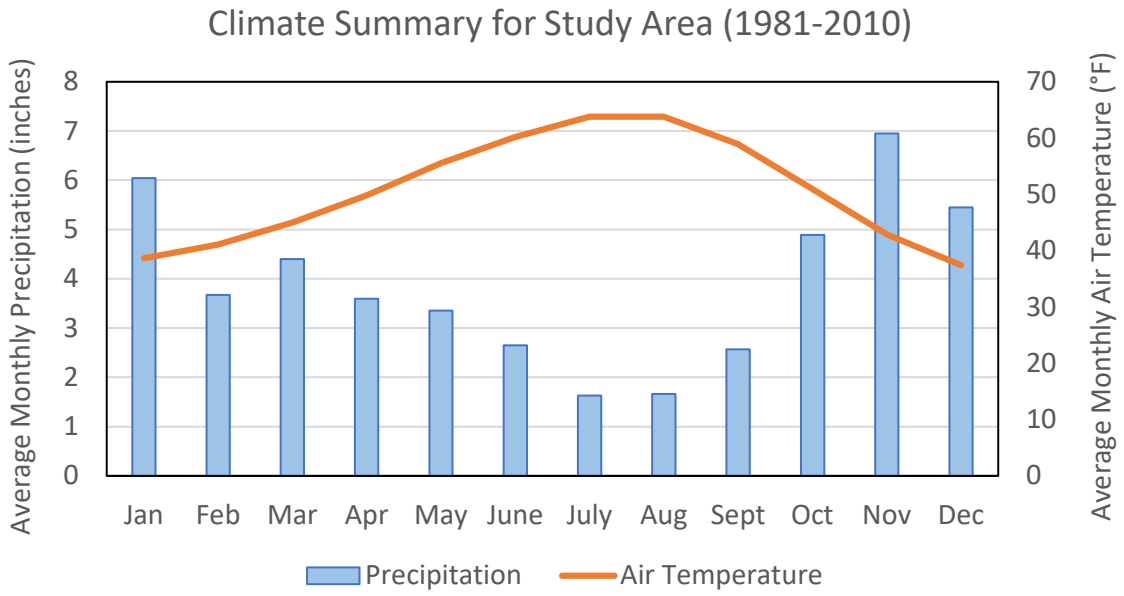

Figure 3. Annual climate summary (1981-2010) for Fishtrap Watershed. Precipitation and ambient temperature are from the Clearbrook, WA weather station located 4 miles east of the Fishtrap Watershed. Data accessed from the Western Regional Climate Center: https://wrcc.dri.edu/ (2020).

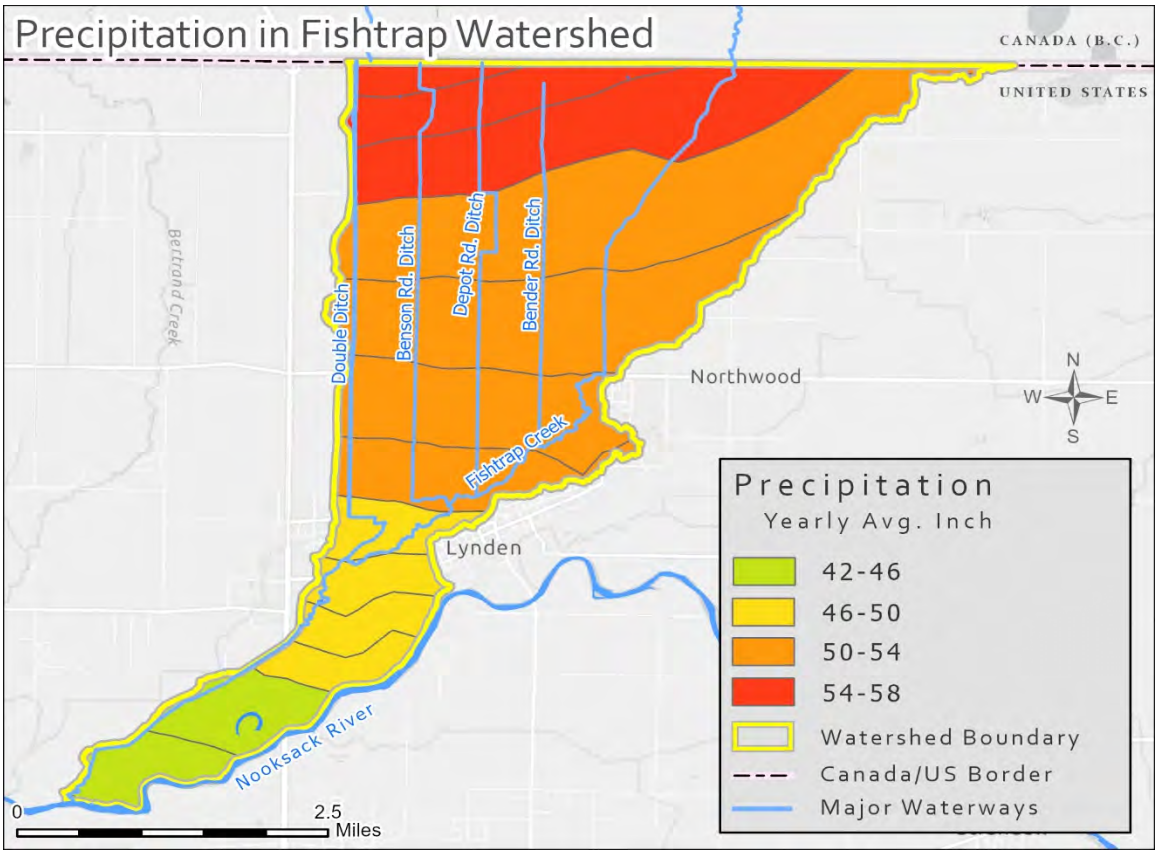

Figure 4. Precipitation in Fishtrap Creek Watershed. Data source: USDA and Texas A&M University.

2.3 Physical Characterization of Watershed Area

Hydrologic Features

Figure 5 shows the hydrologic features, including waterways and wetlands, of the Fishtrap Creek Watershed. These waterways include the mainstem of Fishtrap Creek and a number of agricultural ditches, which primarily run north-south through the watershed: Assink Road Ditch, Bender Road ditch, Depot Road Ditch, Benson Road Ditch, and Double Ditch Drain. Double Ditch originates in BC as Pepin Creek and is diverted along both sides of Double Ditch Road (Double Ditch East and Double Ditch West) when it enters the US.

Fishtrap Creek flows into the Lower Nooksack River at Ferndale, WA. Additional information on the hydrology of the Fishtrap Creek Watershed is found in Section 3.

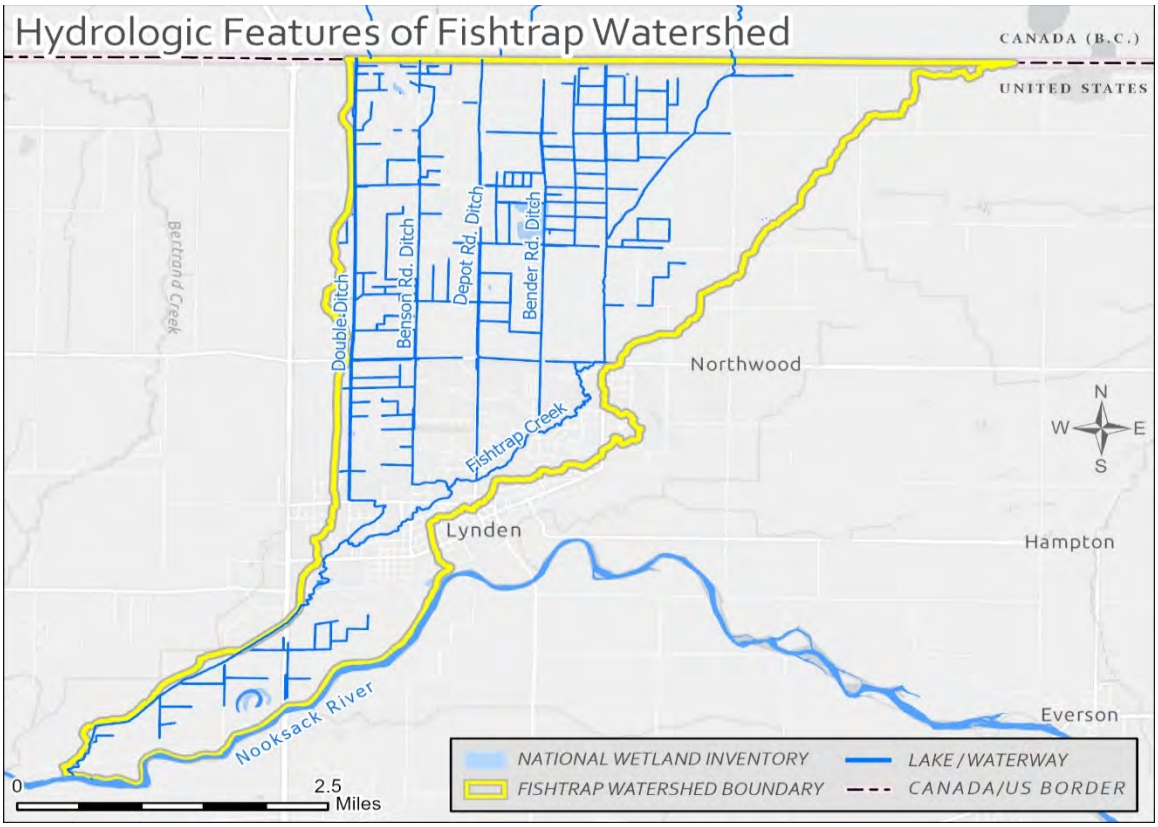

Figure 5. Hydrologic features of Fishtrap Creek Watershed.

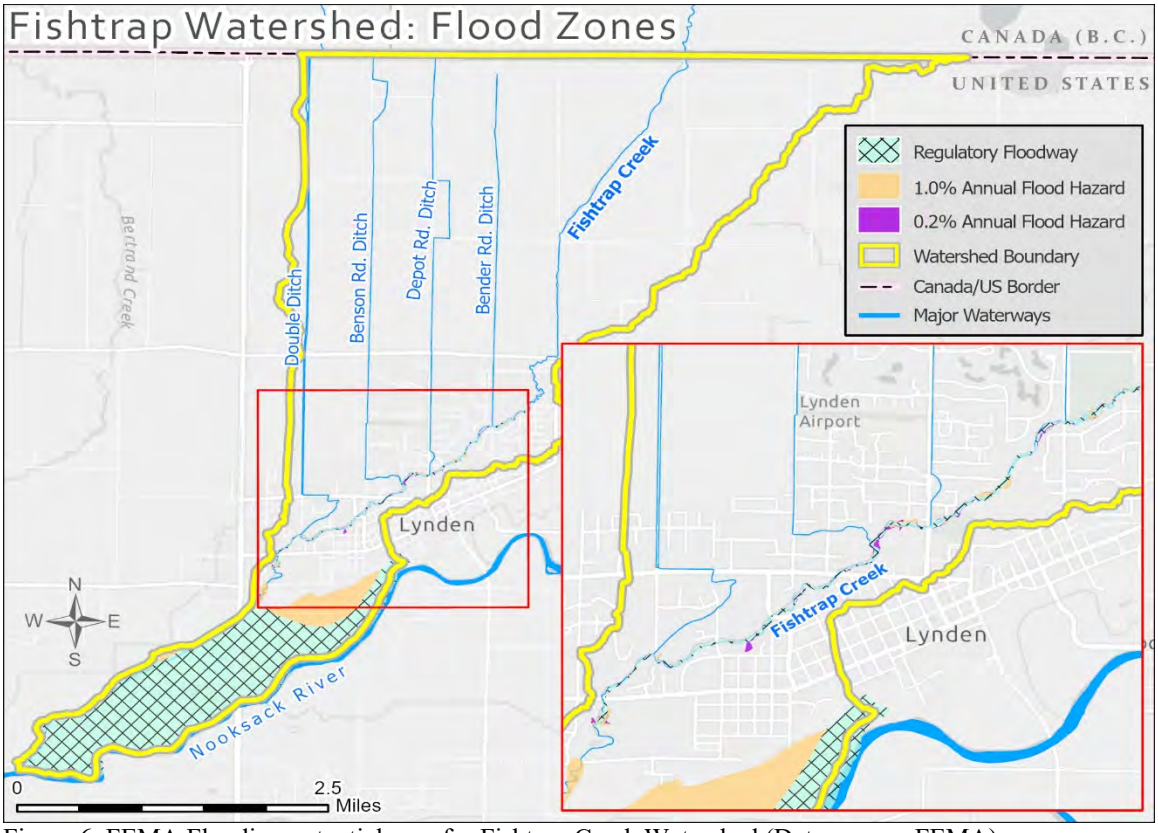

Figure 6. FEMA Flooding potential map for Fishtrap Creek Watershed (Data source: FEMA).

FEMA Flood Zones

The Federal Emergency Management Agency (FEMA) provides flood hazard and risk data and defines the boundaries of regulatory floodways. The lowermost portion of the Fishtrap Creek Watershed falls within the Nooksack River Regulatory Floodway and the Special Flood Hazard Area for the Nooksack River (Floodway and Zone AE) (Figure 6). This equates to a traditional 100-year flood risk zone.

Fishtrap Creek also has a Regulatory Floodway and a Special Flood Hazard Area (Floodway and Zone AE) that extends from the Nooksack River Zone AE to the northern portion of the City of Lynden. Much of the remaining portion of the watershed is designated as FEMA Flood Zone X, or minimal risk of flooding (0.2-percent-annual-chance flood).

More information about these flooding designations can be found online at: https://msc.fema.gov/portal/home

Soils

For NRCS purposes, soils are most often defined by their hydrologic soil group (Figure 7). Fishtrap Watershed is comprised primarily of Group C soils (56%), with Group D soils (21%) also existing throughout the watershed. Group A soils (12%) predominately run along the Fishtrap Creek corridor and Group B soils (11%) in the northern-most US portion of the watershed and into BC.

For the purposes of the spatial modeling, soils were defined by their drainage class (Figure 8). This has been found to be the soil characteristic that best predicts runoff potential, given research by the WCD. Well drained and moderately well drained soils are found along the Fishtrap Creek corridor and on the eastern portion of the watershed (22% and 15% of watershed, respectively). Somewhat poorly drained soils are found throughout the north-central portions of the watershed (37%) with very poorly drained soils making up 16% of the watershed, and corresponding with the Fishtrap muck and Pangborn muck soil types. The lowest elevation portion of the watershed that lies between Fishtrap Creek and the Nooksack River is classified as poorly drained (10% of watershed).

There are 19 unique soil types in the Fishtrap Watershed, with the most common (by acreage) being Hale Silt Loam, drained (25%); Kickerville Silt loam (11%); Clipper Silt Loam, drained (10%); and Pangborn Muck, drained (8%). Soil types are represented in Figures 7 and 8 by grey lines between different soil types.

Digital Elevation Model

The digital elevation model (DEM) shows the elevation profile of the Fishtrap Watershed, from 30 feet at its lowest point to 174 feet on the northernmost edge of the US portion of the watershed (Figure 9). The DEM was derived from the 2006 LiDAR imagery for the North Puget Sound accessed through the Washington LiDAR Portal hosted by the WA Department of Natural Resources (WA DNR): https://lidarportal.dnr.wa.gov/.

Slopes were derived from this DEM in a 100ft by 100ft grid. DEM values for the 100x100 foot grid square were averaged to obtain a percent slope for each grid square (Figure 10).

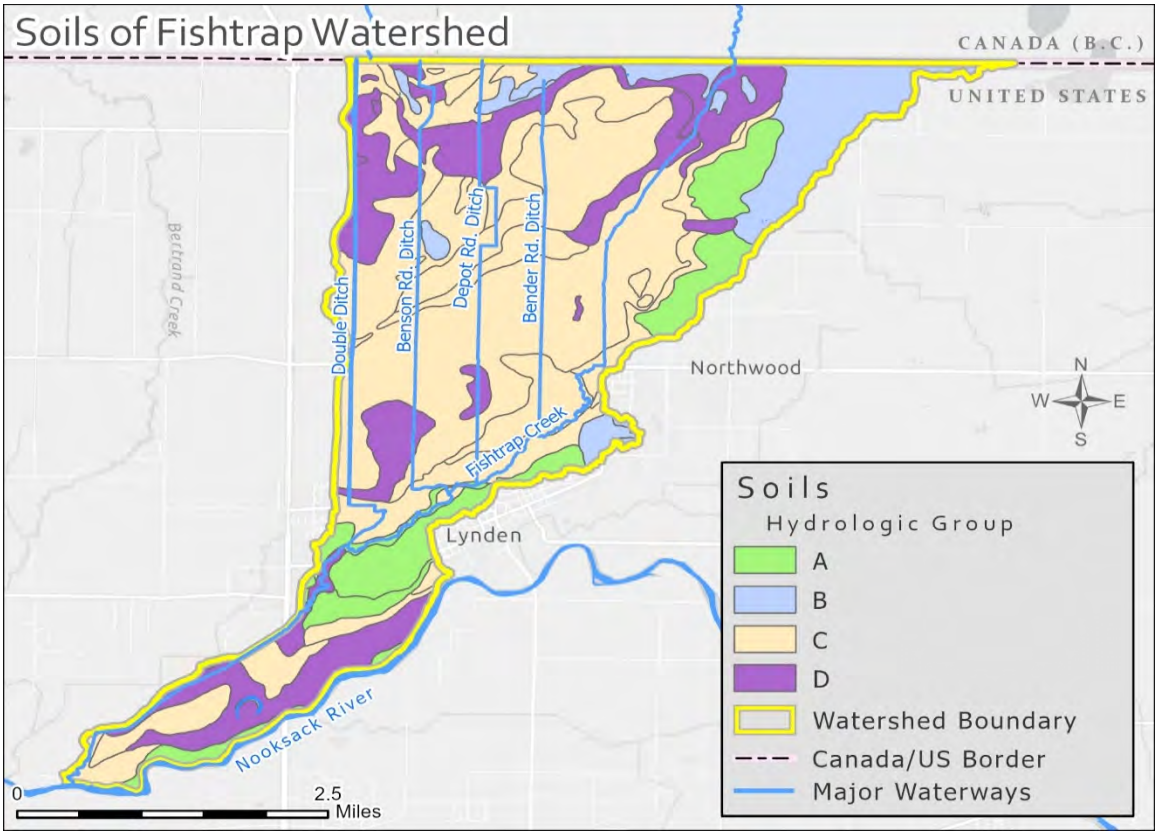

Figure 7. Soils of Fishtrap Creek Watershed by hydrologic soil group (Data source: NRCS).

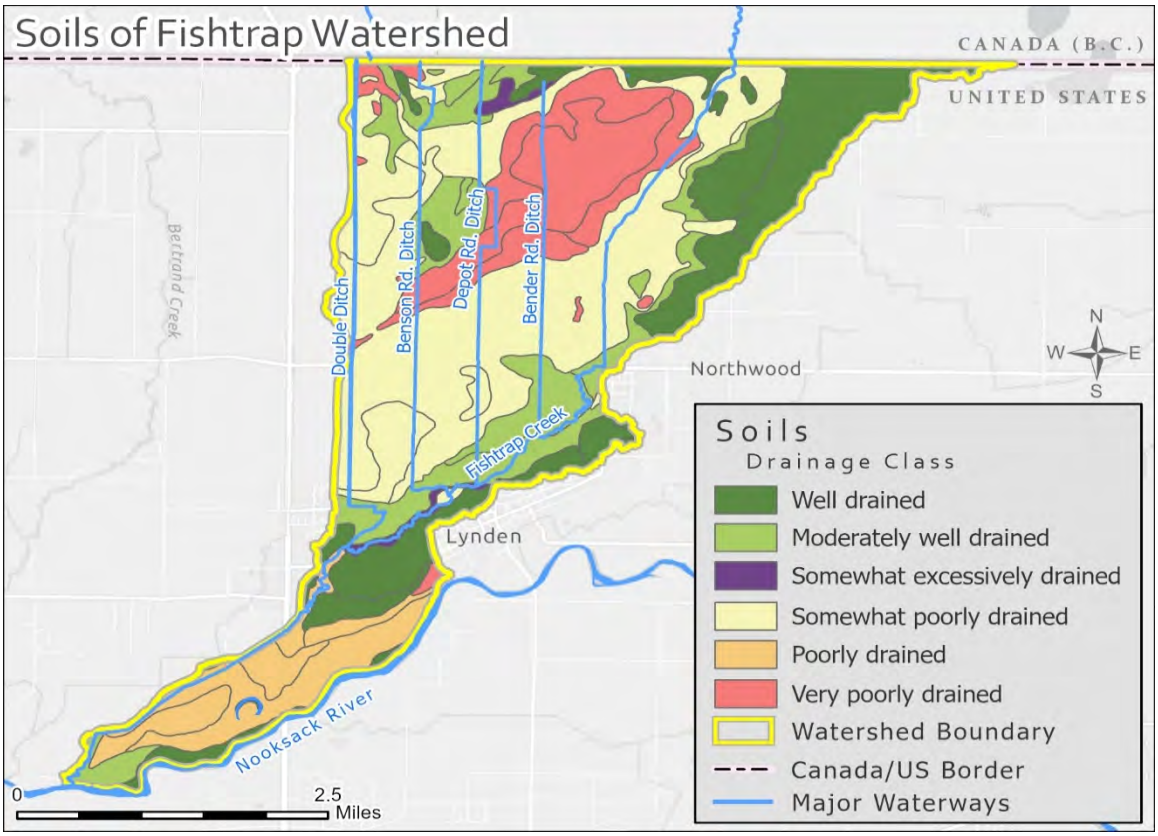

Figure 8. Soils of Fishtrap Creek Watershed by soil drainage class (Data source: NRCS).

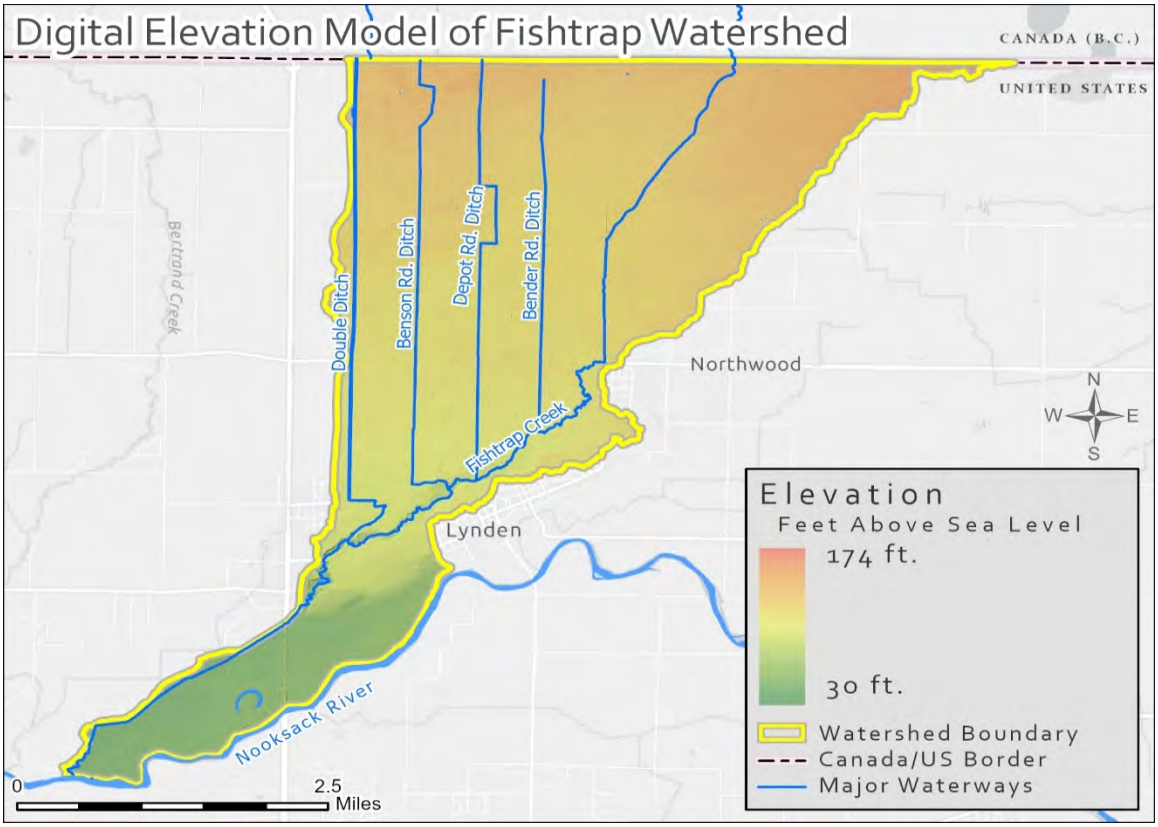

Figure 9. Digital elevation model of Fishtrap Creek Watershed derived from LiDAR imagery (WA DNR).

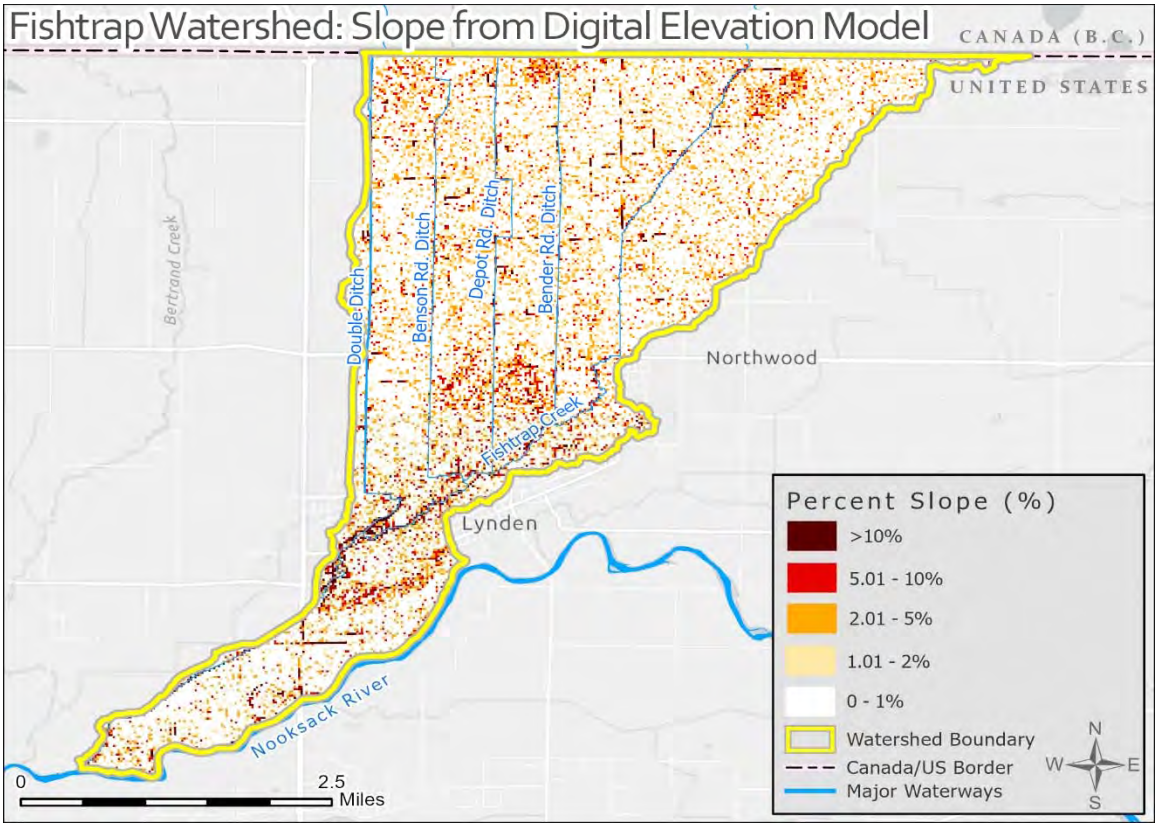

Figure 10. Slopes derived from LiDAR imagery for Fishtrap Creek Watershed (LiDAR source: WA DNR).

2.4 Land Cover and Use

Land Use Characterization

Land use in the Fishtrap Watershed is predominantly crop land and livestock agriculture (75% by acreage). Crop land in the watershed includes pastured lands, hay and silage grass, silage corn, berry crops (caneberry and blueberry), potatoes, and a small number of orchards, tree nurseries, and vegetable crops (Figure 11).

National-scale land cover datasets such as NOAA's Coastal Change Analysis Program (C-CAP) Land Cover Atlas and the USGS National Land Cover Database (NLCD) are available for the Fishtrap Creek Watershed and provide a general overview of land use in the watershed. However, these national scale land cover data sets lack the specificity and resolution that we required for the watershed assessment modeling and associated outreach. Thus, recent land use characterizations from Whatcom County (2018) and Washington State Department of Agriculture (2019) were combined to create a single land cover/land use dataset for the watershed. The work to combine these datasets in ArcMap10 and ground-truth any gaps or discrepancies was done by WCD in 2020. The land use classifications used in the modeling were modified from the NQWI Watershed Assessment for the Tenmile Watershed (Embertson, 2018).

Table 3 summarizes the results of this survey in the Fishtrap Watershed by four broad land use categories (agricultural crop, farmstead, developed, natural space) (Primary category) and more specific subcategories (Secondary category). Figures 11 through 13 show results of this land use survey. Figure 12 shows the location of all on-site septic (OSS) systems in the watershed in addition to the developed land uses.

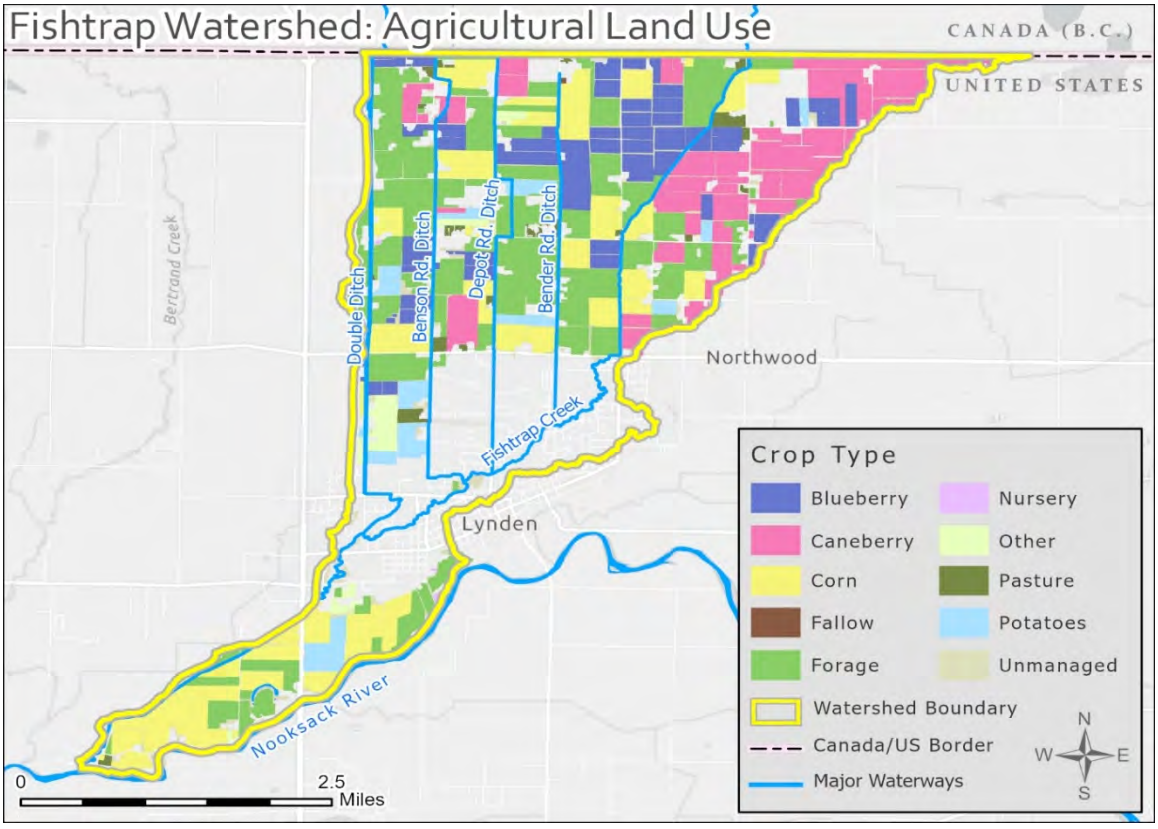

Figure 11. Agricultural crop land uses of Fishtrap Creek Watershed by crop type.

Table 3. Land use in the Fishtrap Creek Watershed. Land uses are categorized into four primary categories (agricultural crops, farmsteads, developed, and natural). Each primary category is subdivided into secondary categories that further describe the land use. All land uses sum to a total watershed area of 9,363.4 acres.

Primary Land Use Category	Secondary Land Use Category	Fishtrap HUC-12 Area (Acres)	Percent of Total Watershed Area
Agricultural Crop	Forage	2,165	23.1%
	Corn	1,393	14.9%
	Caneberry	1,183	12.6%
	Blueberry	933	10.0%
	Unmanaged	344	3.7%
	Potatoes	338	3.6%
	Small Grain	110	1.2%
	Pasture	100	1.1%
	Other	19	0.2%
	Nursery	8	0.1%
	Strawberry	2.9	0.0%
	Orchard	2.3	0.0%
	Fallow	2.3	0.0%
	Vegetable	0.5	0.0%
	Total:	***6,600***	***70.5%***
Farmstead	Dairy	213	2.3%
	Other Animal	127	1.4%
	Crop	52	0.6%
	Total:	***391***	***4.2%***
Developed	Residential	1,190	12.7%
	Commercial	224	2.4%
	Commercial Turf Grass	211	2.3%
	Road	199	2.1%
	Unmanaged	37	0.4%
	Residential Turf Grass	16	0.2%
	Gravel	1	0.0%
	Total:	***1,878***	***20.1%***
Natural Space	Riparian/Streambank	240	48.6%
	Forest	184	37.2%
	Water	70	14.3%
	Wetland	0	0.0%
	Total:	***494***	***5.3%***

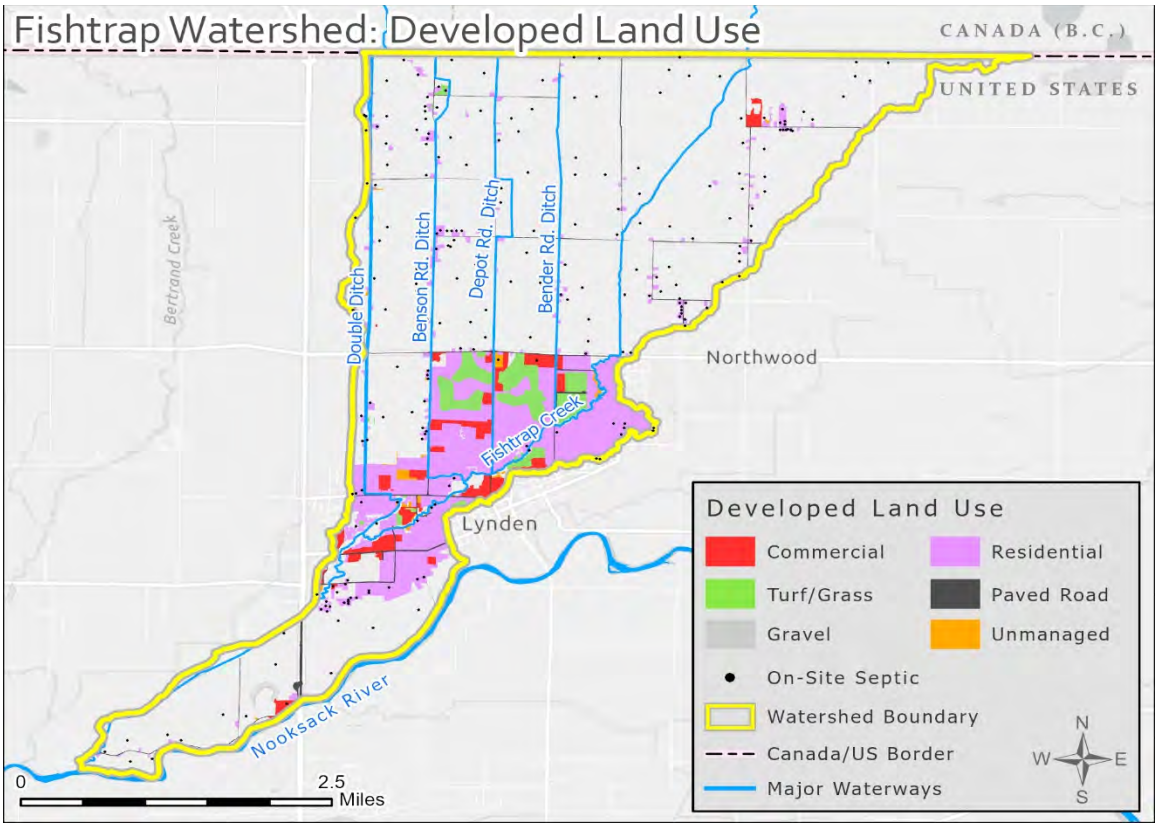

Figure 12. Developed land uses of Fishtrap Creek Watershed. On-site septic systems are shown as black dots.

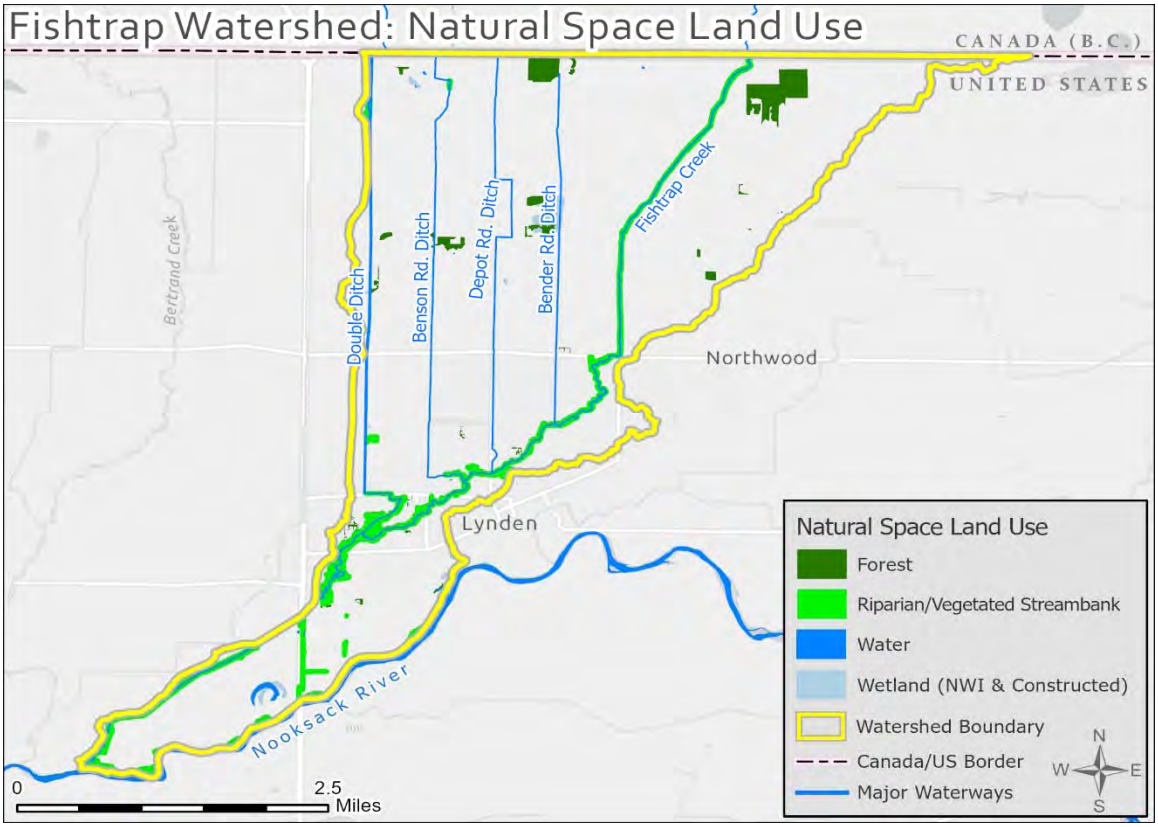

Figure 13. Natural land uses of Fishtrap Creek Watershed. Mapped wetlands include the National Wetland Inventory (NWI) and constructed wetlands. Riparian areas and vegetated streambank are mapped together.

Septic System Locations and Compliance Classification

Whatcom County Health Department (WCHD) maintains records of all on-site septic (OSS) systems in Whatcom County, including the inspection and maintenance status of each OSS. Inspections of residential OSS are required every 1 to 3 years, depending on the type and design of each system. WCHD tracks OSS compliance using five categories: new, in compliance, out of compliance, out of compliance/late for inspection, or failing. Compliance status is updated regularly. Locations of OSS in Fishtrap Creek Watershed are shown in Figure 12.

Livestock Surveys

In addition to the land use characterization work, parcels with livestock in the Fishtrap Creek Watershed (Figure 14, Table 4) were identified using *windshield* surveys of the watershed by WCWP partners. This livestock information was used in the spatial modeling and will be useful for designing and implementing livestock-specific outreach. The data used in this assessment is being used with permission from WCWP partners. WCWP partners had previously conducted livestock *windshield* surveys in the watershed between 2015 and 2020. WCD staff conducted additional *windshield* surveys during June 2020 to update the oldest records (2015-2018) and fill in gaps in information or spatial coverage.

The *windshield* surveys represent observations of livestock on the landscape at the time of the survey. They are not comprehensive nor all inclusive. While attention was given to complete coverage of the watershed, there are some limitations to this data. First, observations were made opportunistically as staff/partners were out conducting sampling and watershed surveys. The season, day, or even time of day that these surveys were conducted can affect whether livestock can be observed. Secondly, all windshield surveys are conducted from the public right of way which limits the observations that can be made in certain areas. Private roads or driveways were *not* used to make observations or properties that are difficult to see from the main roadways.

The livestock survey results indicate approximately 51 properties with livestock have been identified in the watershed (Table 4). Most prevalent are cattle (including dairy heifers, observed grazing dairy cattle, and beef cattle), dairy operations (identified via presence of milk cows at the dairy farmstead), and horse properties. The “cattle” category included grazing dairy cattle that may have been associated with a dairy operation. However, this grouping was made as the conservation practices from grazing dairy or beef cattle are similar. An additional six properties were identified as having pigs, goats, llamas, or other small livestock species. While the numbers are not comprehensive, these estimates of the livestock within the watershed will help to guide outreach suggestions within the watershed.

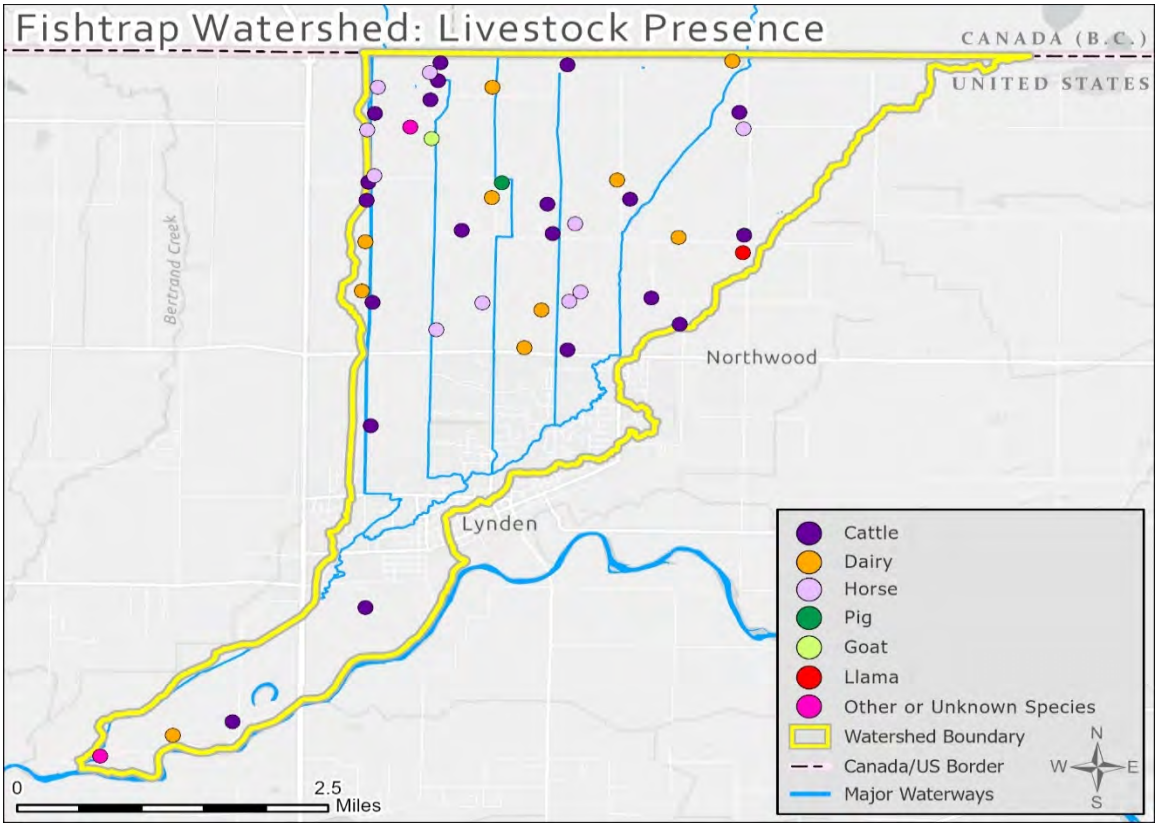

Figure 14. Livestock presence in the Fishtrap Creek Watershed by animal type from windshield survey conducted by the Whatcom Clean Water Program from 2015-2020 and updated most recently by the WCD in June 2020.

Table 4. Livestock properties in Fishtrap Creek watershed by animal type. Density of properties is calculated using a total watershed area of 14 square miles.

Animal Type	Number of Properties	Density (#/per sq mile)	Percent of Total (%)
Cattle*	24	1.7	47%
Dairy*	10	0.7	20%
Horse	11	0.8	22%
Sheep	0	0.0	0%
Goat	2	0.1	4%
Pig	1	0.1	2%
Poultry	0	0.0	0%
Llama	1	0.1	2%
Other	2	0.1	4%
Total	**51**	**3.6**	**100%**

**Cattle includes dairy heifers, observed grazing dairy cattle, and beef cattle. Dairy includes milking facilities associated with dairies. These categories were defined as such based on the specific activities and management practices of these properties or facilities.*

2.5 Socioeconomic and Demographic Characterization of Watershed

The Fishtrap Watershed consists of large acreage agriculture, small acreage hobby farms, high density urban areas, commercial business districts, and rural residential. The watershed is predominately zoned Agriculture and Incorporated City Limits (City of Lynden) with its associated Urban Growth Areas (https://www.whatcomcounty.us/822/Zoning-Maps).

In the US portion of the watershed, there are 3,995 individual parcels in the 9,243 acre watershed. Over 3,400 parcels are less than 1 acre in size; these are primarily general commercial and rural residential. Approximately 200 parcels are greater than 10 acres. The watershed includes the City of Lynden and is included within the Lynden School District #504, though some residents reside within the Meridian School district (https://www.whatcomcounty.us/1591/Other-Maps).

While Census data is not available for the Fishtrap Watershed specifically, the Census of Agriculture for Whatcom County (USDA 2017), which can be extrapolated to the watershed, indicates that of the 1,721 farms and 2,982 producers who responded:

- 93% of farm producers indicate that they identify as White (includes Hispanic/Latino/Spanish which is 3% of "White" total) and 5% Asian. Less than 1% of the producers were American Indian/Alaska Native, Black, or Native Hawaiian/Pacific Islander.
- 56% of farm producers are male with 56% within White, 72% in Hispanic, and 66% in Asian race categories.
- The percent of farmers indicating they are "New and Beginning" is 28% in white, 41% in Hispanic, and 38% in Asian race categories.
- The majority of all farm producers are between the ages of 35-64 (60%), with 32% over the age of 65. While this largely represents values for White producers, Asian demographics show 75% of producers are 35-65 and only 9% over the age of 65, and Hispanic producers had 25% of producers under the age of 35.
- 52% of farms have less than $2,500 in annual sales and 30% greater than $10,000 in annual sales.
- The average farm size was 57 acres for White, 44 for Hispanic, 75 acres for Asian, and 172 for America Indian (largely skewed by one producer) producers, with the majority of producers having less than 50 acres (80, 83, 61, and 91%, respectively).
- The majority of farms identifying as Asian were producing berry crops (75%) representing 35% and 66% of the total acres in raspberry and blueberries, respectively.
- The majority of forage (99%) and corn (100%) crops where produced by White producers representing 29% of the total number of White identified farm operations. White farms also accounted for 75% of raspberry production acres farmed, and nearly 100% of total numbers of layer chickens, cattle, and horse animal units produced/raised.

The implications of these socioeconomic and demographic boundaries are discussed in further detail in Section 6 (Outreach).

3. HYDROLOGIC AND WATER QUALITY CHARACTERIZATION

3.1 Available Water Quality Data and Resources

Surface water quality monitoring efforts in the Fishtrap Creek Watershed focus largely of pathogens, though specific projects have targeted sampling for nitrogen, phosphorus, and sediment between 1997 and 2019. Surface water sampling for each of the four pollutants of concern in this assessment (nitrogen, phosphorous, sediment, pathogens) are summarized in Table 5. Monitoring stations for pathogens are shown in Figure 16 symbolized by each site's five-year geometric mean for fecal coliform.

More information on the results of this water quality monitoring is provided in section 3.3.

Table 4. Surface water quality sampling in the Fishtrap Creek Watershed.

Pollutant	Measured as	Sampling Locations	Period of Record
Sediment	Turbidity (NTU)	2 monitoring stations for grab samples	1999- present
Nitrogen	Total Kjeldahl Nitrogen (mg/L) Ammonia (mg/L) Nitrite+Nitrate (mg/L)	3 monitoring stations sampled during TMDL Evalaution Nitrate+nitrite sensor on Fishtrap Creek at Front St.	1997-1998 April 2018-May 2020
Phosphorus	Total Phosphorus (mg/L) Orthophosphate (mg/L)	3 monitoring stations sampled during TMDL Evalaution	1997-1998
Pathogens	Fecal coliform (#/ 100 ml)	22 monitoring stations for grab samples	1997-present for 1 site 2015-present for the majority of sites

3.2 Watershed Hydrology

Gauging Stations

The US Geological Survey (USGS) maintains a gauging station on Fishtrap Creek at Front Street (USGS 12212050). This station records discharge (cubic feet per second), gage height (feet), and temperature (degrees C). There are is also a nitrate + nitrite sensor at this site that records nitrate in real-time. Data from this station can be accessed online at https://waterdata.usgs.gov/wa/nwis/uv?site_no=12212050.

Environment Canada (EC) previously maintained a gauging station on Pepin Creek at the international border (08MH156) from 1985-2018. More information about the site can be found online at https://wateroffice.ec.gc.ca/station_metadata/reference_index_e.html?stnNum=08MH156.

Stream Flow Analysis

The Whatcom County Stream Flow Analysis provides a comprehensive summary of historic and current precipitation and stream flow records in WRIA 1, including within the Fishtrap Creek watershed (RH2 Engineering, Inc, 2016). This document is available online at https://drive.google.com/file/d/1qEqE-4k-LDLnIcaQA2TDRyEAyD50QoCY/view.

Over the period of record (1999-2015), Fishtrap Creek (as measured at Front St.; USGS 12212050) has shown an overall increase in maximum and mean daily discharge. However, in more recent years (2011-2015), maximum and mean daily discharges appear to be decreasing. Minimum flows tent to occur in late August or early September and data show that minimum flows are occurring earlier each year. Maximum flows, which occur between mid-December and mid-January, are occurring later in the water year.

Relative Contribution of Fishtrap Creek to the Lower Nooksack River

According to the Nooksack TMDL Evaluation (Joy, 2000), which calculated a water balance for the 1997-1998 water year, Fishtrap Creek comprised 2.2% of the discharge to the Lower Nooksack River. For context, the Upper Nooksack River (measured at North Cedarville) contributed 89.4% of the water balance and the only tributary to exceed Fishtrap Creek in percent contribution was Bertrand Creek at 2.8%.

This water balance was calculated using gauging stations on the mainstem Nooksack River and simulated hydrographs for the tributaries. The hydrographs for each tributary were developed from regression equations, comparing tributary flow to the gauging station on Bertrand Creek (Joy, 2000). Any questions of data requests regarding these regression equations and resulting hydrographs should be addressed to Ecology.

The Lower Nooksack Water Budget, compiled by Whatcom County and the WRIA 1 Joint Board, describes in further detail the water budget of the Lower Nooksack and its tributaries (Bandaragoda et al., 2012). This document provides information on rainfall to runoff ratios (the proportion of rainfall that is converted to streamflow) and seasonal timing of stream flow in the Lower Nooksack and its tributaries.

Seasonality of Water Quantity

Average annual discharge in the Nooksack River is dominated by snowmelt and rainfall in the upper watershed. By contrast, average annual discharge in the lowland tributaries (including in Fishtrap Creek) is dominated by lowland rainfall between the months of October and April. Thus, flows in Fishtrap Creek fluctuate throughout the year, with highest flows throughout the winter months and immediately following storm events. Low flows in Fishtrap Creek during the summer months is typical, with some tributaries and ditches in the watershed drying up completely during this time. Additional information on seasonal patterns of water quality can be found in Section 4.2 of the Lower Nooksack Water Budget (Bandaragoda et al., 2012).

Instream flow requirements for Fishtrap Creek are outline in WAC 173-501-030 of the Washington Administrative Code (WAC). Year-round limitations to further consumptive use are established in WAC 173-501-040 for Fishtrap Creek (including Double Ditch).

Precipitation-Runoff Budget

The Lower Nooksack Water Budget (Bandaragoda et al., 2012) estimated the ratio of rainfall that is converted to streamflow runoff for the Fishtrap Creek Watershed and other lower Nooksack tributaries (Figure 15). Fishtrap Creek has an estimated runoff to rainfall ratio just below 50%, meaning that about half of the rainfall is converted to streamflow. No further modeling or estimation of precipitation-runoff budget was performed for this assessment.

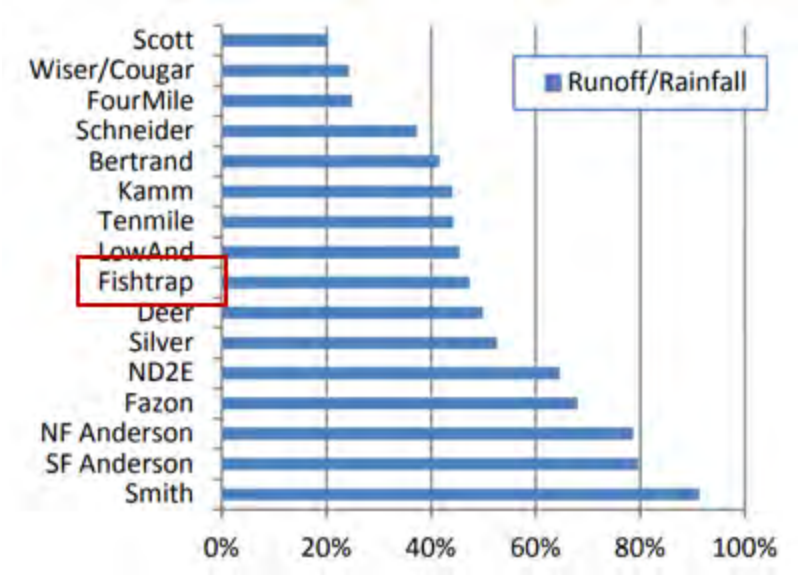

Figure 15. Lower Nooksack Water Budget (data from: Bandaragoda, 2012).

Groundwater Recharge Potential

In 2018-19, a spatial assessment of groundwater recharge potential was conducted by University of British Colombia (Ayetan, 2019). In a similar spatial modeling approach employed by this watershed assessment for runoff potential (as described in Section 4), the authors combined multiple spatial factors that impact groundwater recharge and combined them using a normalized weighting/ranking calculation to determine groundwater recharge potential across Whatcom County. Groundwater recharge potential was given a 5-scale ranking (Low, Moderately Low, Moderate, High, Very High), which was mapped spatially.

Groundwater recharge is an important consideration for both water quantity and water quality. Projects that utilize groundwater recharge to replenish water stores can be vital to the function of the groundwater aquifer. However, groundwater recharge can also provide a pathway for land-based pollutants, such as nitrates, to enter the groundwater.

In the Fishtrap Creek Watershed, groundwater recharge is generally highest in the northern most portion of the watershed. This is largely driven by lower slopes and less curvature (i.e. flatter land), higher average precipitation, and less developed land cover.

3.3 Irrigation in the Fishtrap Creek Watershed

A study of agricultural irrigation water use was completed in 2016 for the Public Utility District No. 1 of Whatcom County (RH2 Engineering Inc., 2016). According to this study, 5,637 acres in the Fishtrap Creek Watershed are irrigated annually (out of a total 6,486 agricultural acres in the watershed). Estimates of water use range from 7,761 acre-feet per year (afy) to 8,956 afy. These estimates were derived from 1) field-specific data from WSDA, and 2) water application efficiencies by irrigation type from Department of Ecology's Water Resources Guidance *GUID-1210 Water Resources Program Guidance for Determining Irrigation Efficiency and Consumptive Use.* The full report is available online at http://wria1project.whatcomcounty.org.

Previous efforts to estimate agricultural water use in the Nooksack Basin are captured in the Lower Nooksack Water Budget Report (Bandaragoda et al., 2012), which can also be found at http://wria1project.whatcomcounty.org.

This NWQI assessment does not evaluate irrigation uses in the Fishtrap Creek Watershed and does not account for irrigation in the spatial modeling. While irrigation data on a field use scale is not available for this watershed, a general overview of irrigation practices was conducted to assess potential high impact land uses for mitigation. In general, irrigation is conducted for the majority of crops grown. For caneberry, blueberry, and strawberry crops, tape and drip irrigation systems are present in almost all acres (2,119 cumulative acres). When applicable, overhead sprinkler type irrigation systems are used for corn, grass, small grain, and potato crops (4,006 cumulative acres). Orchard, nursery, and vegetable crops use different methods including drip and sprinkler type irrigation systems, but almost all are irrigated. Most irrigation water is from groundwater wells. More work is needed to properly inventory the number of acres irrigated. Challenges include crop rotation and seasonal variability which impact the need to irrigate, which will affect the timing, volume, and number of acres irrigated annually.

3.4 Current Water Quality Conditions

Pathogen Monitoring (Whatcom Clean Water Program)

Monitoring of fecal bacteria, as an indicator of pathogens in water, is coordinated by the WCWP. Six partner agencies sample fecal bacteria in the Fishtrap Creek Watershed.

- Whatcom County Public Works
- Washington Department of Agriculture
- Washington Department of Ecology
- City of Lynden
- Volunteer Stream Team / Whatcom Conservation District (WCD)
- Nooksack Indian Tribe

The fecal bacteria monitoring within the watershed can be broken into three subcategories.

1. *Long-term Ambient monitoring (1998 to present):* seven sites sampled twice monthly during Nooksack routine run. These monitoring results at select stations within the watershed are used for comparing bacteria trends over time across the subbasins of the Nooksack Watershed.
2. *Short-term Ambient monitoring (2015 to present):* 25 sites sampled twice monthly during Fishtrap Focus run. This 5-year dataset is used primarily for evaluating short-term data trends, seasonal analysis, and provide better spatial coverage of the watershed.
3. *Source ID and Storm Event (2014 to present):* varies by season and need. Source identification and storm event samples are used for informing source correction efforts and understanding the impact of rain events on bacteria concentrations in the watershed.

The primary indicator of bacteria for the monitoring program described above is fecal coliform, though some agencies also monitor additional indicators of *Eschericia Coli (E.coli)* and *Enterococcus*. Monitoring results are compared to state WQ criteria for fecal bacteria the geometric mean and 90th percentile (described in more detail in Section 1.3, Table 1) at each monitoring station on an annual and 3-year timeframe. Three-month seasonal statistics and dry-versus-wet season statistics are also calculated. Summaries of current bacteria monitoring can be found at: http://www.whatcomcounty.us/2606/Focus-Area-Monitoring-Results.

Twenty-two monitoring sites in the Fishtrap Creek Watershed have been sampled as part of the Fishtrap Focus Monitoring since 2015. From 2015 to late 2018, these sites were sampled weekly.

In late 2018, the frequency of sampling was reduced to twice monthly (ongoing through the date of this report).

Four of these 22 sites (F1, F3, DDE, DDW) are sampled an additional twice a month as part of the Nooksack Routine monitoring run. Eight sites in the BC portion of the watershed are sampled one time per month by BC Ministry of the Environment in coordination with WA partners (sites not shown in Figure 16). Additional sites throughout the watershed are sampled for source identification (source ID) work; annual and 3-year statistics are not calculated for these source ID sites.

Of the 22 monitoring sites that make up the Fishtrap Focus Area, 10 of the sites are on the mainstem of Fishtrap Creek and 12 are on tributaries to Fishtrap Creek (Assink Road Ditch, Bender Road ditch, Depot Road Ditch, Benson Road Ditch, and Double Ditch).

For the period of 2015-July 2020:

- 16 out of 22 Fishtrap Creek stations are currently meeting the criteria for geometric mean. Six stations are not meeting this criterion, these are shown in orange in Figures 16 and 17.
- A single tributary site (FT9) is meeting the criteria for the 90th percentile.
- Generally, average fecal coliform levels increase as Fishtrap Creek leaves the agricultural areas and passes through the City of Lynden (Figure 16). This indicates a need for water quality improvements to sources outside of typical NRCS customers and program focus.

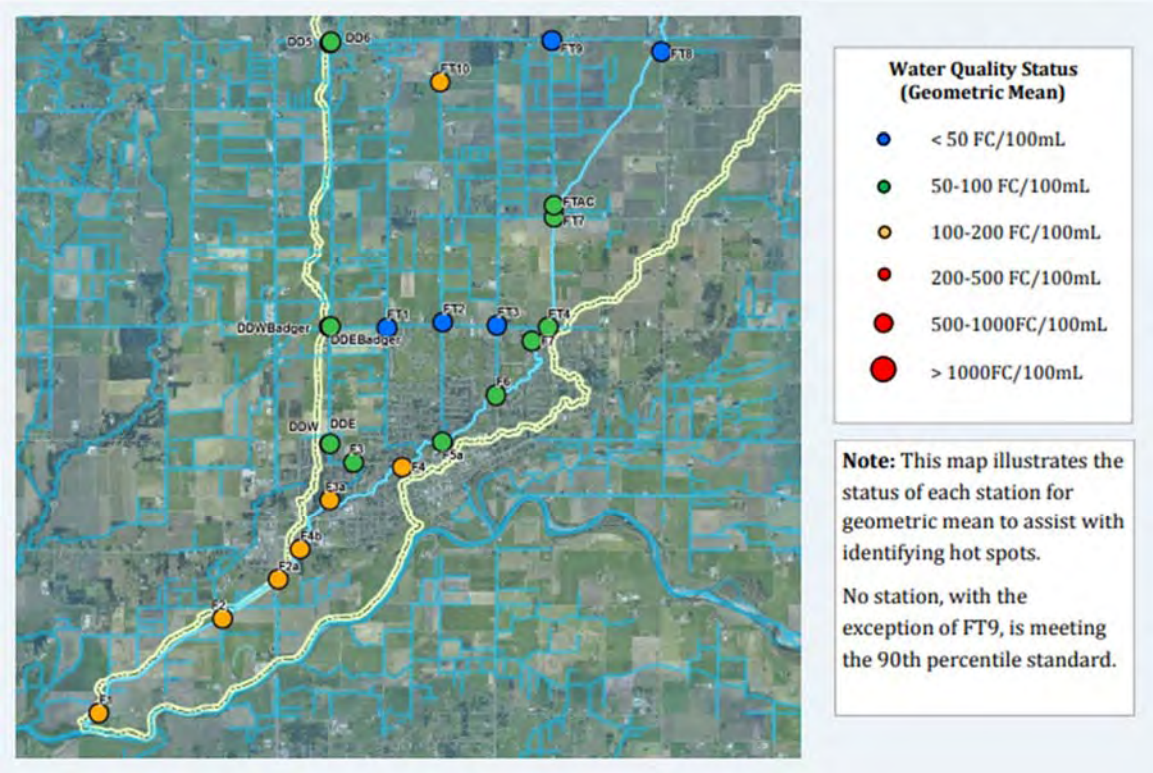

Figure 16. Map of Fishtrap Creek Focus Area monitoring stations represented by the geometric mean for fecal coliform (March 2015-August 2020).

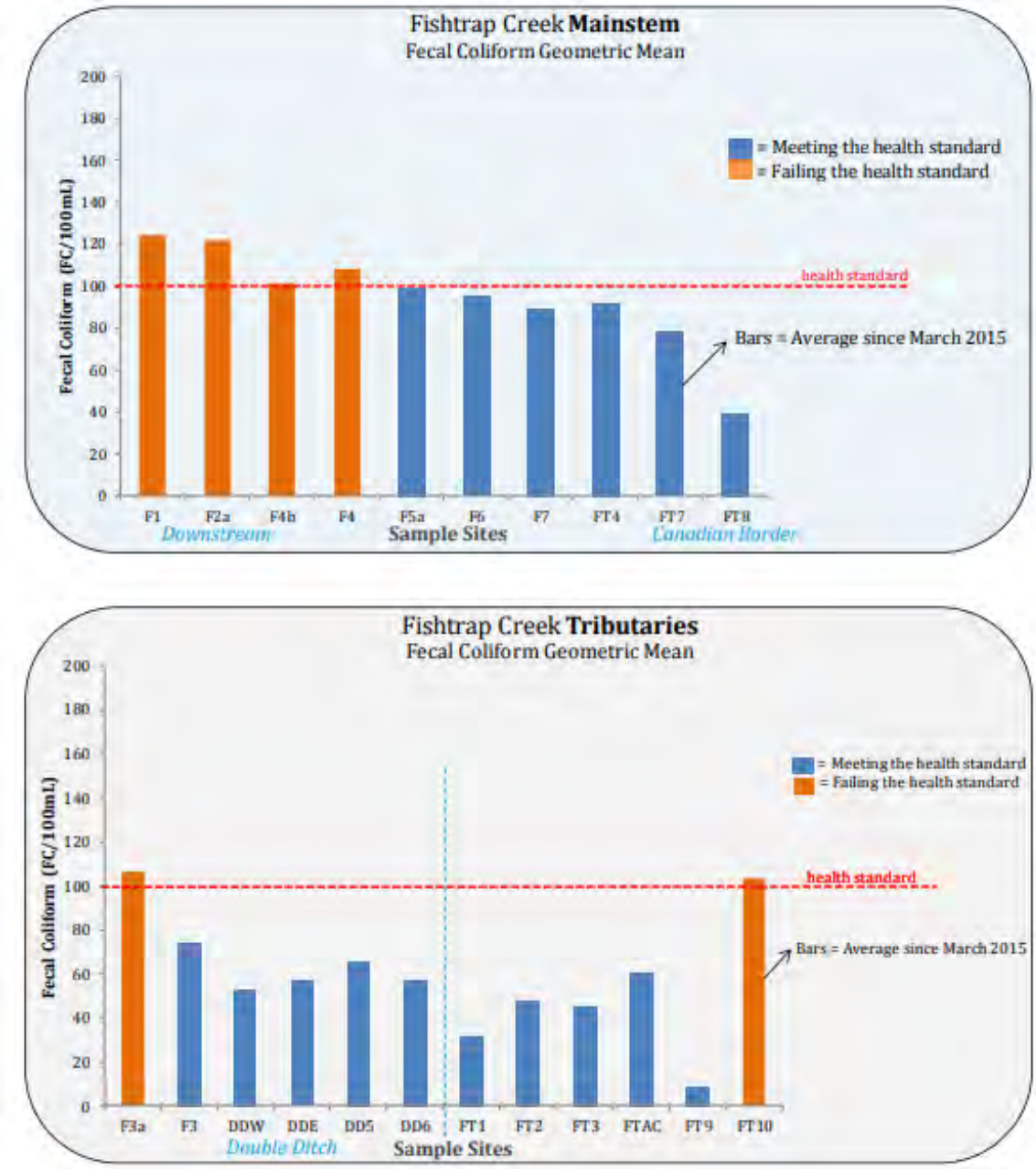

Figure 17. Geometric mean for fecal coliform (March 2015- August 2020) for 10 stations of the mainstem Fishtrap Creek and 12 tributary stations. Blue bars indicate that the geometric mean for the station is below the water quality standard for fecal coliform.

Nitrogen and Phosphorus

There is very limited monitoring of nitrogen and phosphorous in the watershed. Historic nitrogen and phosphorus data are available from the TMDL evaluation study from 1997 to 1998 at three sites in the Fishtrap watershed (Joy, 2000). However, the authors are not aware of current nitrogen or phosphorus grab sample monitoring being done in Fishtrap Creek watershed.

A real-time nitrate + nitrite sensor is located at the USGS stream gage site at Front Street (USGS 12212050). This sensor was deployed in 2018 and data is available from April 2018 through May 2020 (Figure 18). Data can be accessed at https://waterdata.usgs.gov/wa/nwis/uv?site_no=12212050.

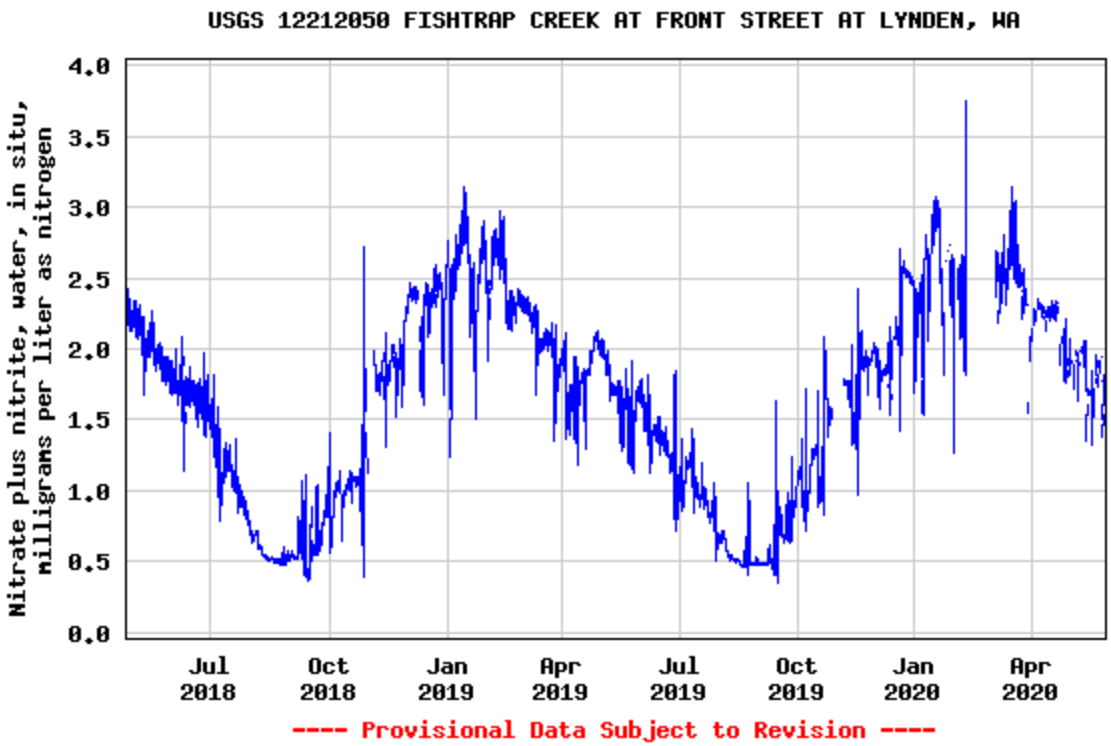

Figure 18. USGS nitrate+nitrite (mg/L) sensor data April 2018 – May 2020.

Sediment

The USGS and Nooksack Indian Tribe (NIT) have published datasets of the total suspended sediment (TSS) concentration and loads for the mainstem Nooksack River from 2009 to 2017 (Curran, 2018). This research does not include monitoring stations within the Fishtrap Creek, but could be used to assess changes in TSS in the Nooksack River Basin over time.

Turbidity, a surrogate measurement of suspended sediment that is easier to monitor in the field, is collected at two sites in the Fishtrap Creek Watershed on a monthly basis by NIT (along with temperature, dissolved oxygen, and specific conductance). For more information on this sampling, see the NIT website: https://nooksacktribe.org/departments/cultural-resources/water-resources/water-quality-monitoring/.

Turbidity measurements were also collected along with temperature, dissolved oxygen, nutrients, and specific conductivity during the TMDL evaluation study from 1997 to 1998 at three sites in the Fishtrap watershed (Joy, 2000).

More regular measurement of either turbidity or TSS in the Fishtrap Creek Watershed would provide a better understanding of suspended sediment in the surface waters of the watershed over time. It would be useful to track seasonal trends in sediment concentrations and peak sediment concentrations after "first flush" rain events in the fall. Additionally, in areas with conversion of land use (e.g. from one agricultural land use to another or from an agricultural land use to developed land use), surface water sediment concentrations would provide a more complete picture of the water quality impacts.

Contribution of the City of Lynden

In addition to the many sources of pollutants in the watershed, the City of Lynden (COL) has been identified as a potential contributing source of pollution to Fishtrap Creek. The COL has

developed a Stormwater Management Program to meet the terms and conditions of its Western Washington Phase II Municipal Stormwater Permit under the National Pollutant Discharge Elimination System (NPDES). The COL Public Works Department is responsible for providing environmentally sound, efficient and effective management of their storm drainage system, which includes catch basins, curbs, gutters, ditches, man-made channels, pipes, tunnels, and storm drains. There are many existing efforts to reduce the discharge of pollutants from the COL municipal stormwater system including monitoring, education, public outreach, and participation, MS4 mapping, illicit discharge detection and elimination systems and code enforcement.

While the area of the Fishtrap watershed within the COL is a large geographic area with impact water quality, this is not an area that should be of focus for NRCS. Thus, it has not been modeled in the spatial analysis portion of this section, see further rationale for this decision in Section 4.2.

4. RESOURCE ANALYSIS ASSESSMENT

4.1 Overview of Watershed Assessment Model

Objective

The potential for pollutants to leave land surfaces and enter nearby surface waters depends on:

1. Terrain features (e.g. soil type, topography, proximity to surface waters)
2. Land use
3. Specific land management activities or practices

The objective of the watershed assessment model was to incorporate spatial data in order to estimate each of the parameters listed and overlay them spatially in order to identify specific critical source areas (CSA) within the watershed. A CSA is an area where pollutant "export" to surface waters is likely the result of a combination of terrain features and land use. The level of risk associated with a CSA can be modified with the addition of a known or modeled land management activity or practice to show where pollutant export can be reduced or eliminated. In many cases, these activities are already being employed by land managers to protect water quality and public health.

It is important to note that these CSA are potential, meaning that they do not necessarily represent the actual conditions of a site. Well considered land use management (e.g. consideration of soil type, topography, and proximity to surface waters) and the implementation of conservation best management practices or "BMPs" can reduce or eliminate the potential for runoff into surface waters, thereby reducing that critical source area risk level.

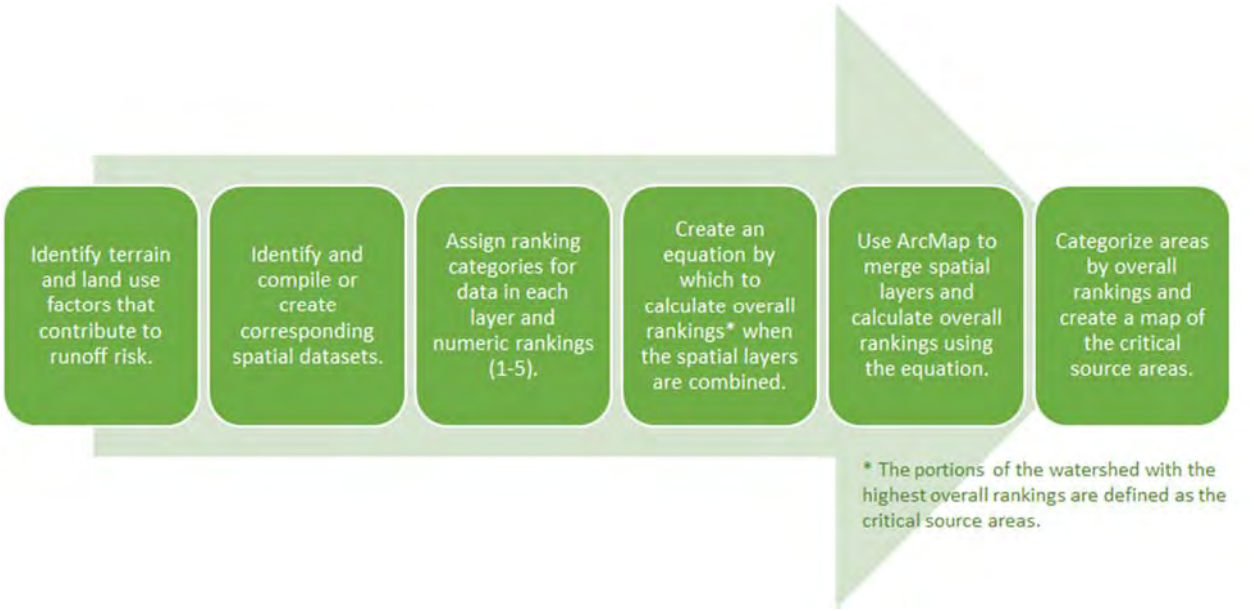

Figure 19. Workflow graphic for spatial modeling approach using ArcMap10.

Spatial Modeling Approach

The workflow process for the spatial modeling approach employed is illustrated in Figure 19. The first step in modeling the critical source areas was to identify factors of terrain and land use that contribute to runoff risk and the potential to export pollutants. These factors were identified, and the necessary spatial data layers were compiled or created to map each factor (e.g. precipitation, soils, and land use data sets). An initial list of more than 20 layers was simplified into a list of eight of the most influential layers (five terrain and three land use layers) used for the final modeling (Table 6). The spatial data layers (or shapefile) included in the model are further described in Appendix A. Additional information about these layers can be found in Section 2 (Watershed Characterization).

In order to combine these layers and compare areas with lower or higher pollutant export potentials, the data in each layer was ordered into 2-5 categories or bins, each of which was given a ranking score of 1-5 (Appendix A). For the land use categories, each land use was assigned five different ranking scores, one for each of the pollutants (phosphorus, nitrogen, sediment, and pathogens) and a combined pollutant ranking score (Appendix B). The combined score represents the combined pollutant export potential for all four pollutants when considered together. The categories and ranking scores were defined by WCD staff using relevant literature and expert knowledge.

The spatial layers (and their associated ranking scores) were combined in ArcMap10 using the Merge tool and Calculate field tool to create unique polygons each with a different overall ranking score. For each polygon, the ranking scores for the contributing input layers was summed to create a relative overall ranking score. A higher relative overall ranking score represents an area with a higher potential of pollutant export, hereafter referred to as a critical source area (CSA). Section 4.1 describes the different CSAs that were created based on the input layers.

The overall ranking scores were categorized as low, medium, medium-high or high pollutant export potential. The areas with a ranking of medium-high or high are the ones defined as a CSA. Maps were created to illustrate the locations of the CSAs within the watershed and help draw conclusions about the most influential terrain and land use factors contributing to CSAs within the Fishtrap Creek Watershed (Section 4.1, Figures 20 through 25).

Table 5. Spatial data layer model inputs were grouped into two categories: terrain factors and land use factors.

Terrain Factors	Land Use Factors
Annual average precipitation	Land use classification
Proximity to waterways	Livestock presence (from livestock surveys)
Location relative to flood zone	Septic system locations and compliance status
Soil Drainage Class	
Slope (derived from DEM)	

4.2 Critical Source Areas (CSA) Identified

The modeled critical source areas (CSA) in the Fishtrap Creek Watershed are described through a series of six maps (Figure 20–25) including:

(1) Critical source areas considering terrain factors only (Figure 20).

(2) Critical source areas considering terrain factors and land use with pollutant risk combined for the four pollutants (nitrogen, phosphorus, sediment, and pathogens) (Figure 21).

(3-6) Critical source areas considering terrain factors and land use with each pollutant (nitrogen, phosphorus, sediment, and pathogens) considered individually (Figures 22 through 25).

The layers included in the CSA calculations for each map are listed in Table 6; more information on each layer can be found in Appendix A. The CSA ratings displayed on the map (Low, Medium, Medium-High, High) are based on the CSA scores described in Section 4.1 (Spatial Modeling Approach). A Critical Source Area is defined as an area with a rating of high or medium-high. It should be noted that the area within the City of Lynden boundaries is not included in Figures 21-25 due to the difficulty in accurately modeling contributing sources (ie., stormwater, residences, greenways, etc.). Since urban area source contributions are not the focus of this assessment, this area was left unmodeled and CSA ratings not provided. This area *is* included in Figure 20 where only terrain factors (and not land uses) are considered in the model.

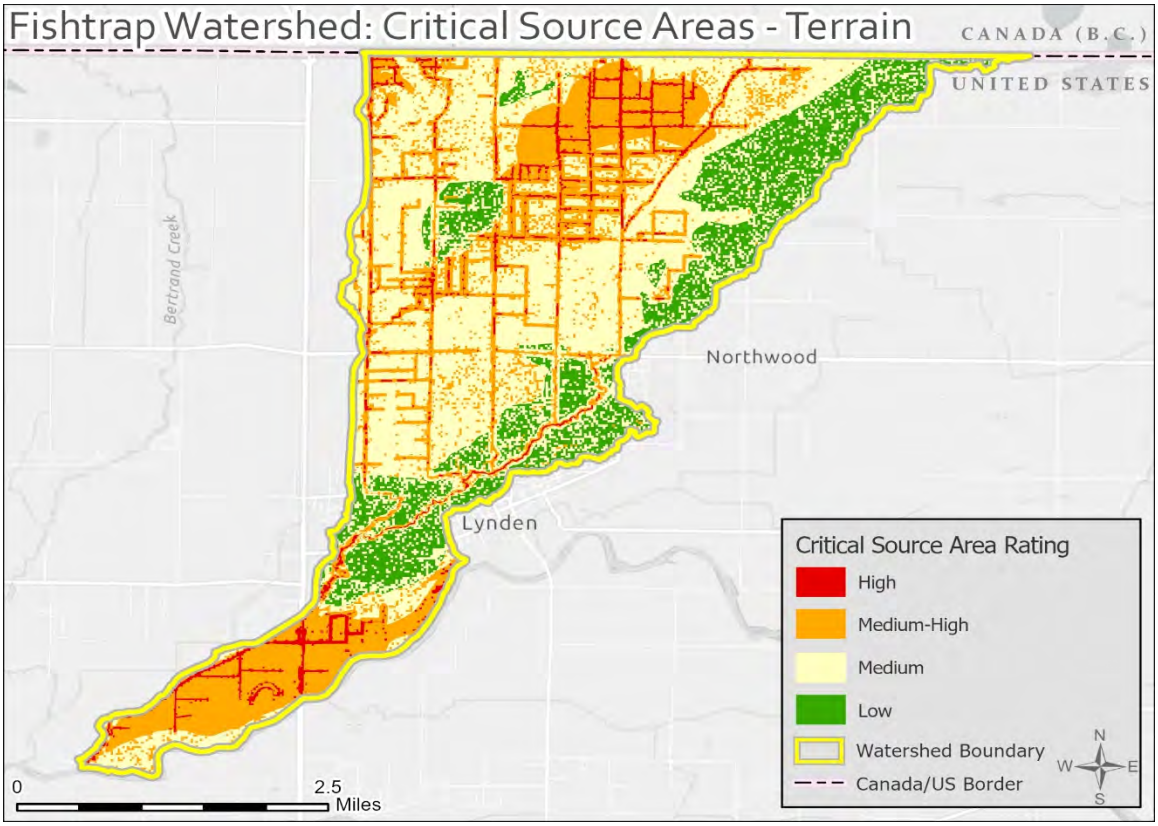

Figure 20. Potential critical source area contribution rating for terrain factors in the Fishtrap Watershed.

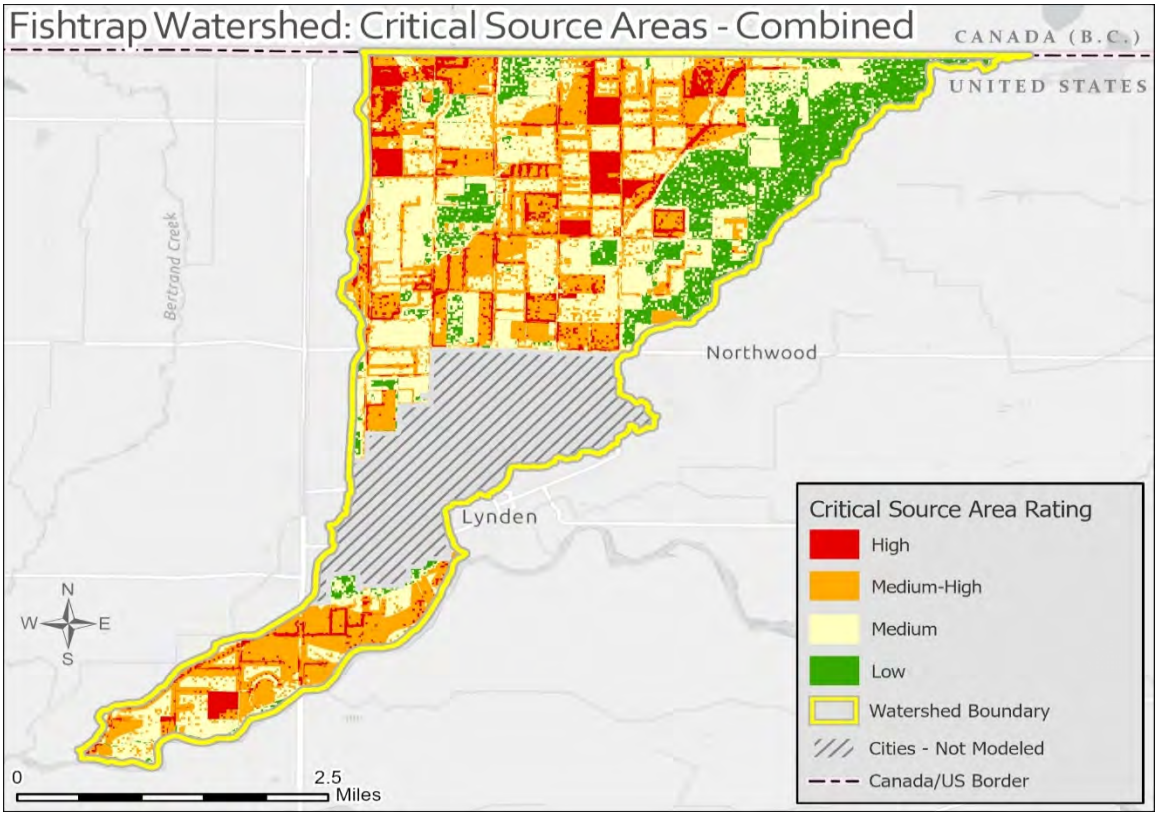

Figure 21. Potential critical source area ratings based on terrain and land use factors in the Fishtrap Watershed using the combined pollutant ranking score.

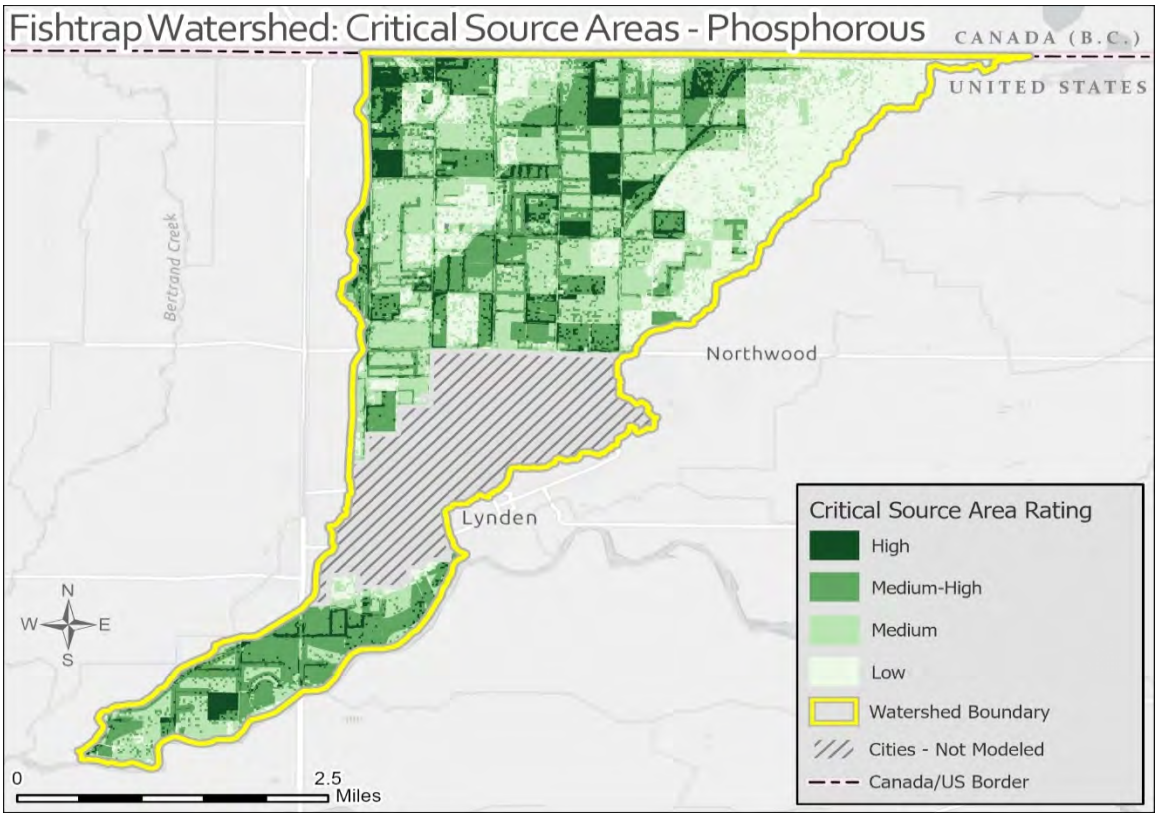

Figure 22. Potential critical source area ratings for Phosphorus based on terrain and land use factors in the Fishtrap Watershed.

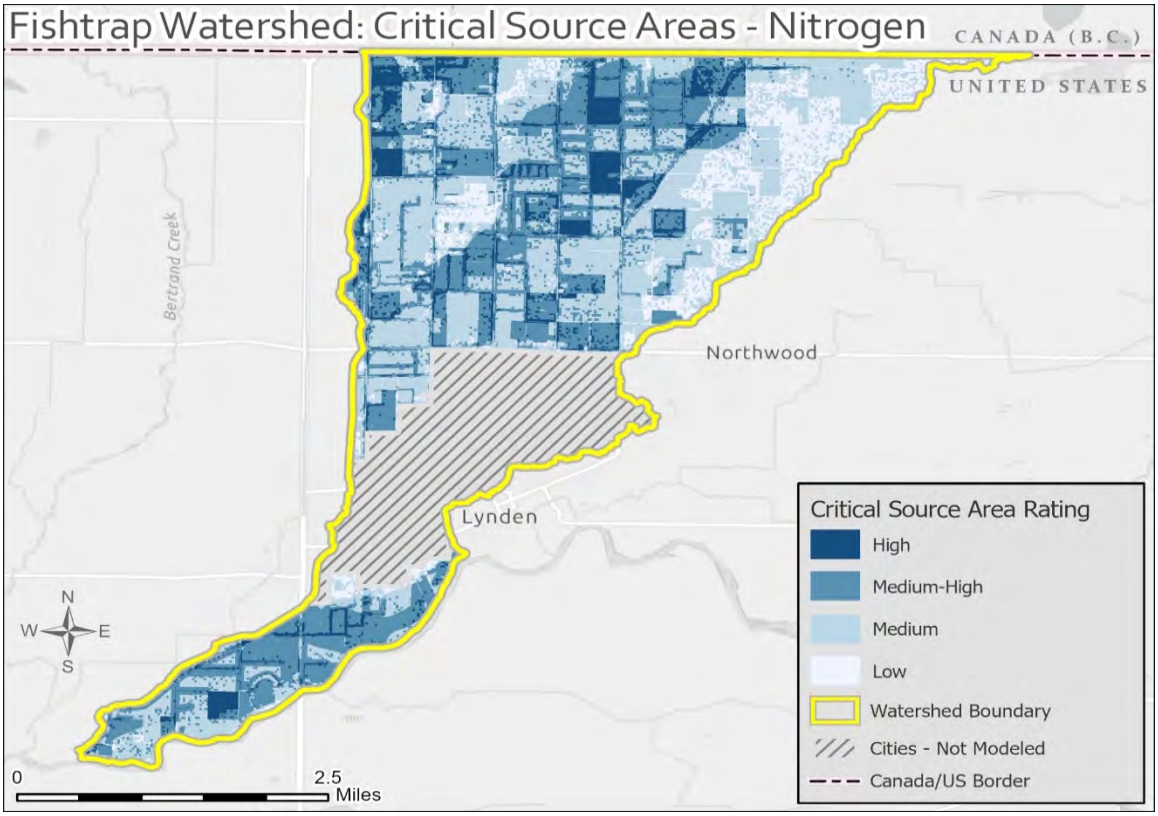

Figure 23. Potential critical source area ratings for Nitrogen based on terrain and land use factors in the Fishtrap Watershed.

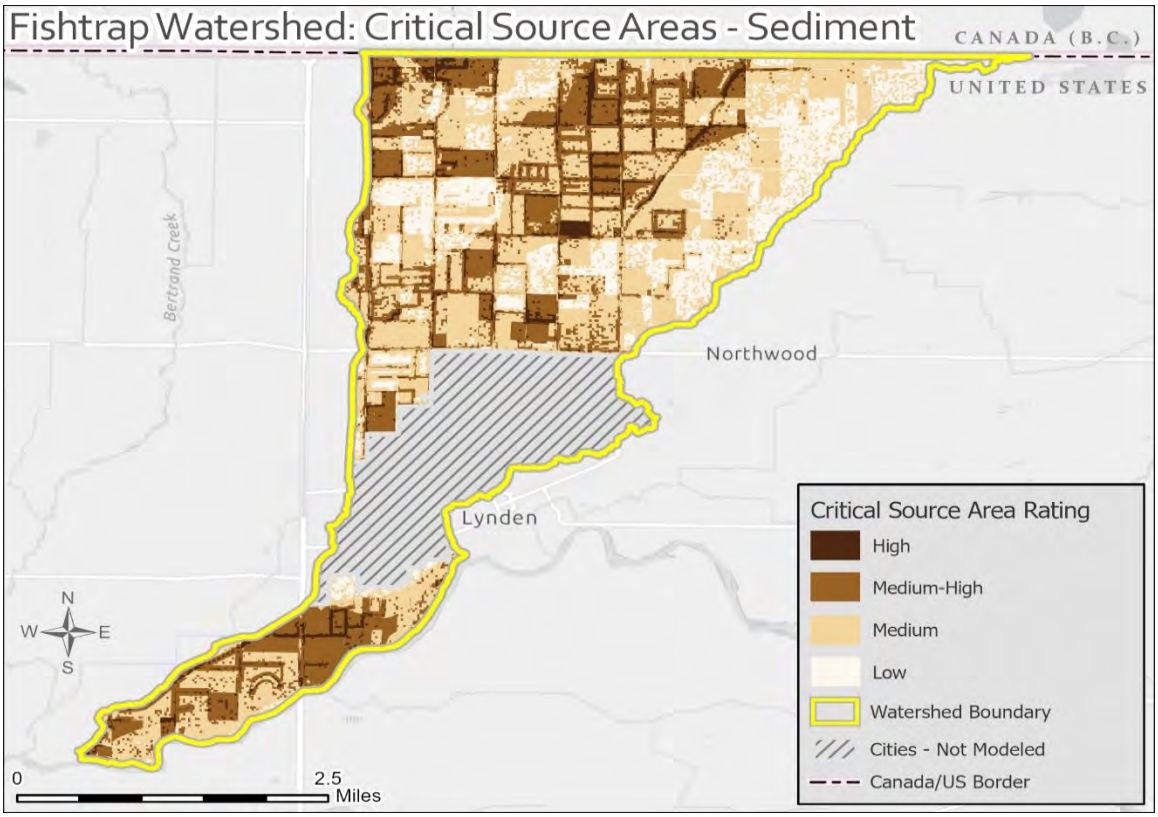

Figure 24. Potential critical source area ratings for Sediment based on terrain and land use factors in the Fishtrap Watershed.

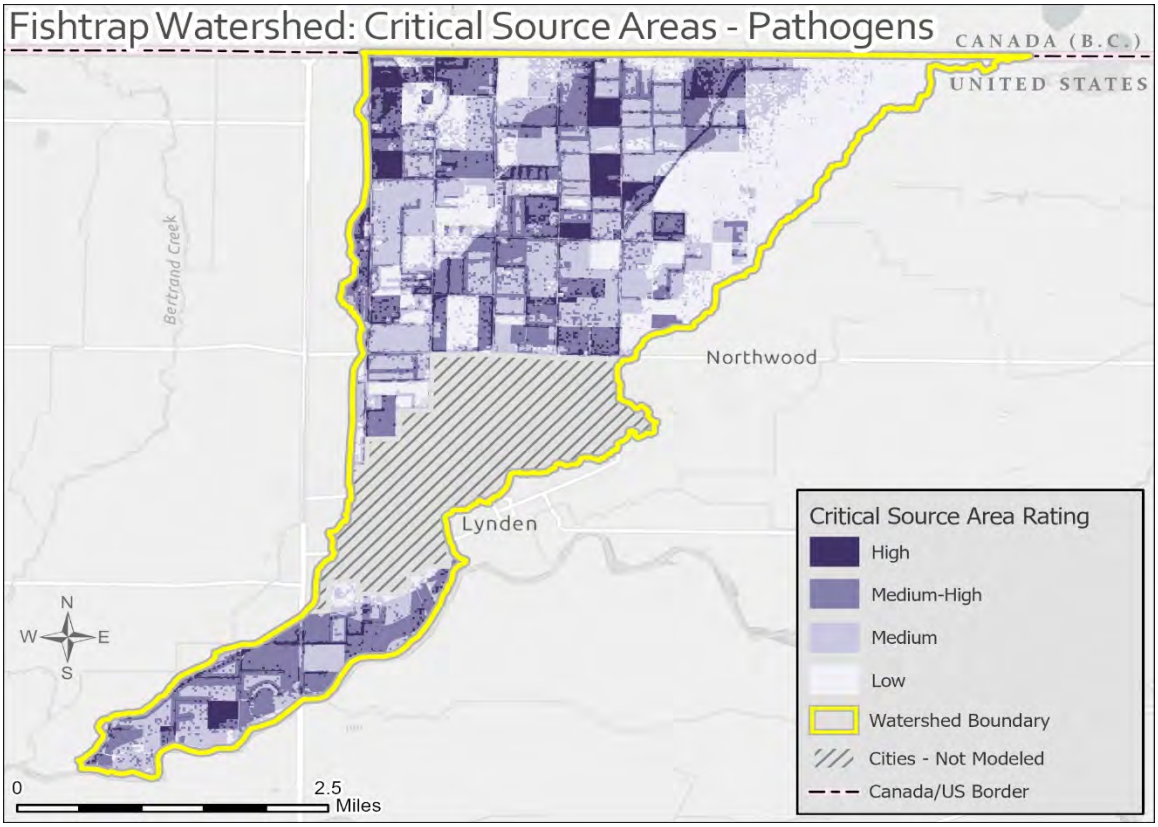

Figure 25. Potential critical source area ratings for Pathogens based on terrain and land use factors in the Fishtrap Watershed.

The critical source areas identified for terrain (Figure 20), combined (Figure 21), and individual pollutants (Figure 22, 23, 24, and 25) shows the effect of both the land features and land use on each assessment. For the terrain map, areas with steep slopes and poorly drained soils had a significant impact on elevating the rating. This can be seen in the combined map which highlights the impact that certain land uses can have on increasing the rating when also overlaid on higher risk terrain. These maps showcase the use of the model to select and tailor conservation practice implementation by location and land use. Further differentiation can be made by assessing the individual pollutant maps which provide insight into the combination of terrain, land use, and pollutant potential when a targeted practice implementation approach is desired. In addition to focused practice implementation by land use, the maps also show locations where targeted outreach on practice and/or land management can be done. By overlapping land assessment maps (Figures 11-14) with the CSAs, these locations can be prioritized in programs and planning.

4.3 Treatments and Opportunities

Conservation Management Practices

NRCS provides conservation practice standards that outline the purpose, applicable conditions, and criteria for why, where, and how a conservation management practice is applied to achieve its intended purpose. Tables 6 and 7 show the top identified NRCS practices for local water quality protection for the Cropland and Farmstead categories assessed, respectively. Practices were identified by WCD and local NRCS staff by reviewing the land use survey and terrain features to determine which practices were relevant to local conditions and would have the largest impact on improving water quality. This list is not exhaustive nor inclusive of all supporting practices. Further ground-truthing of the effectiveness of each practice, for each pollutant, is encouraged to identify impact to modeled pollutants.

It should be noted that selection of practices for a cropland or farmstead site is typically done as a suite to achieve the desired resource protection outcome. It is less common for a singular practice to achieve the desired conservation goals. Additionally, some practices, such as Riparian Forest Buffer (NRCS Practice Standard 391), work best when implemented by several landowners in a connected fashion over a waterway, not as discrete, disconnected pockets. Therefore, practices should be selected based on current cropland and farmstead conditions, landowner goals, and desired level of resource protection.

For more effective use, the information provided in Tables 6 and 7 should be coordinated with the CSA results presented in Figures 20 through 25 to identify the top land uses and areas in the watershed to apply the practices to. In this way, the planning approach will be targeted to the most effective and promising land uses.

Assessment of Management Scenarios

In addition to identifying critical source areas based on terrain and land use features, this model can be used to inform decision making around management practice implementation. The following two examples show how this could be done in the Fishtrap Watershed.

Identify potential locations for management practice installation. Terrain and land use features impact both the feasibility of practice installation and the effectiveness of the practices installed. For example, Structure for Water Control (NRCS Practice Standard 587) are an effective practice when installed to improve subsurface irrigation water management but should not be installed on well-drained soil types where the practice is not necessary. The model could be used to evaluate or prioritize locations for these water control structures within the watershed by assessing soil and terrain features along with land use to identify and prioritize impact areas.

Better understand how management practices will impact water quality across the watershed. Broad implementation of conservation management practices can minimize the risk of pollutant runoff, thereby reducing the amount of high and medium-high CSAs. By incorporating these practices into the pollutant ranking scores used within the model (see Section 4.1, Appendix B), reductions in critical source areas can be estimated at discrete locations and across the watershed.

Table 6. Most effective NRCS conservation management practice(s) identified for surface water quality protection by agricultural crop.

Conservation Management Practice	Irrigation Water Management	Structure for Water Control	Nutrient Management	Manure Application Setbacks	Prescribed Grazing	Conservation Cover / Cover Crop/Conservation Crop Rotation	Field Border	Filter Strip	Riparian Forest Buffer	Mowing / Brush Management	Underground Outlet (Ditch Cover) / Drainage Ditch Covering
NRCS Practice Standard Code	449	587	590		528	327/340/328	386	393	391	314	620/775
Crop-Blueberry	x	x	x	x		x	x	x	x		x
Crop-Caneberry	x		x	x		x	x	x	x		x
Crop-Corn	x	x	x	x		x	x	x	x		x
Crop-Forage	x	x	x	x					x		x
Crop-Pasture	x	x	x	x	x				x		x
Crop-Nursey	x		x	x		x			x		
Crop-Orchard	x		x	x		x			x		
Crop-Potatoes	x	x	x	x		x	x		x		x
Crop-Unmanaged			x	x					x	x	

Table 7. Most effective NRCS conservation management practice(s) identified for surface water quality protection by farmstead type.

Conservation Management Practice	Watering Facility	Feed Management (Seasonal Feeding)	Fence / Access Control	Field to Road Tracking	Heavy Use Area	Roof Runoff Structure & Outlet	Waste Transfer	Waste Storage Facility	Roofs and Covers	Access Road	Vegetative Treatment Area	Agrichemical Facility (Fertilizer mixing)
NRCS Practice Standard Code	614	592	382/472		561	558	634	313	367	560	635	309
Farmstead-Crop				x		x						x
Farmstead-Dairy	x		x	x		x	x	x	x	x	x	
Farmstead-Other Animal	x	x	x		x	x		x	x	x	x	

5. SUMMARY AND RECOMMENDATIONS

5.1 Watershed Assessment Summary

The watershed assessment was conducted on the Fishtrap Creek Watershed to better understand the dynamics of the pollutants of concern (Nitrogen, Phosphorous, Sediment, Pathogens) including the source areas of these pollutants and the way in which management practices can be implemented in the watershed to reduce pollutant concentrations and loading.

A spatial modeling approach was used to identify potential critical source areas (CSA) based on terrain characteristics, land use, and estimated impacts. These critical source areas are areas that can be targeted for management practice implementation through improved outreach, planning, and even NRCS cost-share prioritization. This strategy is covered further in Section 6 (Outreach), which identifies outreach strategies for communicating with landowners in the watershed.

5.2 Practice Implementation Recommendations

This assessment has identified current agricultural land uses (Table 3) and potential conservation practices (Tables 6 and 7) which are recommended for the Implementation Phase of the NRCS NWQI program. These practices are based on local land use, climate, effectiveness, and practicality. Additional modeling work needs to be conducted to identify the most effective practices for each land use based on current practices by the landowner. This information needs to be gathered on an individual basis through landowner engagement.

Estimation of costs for recommended practices should be based on current EQIP cost-share rates.

5.3 Effectiveness Monitoring

The following subsections outline the various areas that NRCS, along with key partners, can establish and track metrics of success for determining the effectiveness of NRCS programs, planning, and practice implementation at protecting surface water quality. By developing a strategic tracking plan in conjunction with this Watershed Assessment, efforts can be directed where they are needed to achieve a greater level of resource protection and/or document those existing efforts that are already successful.

Effectiveness Monitoring of Watershed Plan

Without a tracking and monitoring plan in place, it is difficult to assess the impact and success of a watershed plan. It is recommended that in conjunction with this Watershed Assessment, the Implementation Phase of the NRCS NWQI watershed plan define and track *measurable* metrics for progress in the following three categories:

1. *Implementation:* Location of where NRCS practices are currently being implemented and to what level. This would be conducted by NRCS and partners such as WCD.

2. *Effectiveness:* Water quality levels at or near implementation sites that are measurable as concentration reductions or load reductions. This would be conducted by local WCWP partners and others as applicable and shared with NRCS.

3. *Broader Impact:* Improvements in *downstream* water quality (Fishtrap Creek at River Road (F1), Lower Mainstem Nooksack stations (M2 and M1), and WA DOH marine monitoring stations) to relate actions in the Fishtrap Creek watershed to improvements in the greater Nooksack Watershed and shellfish restoration objectives. This monitoring is currently being conducted by local WCWP partners and evaluated routinely, including by WA DOH, which evaluates marine water quality patterns and growing area closures.

Conservation Practice Implementation

The implementation of conservation practices to the landscape is imperative to reduce any impacts of terrain and land use interactions as demonstrated in Section 4.2. To assess both the coverage by land use type and resource impact, implementation of conservation practices across the watershed should be tracked by NRCS and planning partners such as WCD including:

- Number of landowners/operators contacted
- Number of landowners/operators participating in programs including land use type and relevant demographic information
- Number of historically underserved producers contacted or enrolled
- Number and type of pollution sources identified
- Number of farm plans completed
- Number and location of practices planned and installed/implemented
- Number of acres treated by implemented practices
- Summary CSA rating of land that practices were installed on

This information could then be aggregated by land use type and CSA if applicable and compared to practices listed in Tables 6 and 7 for applicability. The outreach plan may inspire conservation stewardship outside the tracking parameters identified above, intrinsic motivation to change behavior, or management not associated with NRCS or WCD programs. These results are more difficult to quantify and would require follow up survey post-implementation for adequate assessment.

Conservation Practice Monitoring

While average effectiveness of conservation practices can be estimated using best available science, the monitoring of conservation practices on the ground is valuable to determine their effectiveness over different terrain features, local conditions, and management strategies. Successful conservation practice monitoring has been shown using Edge of Field (EoF) monitoring for assessing the impact of land management activities to adjacent surface waters. This system installs surface flow (and sub-surface flow, when appropriate) monitoring equipment at the edge of a field/area in a controlled experimental design (control-treatment scenario), and implements specific management practices/scenarios on the land surface and measures their potential impact/protection on water quality.

Continued EoF monitoring in Whatcom County is recommended in order to collect event mean concentration (EMC) data for various soils, land use types and practices. These EMC values could be used to strengthen the spatial modeling described in this assessment or to support other modeling by local and State. EoF data also gives indication of when specific soil types have surface runoff, data which can be used to strengthen the model and/or assist in tailored conservation practice implementation. These results can guide recommendation of various conservation practices for maximum protection of water quality.

For more information on the NRCS Edge of Field Monitoring program:
https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/water/quality/tr/?cid=stelprdb1240285

Conservation Planning

Conservation planning, also referred to as "farm planning", is an important part of the overall success and monitoring of the watershed plan. The planning process allows interaction with individual landowners and assessment of their level of implementation of current and planned practices. It also allows a planner to conduct an assessment of their landscape, which can be used to validate the model parameters and improve the effectiveness of conservation practice implementation. Lastly, the final step of the planning process requires the process of adaptive management and plan evaluation. This can be used to track progress of individual landowners in implementation of land use activities and subsequent water quality impacts, both positive and negative. It can also assist in modification of practice adoption or implementation as new science-based information is obtained about practice effectiveness. It is recommended that the activities associated with adaptive management be added to the long-term planning process as a practice to ensure they are conducted.

Water Quality Monitoring

Water quality sampling provides an on-going, real-time way to look at water quality on a scalable level (i.e., by total watershed, sub-watershed, or field level) to assess actions taken within a discrete area. Current water quality monitoring efforts are conducted locally by the WCWP partners. The following recommendations are those activities that support the watershed assessment and monitoring for progress:

- *Current surface water monitoring* - WCWP partners conduct regular surface water fecal bacteria monitoring. This includes both the twice-monthly monitoring of 22 ambient stations and continued source identification and storm event monitoring as needed to track and address sources or bacteria pollution within the watershed.
- *Needed surface water monitoring* - Regular sampling of nitrogen, phosphorus, and sediment (as TSS or turbidity) in the Fishtrap Watershed is recommended, at minimum, on a quarterly schedule to establish a baseline and progression of watershed impacts. Consistency in which analytes are measured (e.g. nitrate and nitrate or nitrate+nitrite; total nitrogen or Total Kjeldahl Nitrogen) between agencies and projects would allow the tracking of trends over time for these nutrients. Targeted sampling in areas with CSAs is recommended to validate the model and effectiveness of implemented practices.
- *Field level runoff monitoring* - WCD conducts field level analysis of conservation practices through the NRCS Edge-of-Field program. Installation of additional sites are encouraged in areas identified as medium-high and high CSAs testing recommended water quality practices (Table 6 and 7).
- *Additional analysis* - Relate flow measurements on Fishtrap Creek at Front St. (USGS 12212050) with bacteria monitoring results in order to estimate seasonal or storm-driven flow at these stations and calculate loading based on measured pollutant concentrations.

Tracking Data Metrics and Trends over Time

To assess the short- and long-term impact of NRCS actions in the watershed, local NRCS offices are required to review and report on metrics for each NWQI watershed. It is recommended that

NRCS review existing local water quality data on at least an annual basis in conjunction with their annual metrics of planning and practice implementation to track metrics of success. A process for identifying, tracking, and reporting on key metrics will be coordinated between the local NRCS staff and the WCD. This metric tracking and reporting process will consider all NWQI watersheds in Whatcom County such that similar metrics are being tracked and reported for each watershed.

The recommendation of this assessment is that annual reports be prepared locally and build on **existing** frameworks for tracking both conservation practice implementation and water quality. The level of detail and format of these reports should be agreed upon by local NRCS staff and their colleagues at the national level.

It should be noted that an existing framework of water quality monitoring stations already exists in the watershed for the purpose of monitoring fecal coliform bacteria (see Section 3.4). The existing layout of these stations may not be broad enough nor ideally located to get a comprehensive assessment of NRCS activity impact, but it can provide some metric of impact when assessed in conjunction with other data sources and non-NRCS activities within the watershed.

Metrics to be tracked and reported on *may* include:

- Three-year trends, annual and/or seasonal data of fecal bacteria water quality results for key watershed monitoring stations. Key stations will be identified such that they show water quality patterns within the upstream most agricultural areas of Fishtrap (north of Badger Road), within the City of Lynden (sites between Badger Road and Guide Meridian), and the area downstream of the City of Lynden to the confluence with the Nooksack River (Guide Meridian to River Road).
- Metrics of NRCS work in the watershed over the past year, including number of clients, acres treated, and practices planned and installed.
- A brief description of important watershed successes or challenges over the past year that provide context for other metrics being tracked. This could include, for example, changes in shellfish harvest closure status, new partnerships, regulatory activities, or significant precipitation or flooding events.

5.4 NEPA Concerns

The National Environmental Policy Act (NEPA) of 1964 requires all federal agencies to conduct an environmental review of all federal actions. This requirement also applies to area wide or watershed planning activities. As part of these plans, the responsible federal agency is required to evaluate the individual and cumulative effects of the actions being proposed. Any project that has significant environmental impacts must be evaluated with an Environmental Assessment (EA) or Environmental Impact Statement (EIS) unless the activities are eligible under a categorical exclusion or are covered by an existing EA or EIS.

NRCS utilizes a planning process that incorporates an evaluation of potential environmental impacts using an Environmental Evaluation checklist. NRCS also has categorical exemptions for several different activities that include many of our conservation practices. These categorical exemptions include conservation practices that reduce soil erosion, involve the planting of vegetation and/or restore areas to natural ecological systems.

The Fishtrap Creek Watershed Plan recommends implementation of conservation practices that have successfully been utilized in the region for years. These practices include a number of nutrient and erosion control field-based practices that are covered by categorical exclusions, and a range of structural practices that are used to address manure management issues on the farmstead. Figures 20-25 should be used to identify the top land uses and areas in the watershed that should be targeted for practice selection and implementation to increase effectiveness of plan implementation.

As part of the planning process, each planned practice will be evaluated individually and in combination with other planned practices to ensure it meets the criteria of the categorical exclusions and any existing Environmental Assessments. Any significant negative practice impacts, either individually or cumulatively, will first try to be avoided, then minimized and/or mitigated to the extent possible or eliminated from the individual farm plan if necessary. There is not an expectation that the practices planned for implementation in the Fishtrap Creek Watershed will necessitate an Environmental Assessment or an Environmental Impact Statement.

6. OUTREACH

6.1 Outreach Plan Goals and Objectives

This Watershed Outreach Plan for the Fishtrap Watershed is designed to increase participation in conservation programs and implementation of conservation practices by focusing outreach on the lands and landowners with the highest probability of adoption and biggest potential impact on water quality. To date, the majority of cooperators for Natural Resource Conservation Service (NRCS) Environmental Quality Incentives Program (EQIP) and National Water Quality Initiative (NWQI) programs have been dairy producers, so this plan also focuses on building messaging and materials to engage and enroll previously underrepresented agricultural types that can have a large impact on water quality.

The objective of this plan is to provide the framework to develop outreach materials to inform and educate target landowners of the technical assistance and tools available to them by considering their values, communication preferences, and trusted sources of information. Outreach goes beyond just informing the public and stakeholders about watershed conservation goals, but rather informs NRCS and partners about issues, barriers, and preferred practices for the watershed, then focuses on the specific audiences that can create the biggest benefit to watershed health.

6.2 Background Analysis for Audience Selection

The intent of this plan is to focus outreach on the lands and landowners with the highest probability of conservation practice adoption and biggest potential impact on water quality. Those with the highest probability of adoption are those landowners with familiarity of NRCS, then those with the highest motivation. The identification of those with the biggest potential impact on water quality are those landowners with parcels intersecting lands with medium-high to high Critical Source Area (CSA) ratings (see Section 4 Resource Analysis Assessment).

Primary Livestock Types in Watershed

Dairy, Cattle and Horses are the primary livestock types (89% of total livestock, and 47%, 20%, and 22%, respectively) in the Fishtrap Watershed according to the livestock survey (Table 4). These specific audiences have distinctly different motivations to enroll in conservation programs and different trusted sources of information to reach them; therefore, each audience requires unique outreach tools. These are broken down in Section 6.4.

Primary Land Use Types in Watershed

Of the parcels have been identified with a CSA rating of med-high or high (Section 4), there are a few land use types that stand out as priority audiences for targeted outreach. Crops represent 88% (2,339 acres) of all lands that are in the med-high to high CSA rating, and 25% of the total acreage in the watershed (Appendix C). Specifically, forage and corn represent 48% (1,268 acres) and 21% (552 acres) respectively, of all med-high to high CSA acres in the watershed. These are the primary crop types to enroll in conservation programs as they will have the highest impact on watershed health. These two land use types are primarily associated with Dairy operations with a small percentage of forage acres also represented by Cattle and Horse; therefore, prioritizing these audiences will be an important focus. Pasture, which accounts for 100 acres of the watershed, is primarily associated with cattle and horse operations. Of those

acres, 54 acres (54%) are in med-high to high CSA, indicating that these audiences can have a large impact on water quality.

Additionally, Berry and Potato crop acres represent 8% (232 acres) and 3% (76 acres), respectfully, of all med-high to high CSA acres in the watershed. While these land use types are a relatively small number of acres, this defined set of landowners provides a great opportunity for outreach as the communication can be one-on-one for greatest impact. It should be noted that within the Berry category, blueberry crops represent more CSA acres than raspberry (224 and 8 acres of CSA, respectively) due to the soil type the crops are grown on. Raspberries tend to be grown on well drained soils away from adjacent waterbodies, while blueberry crops are grown on heavier soils, often with closer proximity to water.

Of the total acres in the watershed, 5% of the Natural land use area was listed as CSA. This includes riparian areas and vegetated stream corridors, which are often home for wildlife and can be a source of nutrient and pathogens entering waterways. While there is little that can be done to mitigate these impacts, they are important to note.

For a complete table of the land use types with med-high to high CSA ratings as compared to the total watershed, see Appendix C.

6.3 Target Audience Prioritization

Focusing outreach on the lands and landowners with the highest probability of adoption and biggest potential impact on water quality will yield the greatest impact on resource management within the watershed. To assess this, we have categorized landowners by their CSA rating, then classified them as likely qualifying for NRCS programming or not, and finally, by their likeliness to participate. The following definitions outline the different categories that were considered when classifying a property.

High impact property: For the purpose of the metrics collected in this analysis, landowners with a Critical Source Area (rating of med-high or high) on a significant portion of the parcel (>40%) are referred to as "high impact properties".

- There are 451 unique landowners on high impact properties which represents 605 total parcels on 2,906 acres. This includes both agriculture and non-agriculture properties.

Agricultural parcels: Properties identified as "agricultural parcels" are assumed to qualify for NRCS programs. Agricultural parcels have been identified by the following criteria: zoned agricultural, and/or those with observed agricultural related activities, and/or those that participate in the Open Space Farm and Agriculture (OSAG) program. OSAG is a voluntary tax reduction program, where participants must prove income generated from agricultural related activities. Using property use codes as designated by Whatcom County Assessor's office, this analysis showed that:

- Of the 4,006 total parcels in the watershed, 311 were determined as agricultural/likely qualifying for NRCS programs, representing 83% of total watershed acreage.
- Of these 311, there are 245 total parcels on high impact properties, representing 2,776 acres and 167 unique landowners.

Likeliness to participate: The highest probability of participation is associated with a landowner's familiarity and trust of NRCS. Cooperators who have previous experience in NRCS cost-share programs will have the highest probability of participation. This was determined through information gathered on NRCS program participation within the last 10 years in the watershed (personal communication with NRCS staff, September 2020).

- 11 producers in the watershed have worked with NRCS in the past 10 years.
- Of the 167 landowners on high impact properties, 8 of them have participated in NRCS cost-share programs.
- 159 landowners have not worked with NRCS and are on high impact parcels. These include both small and large agricultural landowners.

Based on the definitions above, landowners have been divided into four audience types representing their impact to the watershed and likeliness to participate in NRCS programs (Figure 26). The 311 agricultural parcels identified in the watershed are categorized as:

- **Audience 1:** High Impact, Likely to Participate. Received NRCS assistance in the last 10 years and are on a high impact property. **8** landowners.
- **Audience 2:** High Impact, Less Likely to Participate. Have not received NRCS assistance but are on a high impact property. **159** landowners.
- **Audience 3:** Low Impact, Likely to Participate. Received NRCS assistance in the last 10 years but are on a lower impact property. **3** landowners.
- **Audience 4:** Low Impact, Less Likely to Participate. Have not received NRCS assistance and are on a lower impact property. These would be the lowest priority for outreach. **141** landowners.

A list of landowners/operators identified in this plan by audience type and agricultural land use category can be made available to NRCS upon request.

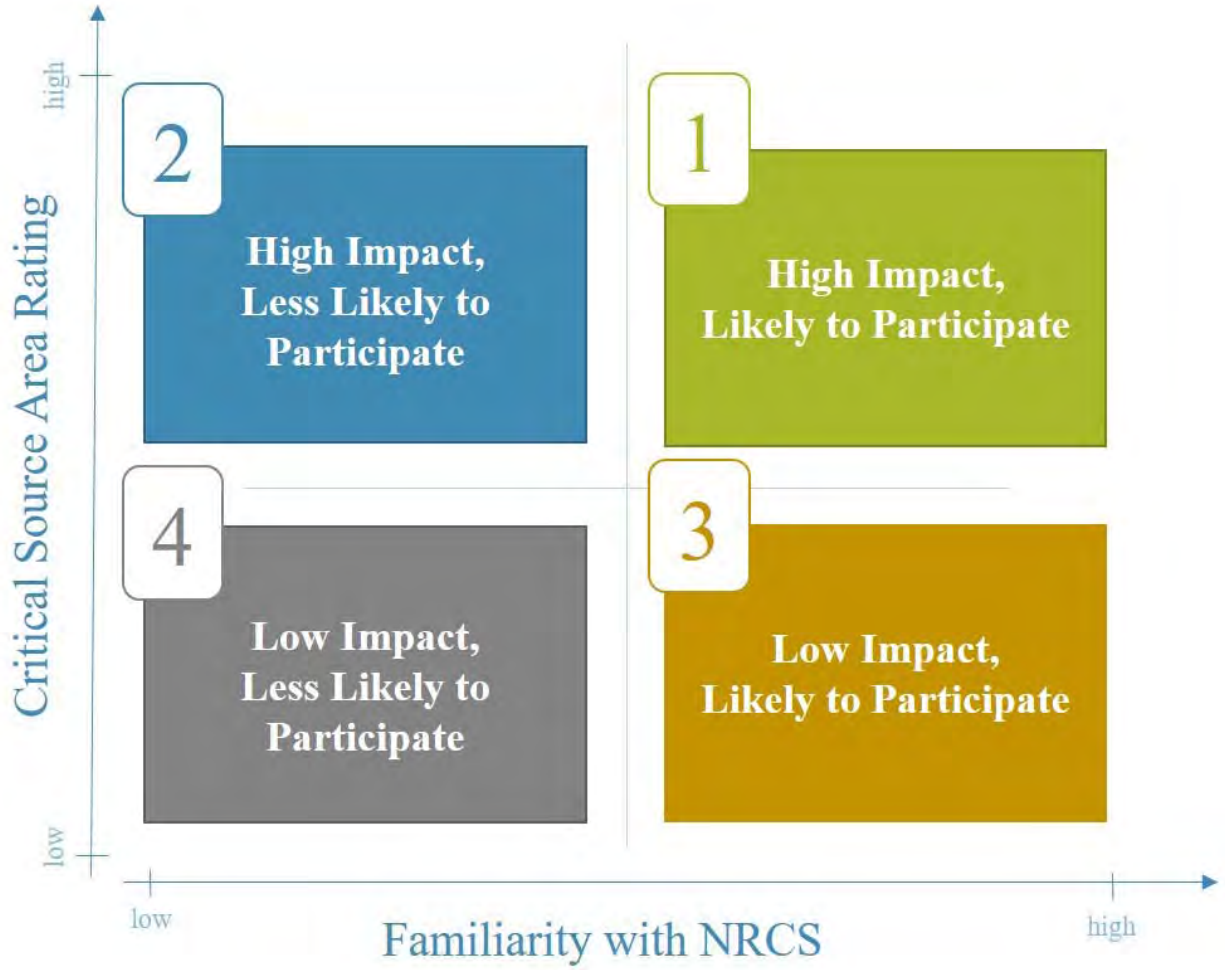

Figure 26. Audience prioritization by likeliness to participate (familiarity with NRCS) and impact on water quality (Critical Source Area Rating).

6.4 Outreach Strategy by Audience Type

Understanding barriers to conservation, what motivates people to adopt conservation practices, who influences adoption of practices, and how information is best disseminated are some key elements that should be understood for success of meeting conservation goals. Knowing what landowners consider to be benefits to practice adoption and addressing their concerns around participation is critical to make conservation practices appealing to landowners.

Historically, Dairy audiences have been the primary participants in NRCS cost-share programs (particularly EQIP) and thus recipients of NRCS funding in the Fishtrap Watershed. This is primarily driven by the responsibility of the producer to comply with the state's Dairy Nutrient Management Act (RCW 90.64) and local manure ordinance, and secondarily by the need for dairy producers to be an economically viable and stay current in a competitive market. Additionally, the familiarity and availability of local technical assistance through the Whatcom Conservation District (WCD) provides a trusted messenger for the Dairy audience. Recommendations included here strive to reach a broader audience, inclusive of many land use types, that have been traditionally underrepresented in NRCS programming.

Recommendations include development of materials and messages that engage potentially eligible landowners on high risk properties by tailoring outreach messaging to motivate them to start the process and get connected with the WCD or NRCS. We broke out the primary agricultural groups (Horse, Cattle, Potato, Berry, Dairy) and provided pertinent information on motivational factors and barriers. In particular, we list the "Priority" and "Motivational" conservation practices which are those practices that address water quality (Priority) and those that entice or grab attention of the landowner (Motivational) (Appendix D).

- **Priority Practices:** Those conservation practices with highest return on investment for resource conservation.
- **Motivational Practices:** As a landowner considering bottom line, return on investment, chore efficiency, and overall farm management, these are the practices the help their business thrive with reduced risk.

Each of the following audiences is important for more broadly addressing the resource management needs and water quality concerns within the Fishtrap Watershed. Numerical codes listed after conservation practices are the NRCS Practice Standard number.

Horse or Equine Facilities

- 11 facilities in watershed.
- *Priority conservation practices*: Fence (382), Waste Storage Facility (313), Roofs and Covers (367), Nutrient Management (590)
- *Motivational conservation practices*: Watering Facility (614), Livestock Pipeline (516), Irrigation Water Management (449)
- *Barriers*: Familiarity with NRCS, intimidation by large construction projects, financial, time management
- *Motivators/incentives*: Farm aesthetics, animal health, chore efficiency, relief from regulators/complaints
- *Preferred communication method/format:* WCD farm planner, word of mouth, social media, boarding facility client feedback
- *Preferred communication partners/messengers*: Backcountry Horsemen, NW Horse Source magazine, peer

Cattle Operations

- 17 unique operators in watershed.
- *Priority conservation practices*: Nutrient Management (590), Prescribed Grazing (528) Heavy Use Area (561)
- *Motivational conservation practices*: Irrigation Equipment and Pipeline (430)
- *Barriers*: Familiarity with NRCS, not wanting to work with government, financial burden to cover upfront costs
- *Motivators/incentives*: Animal health, relief from regulators
- *Preferred communication method/format:* WCD farm planner, word of mouth, social media
- *Preferred communication partners/messengers*: Whatcom County Cattleman Association, Everson Auction Market, KGMI radio

Potato Growers

- Approximately 338 acres and 2 growers in watershed
- *Priority conservation practices*: Conservation Cover (327), Nutrient Management (590)
- *Motivational conservation practices*: Waste Facility Closure (360), Irrigation Water Management (449), Underground Outlet/Drainage Ditch Covering (620/775)
- *Barriers*: Leasing or renting of fields, rotation with other crops, very few growers in watershed
- *Motivators/incentive*s: Financial, cover ditches to farm on top of it, fill in existing waste storage ponds
- *Preferred communication method/format:* word of mouth, social media
- *Preferred communication partners/messengers*: WID, WSU Extension, Whatcom Family Farmers, Washington State Potato Commission

Berry (Caneberry, Blueberry) Growers

- Approximately 2,176 acres and 25 growers in watershed
- *Priority conservation practices*: Field Border (386), Agrichemical Handling Facility (309), Nutrient Management (590)
- *Motivational conservation practices*: Underground Outlet (620), Conservation Cover/Cover Crop (370/340), Hedgerow Planting (422), Irrigation Water Management (449)
- *Barriers*: Do not want to work with government, limited practices that are applicable, language/cultural
- *Motivators/incentives*: Financial, cover ditches to farm on top of it, East Indian population for historically underserved incentive
- *Preferred communication method/format:* Cultural centers, word of mouth
- *Preferred communication partners/messengers*: Washington Red Raspberry and Blueberry Commissions, WSU Extension, WID

Dairy Producers

- Approximately 4,126 acres (Forage, Corn, and Dairy Farmstead) and 10 of facilities in watershed
- *Priority conservation practices:* Nutrient Management (590), Cover Crop (340), Roof Runoff Structure/Outlet (558)
- *Motivational conservation practices*: Waste Storage Facility (313), Underground Outlet (620), Irrigation Pipeline (430)
- *Barriers*: Do not want to work with government, tradition
- *Motivators/incentives*: Trust, relief from regulators
- *Preferred communication method/format:* word of mouth, mailers, personal communication
- *Preferred communication partners/messengers*: NRCS, WCD, Washington State Dept of Agriculture (WSDA), Farm Service Agency (FSA) newsletters, Whatcom Family Farmers, KGMI radio

6.5 NRCS Outreach Barriers and Recommendations

In Whatcom County, NRCS lacks a direct outreach and communication presence with local producers and landowners and has long relied on local WCD staff to bring cooperators into their programs. From interviews with local NRCS staff, it appears that funds are allocated for planning and programs, but there is little to no funding available for outreach and education. Reliance on other agency staff for landowner engagement has proven sufficient to date (demonstrated by NRCS cost-share dollars allocated in Whatcom County), yet WCD and NRCS staff have identified shortcomings and barriers to enrollment in NRCS programs for a number of crop and livestock producers.

General barriers to NRCS program participation include:

- Landowners do not hear about NRCS programs directly and do not engage in the process (no method of communication). This is particularly true for individuals who have not previously worked with NRCS nor have an existing relationship with WCD.
- Information and deadlines for programs are usually communicated by NRCS late (not enough time to engage and complete all paperwork and planning in time to meet deadlines) and/or deadlines are changed without much notice to the public.
- NRCS materials and notices regarding programs are not user friendly and can be very difficult to read and interpret, particularly for landowners. Additionally, materials are not translated for local non-English speaking audiences, who also tend to be historically underserved audiences.
- Many small farms in the watershed are not eligible for programs such as EQIP.

Another significant barrier is the requirement of a Comprehensive Nutrient Management Plan (CNMP) for enrollment of livestock operations into EQIP programs, which presents a large hurdle for producers and planners to work through including:

- Many of the farmers in the watershed are small operations (<20 acres), therefore CNMP is too robust for their use.
- There are a limited number of local certified CNMP planners or Technical Service Providers (TSP) to complete a CNMP.
- The time required to complete a CNMP is considerable, which can be frustrating to producers particularly if they do NOT end up receiving EQIP funds.

Recommendations for NRCS specific outreach improvements:

- 0.5 FTE (full time equivalent) devoted to outreach and information dissemination.
- Translation of material into priority languages to support historically underserved audiences.
- Revamping current NRCS program materials to be more photo-centric, user friendly, and locally relevant for all target audience.
- Create landowner stories of NRCS projects in local papers/newsletters that represent examples for all target audiences.
- Provide news releases in local media on program open enrollment periods and deadlines with simple, clear instructions on eligibility and application procedures.
- Given the priority audiences outlined in Section 6.3, develop mailing lists for Audience types 1 and 2. Using locally relevant, audience specific messaging (as outlined in Section 6.4) developed a mailing strategy at critical times throughout the year.

- Enroll and engage partners in both agricultural and non-agricultural sectors (Section 6.7) in general water quality awareness outreach. NRCS outreach staff should collaborate with all partners and develop trusting relationships so that information sharing simple and fluid. Specifically, we recommend engaging with Whatcom County Pollution Identification and Correction (PIC) Outreach Committee and Field Staff.

6.6 Evaluation of NRCS Program Impact and Adaptive Management

To assess the impact of NRCS programs on improvements in water quality in the watershed, NRCS should assess water quality metrics in a meaningful way. WCD and local water quality partners will work with NRCS to generate an annual metrics reporting framework including identification of water quality metrics, progress reports on water quality changes over time, landowners contacted, project planned, conservation practices implemented, and others as needed (see Section 5.3 for more detail on these recommended metrics). These annual reports will also be distributed to local stakeholders for continued program support.

Water quality impairments in the Fishtrap Watershed and Nooksack Basin have come about over many decades and may take time to fully resolve. Therefore, simply using water quality improvements as a measure of outreach plan effectiveness is likely inadequate in the short-term. Confirmation that new producers are being engaged and enrolling in programs will be the best evaluative tool to assess outreach plan effectiveness. Over the long-term, established monitoring in the Fishtrap Watershed and Nooksack Basin will allow NRSC and local partners to track water quality changes over time (Section 5.3).

To track the results of this outreach strategy, a survey should be administered within one year of outreach implementation to determine if the following social outcomes have been met:

For the target agricultural audiences:

- Increased awareness of technical assistance programs available
- Increase awareness of NRCS and Whatcom CD
- Increase adoption of practices to improve water quality

For the general or non-agricultural audience:

- Increased awareness of water quality issues
- Changes in attitudes toward water quality improvements
- Increased support for water quality improvement projects.

Local partners including the WCD could provide guidance and recommendations to NRCS on how to complete this survey. For examples of survey methodology and potential metrics to evaluate, refer to the *NRCS NWQI Outreach Plan for Tenmile Watershed* (Whatcom Conservation District, 2018)

6.7 Partners in Outreach

Development and implementation of the outreach plan for the Fishtrap watershed will involve partners to ensure the plan is supported throughout the watershed. Below is a list of local partners who have been identified as trusted messengers of information and should be engaged in the communication and outreach effort to ensure broader sharing and success in water quality goals.

Agricultural Audience Focus

Natural Resource Conservation Service

The Natural Resource Conservation Service (NRCS) conservationists provide technical expertise, conservation planning, and distribute financial assistance for farmers, ranchers and forest landowners wanting to make conservation improvements to their land. The Everson Service Center provides services for all of Whatcom County including Fishtrap Watershed.

Whatcom Conservation District

The Whatcom Conservation District (WCD) mission is to assist land managers with their conservation choices, through a variety of services including farm planning, habitat programs, outreach, and education. Since 1946, WCD has worked to promote responsible stewardship, sustainable land management, and support for natural resource based economies.

Washington State Department of Agriculture

Washington State Department of Agriculture (WSDA) Dairy Nutrient Management Program work directly on Dairy Nutrient Management Act (RCW 90.64) compliance. Dairy Nutrient Management Program regulatory staff inspect dairy facilities and provide technical assistance to dairy producers. Staff monitor water quality and follow a referral process to communicate to partner agencies about possible manure-related discharges and complaints regarding dairy and non-dairy agriculture properties.

Watershed Improvement District - North Lynden

The North Lynden Watershed Improvement District (WID) is a special purpose district managed by farmers and landowners who live and work within the district. The North Lynden WID overlaps much of the Fishtrap Watershed.

Washington State Department of Ecology

Washington State Department of Ecology, Water Quality Program works directly on non-dairy agriculture, Water Pollution Control Act (RCW 90.48) compliance. Regulatory staff monitor water quality, identify sources of preventable fecal bacteria pollution from non-dairy agricultural properties, and offer residents technical help to fix pollution sources. Staff may use enforcement authority when a landowner is unwilling to act to fix an identified and preventable fecal bacteria pollution source.

Washington State University

For nearly a century, WSU Whatcom County Extension has worked with local agriculture producers to bring research-based information to improve the productivity, efficiency, economic well-being, and safety of products produced in this diverse agricultural community. WSU Extension is a local trusted resource, particularly to berry and potato growers in Whatcom County.

Whatcom Family Farmers
Whatcom Family Farmers is a non-profit organization with a mission of preserving the legacy and future of family farming in Whatcom County by unifying the farming community and building public support. They reach out with positive messages on farmer stewardship, food safety, animal welfare, and the positive relationships farmers have with their employees. This organization is a leader and trusted voice in the farm community.

Washington Red Raspberry Commission
The Washington Red Raspberry Commission (WRRC) was formed in 1976 to support and promote the raspberry industry. They establish promotion plans and conduct programs for advertising, sales, promotion, and/or other programs for maintaining present markets and/or creating new or larger markets for raspberries.

Washington Blueberry Commission
The Washington Blueberry Commission was formed under a marketing order from the Director of Agriculture in 1969, following Washington Agricultural Enabling Act of 1955. The commission serves as a touchstone for grower advocacy, research and best practices, and marketing for the hardworking growers and their 18,000+ planted acres across Washington State.

Washington State Potato Commission:
The mission of the Washington State Potato Commission is to support an economically and environmentally sustainable Washington State potato industry by providing strong leadership and innovation and building partnerships to meet the demands of global consumers.

KGMI - News Talk Radio 790:
KGMI News/Talk 790 covers issues related to Whatcom County, including a weekly farming show. Trusted and most listened to radio station by Whatcom County farmers.

Other Agricultural Industry Based Organizations:
Washington State Dairy Federation, Whatcom County Cattlemen's Association, Whatcom Chapter Backcountry Horsemen of Washington, Whatcom County Dressage and Eventing Association, Everson Auction Market.

Non-Agricultural or General Audience Focus

Whatcom County Public Works
Whatcom County Public Works' Pollution Identification and Correction (PIC) Program uses water quality monitoring data to identify areas with high levels of bacteria in surface waters and work with local landowners to reduce these water quality problems. The PIC program provides community outreach and education, technical and financial assistance for landowners, and coordination with County departments and other agencies to identify and address potential bacteria sources.

Whatcom County Health Department
Whatcom County Health Department (WCHD) manages community health and environmental health, including oversight of on-site sewage (OSS) evaluations and code enforcement. Partner in Whatcom County PIC program. Staff provide homeowner education, technical help, and notification regarding proper septic system operation and maintenance. Staff also enforce codes and investigate septic-related complaints

Whatcom County Planning & Development Services

Whatcom County Planning & Development Services (PDS) oversees environmental permitting in Whatcom County, including activities that impact shorelines, wetlands, and other critical areas. PDS works regularly with Whatcom County Public Works and other partners through the PIC program. Critical Areas Ordinance (WCC: Title 16.16) compliance - PDS regulates land use in unincorporated Whatcom County, including ensuring that farms comply with the Critical Areas Ordinance (CAO). PDS approves farm plan applications submitted for compliance with the CAO through Whatcom County's Conservation Program on Agriculture Lands (WCC 16.16. Article 8).

City of Lynden

The City of Lynden (COL) includes dense areas of residential housing, commercial development, and light industry in the lower Fishtrap Watershed. The COL Public Works Department is required to develop, implement, and enforce a program to reduce pollutants in stormwater runoff discharging to the municipal separate storm sewer system from new development, redevelopment, and construction site activities.

7. REFERENCES

Ayetan, O. 2019 GIS Assessment of Groundwater Recharge Potential in Whatcom County, Washington State: Implications for Land Use. Thesis: University of British Colombia. Accessed 03 July 2020 at http://lfs-mlws.sites.olt.ubc.ca/files/2019/09/Ayetan-2019-GIS-Assessment-of-Groundwater-Recharge-Potential-in-Whatcom-County.pdf

Bandaragoda C, Greenberg J, Dumas M, Gill P. 2012. Lower Nooksack Water Budget. Whatcom County, WA: WRIA 1 Joint Board. Accessed 30 September 2020 at http://wria1project.whatcomcounty.org/.

Curran, CA, Anderson, SW, Foreman, JR, Beaulieu J. 2018. Suspended sediment concentration and loads in the Nooksack River Basin, northwest Washington: U.S. Geological Survey data release. Accessed 03 July 2020 at https://www.sciencebase.gov/catalog/item/5a32c98be4b08e6a89d883c6

Hood S. 2002. Nooksack River Watershed Bacteria Total Maximum Daily Load- Detailed Implementation Plan. WA Department of Ecology Water Quality Program. Accessed 28 September 2020. https://fortress.wa.gov/ecy/publications/documents/0110060.pdf

Joy J. 2000. Lower Nooksack River Basin Bacteria Total Maximum Daily Load Evaluation. WA Department of Ecology- Environmental Assessment Program, Watershed Ecology Section. Accessed 28 September 2020. https://fortress.wa.gov/ecy/publications/documents/0003006.pdf

[NRCS] Natural Resources Conservation Service. 2013. National Planning Procedures Handbook (NPPH), Amendment 5. Title 180 – National Planning Procedures Handbook. US Department of Agriculture, Natural Resources Conservation Service. Accessed 30 September 2020 at https://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=33234.wba.

Puget Sound Partnership. 2014. *The 2014/2015 Action Agenda for Puget Sound, Section 4: Local Recovery Actions, Whatcom County/Nooksack Watershed.* Puget Sound Partnership. Accessed 28 September 2020 at http://www.psp.wa.gov/downloads/2014_action_agenda/Final%202014%20action%20agenda%20update/2014-2015_Action_Agenda_for_Puget_Sound.pdf

RH2 Engineering, Inc. 2016. *Public Utility District No. 1 of Whatcom County: Quantification of Agricultural Irrigation Water Use and Water Rights.* RH2 Engineering, Inc. Accessed 13 September 2020 at http://wria1project.whatcomcounty.org

Schilling KE, Wolter CF, McLellan E. 2015. Agro-hydrologic Landscapes in the Upper Mississippi and Ohio River Basins. Environmental Management 55:646-656. DOI 10.1007/s00267-014-0420-x

[USDA] United States Department of Agriculture. Census of Agriculture for Whatcom County, WA. 2017. USDA National Agricultural Statistics Service. Volume 1, Chapter 2. Available at: https://www.nass.usda.gov/.

Whatcom Conservation District. 2018. *NRCS NWQI Outreach Plan for Tenmile Watershed.* Whatcom Conservation District. Accessed 25 November 2020 at https://whatcomcd.org/research-projects.

Whatcom County Agriculture-Watershed Pilot Project. 2016. *Agriculture-Watershed Characterization and Mapping Report for the Laurel Watershed Improvement District.* Whatcom County Planning & Development Services, August 2016. Accessed 6 September 2020 at https://sites.google.com/site/wcwatershedag/home.

Whatcom County Agriculture-Watershed Pilot Project. 2017. *Project summary.* Whatcom County Planning & Development Services, August 2016. Accessed 6 September 2020 at https://sites.google.com/site/wcwatershedag/home.

8. LOCAL CONTACTS

Whatcom Clean Water Program
https://www.whatcomcounty.us/DocumentCenter/View/41596/WhatcomCleanWaterProgram

Washington State Department of Health PIC Programs
https://www.doh.wa.gov/CommunityandEnvironment/Shellfish/EPAGrants/PathogensGrant/PIC

Department of Ecology Bellingham Field Office - Water Quality Program
http://www.ecy.wa.gov/programs/wq/wqhome.html

EPA Region 10
https://www.epa.gov/aboutepa/epa-region-10-pacific-northwest

WSDA Dairy Nutrient Management Program
https://agr.wa.gov/departments/land-and-water/livestock-nutrients

Whatcom County Public Works
http://www.co.whatcom.wa.us/308/Public-Works
http://wa-whatcomcounty.civicplus.com/1072/Water-Quality

Whatcom County Health Department
http://www.co.whatcom.wa.us/360/Health-Department

Whatcom County Planning & Development Services
http://www.co.whatcom.wa.us/358/Planning-Development-Services

City of Lynden Public Works
https://www.lyndenwa.org/public-works/

Whatcom Conservation District
http://www.whatcomcd.org/

Nooksack Tribal Natural Resources
http://nooksacktribe.org/departments/natural-resources/

Lummi Nation Natural Resources
https://www.lummi-nsn.gov/Website.php?PageID=1

Washington State Conservation Commission
http://scc.wa.gov/

North Lynden Watershed Improvement District
https://www.northlyndenwid.com/

Ag Water Board
http://www.agwaterboard.com/

Whatcom Family Farmers
http://www.whatcomfamilyfarmers.org/

Nooksack Salmon Enhancement Association
http://www.n-sea.org/

9. APPENDIX

Appendix A. Inputs to the spatial model. Each input represents a geographic information systems (GIS) data layer.

Feature	Description	Categories and associated ranking (1-5)	Data Source
Terrain Features			
Slope	Average slope of 100 ft by 100 ft area derived from LiDAR images. Slope categories are based on those used by Schilling et al. 2015.	0-1% slope= 1 1.01-2% slope = 2 2.01-5% slope =3 5.01-10% slope = 4 >10% slope = 5	Derived from WA DNR LiDAR
Soil drainage class	Drainage class from NRCS soils layer	Gravel, Somewhat Excessively drained = 1 Well drained, Moderately Well drained = 2 Somewhat poorly drained = 3 Poorly drained = 4 River wash, Very poorly drained = 5	NRCS Soils
Precipitation	Annual rainfall (inches)	Less than 40= 1 40.01-46 = 2 46.01-50 = 3 50.01-54 = 4 54.01-58 = 5	Texas A&M University
Proximity to waterways	Distance to waterways defined by waterway buffers within GIS. A shorter distance to a waterway is reflected as a higher ranking score.	100- 180 feet =1 81- 100 feet = 2 41-80 feet = 3 11- 40 feet = 4 Less than 10 feet = 5	NW WA Waterways based on National Hydrography Dataset (NHD)
Flooding potential	FEMA flood maps categorized by flood zones (Percent annual flood risk corresponds to 500-year and 100-year floodplains)	Less than 0.2 % annual flood risk = 1 0.2% annual flood risk = 2 1% annual flood risk = 3 Regulatory floodways = 5	FEMA flood maps

Feature	Description	Categories and associated ranking (1-5)	Data Source
Land cover Features			
Land use category	WCD classifications based on Whatcom County and USDA layers, aerial imagery, and windshield surveys	28 categories (see Appendix B for categories and associated pollutant rankings)	Whatcom Conservation District 2020
Presence of livestock	Properties with livestock determined by windshield surveys, WCD and WCWP partners 2015-2020	No livestock observed = 1 Livestock observed = 5	Whatcom Conservation District 2020
Locations of septic systems	Onsite Septic Systems (OSS) in Whatcom County, including the OSS compliance status	No septic on parcel = 1 Status New or In-compliance (IN) = 2 Status Out of Compliance (Out, OutL) = 3 Status Septic Failing = 5	Whatcom County Health Department 2019
Miscellaneous			
Watersheds	Watershed boundaries based on LiDAR and National Hydrography Dataset (NHD)	NA	Whatcom Conservation District 2020
Parcels	Whatcom County parcel layer	NA	Whatcom County 2019

Appendix B. Land use categories with associated pollutant rankings and definitions.

Land Use Category		Pollutant Rankings					Definition of Land use Category
Primary	Secondary	Phosphorus	Nitrogen	Sediment	Pathogens	Combined	
Crop	Blueberry	2	4	3	1	3	Blueberry crop, all varieties and management.
Crop	Caneberry	2	4	4	1	3	All caneberries including raspberry, blackberry, currant.
Crop	Corn	4	4	4	4	4	All corn varieties including silage corn and sweet corn.
Crop	Fallow	2	2	5	1	3	Uncultivated land with no crop growing or field that has been plowed/harrowed but not planted in a crop for at least an entire growing season; not in short term transition to a second crop.
Crop	Forage	5	5	2	5	5	Perennial grass or other forage crop grown and harvested for silage or hay with at least one seasonal cutting; likely to have had at least one seasonal manure application; category does not include seasonal cover crop.
Crop	Pasture	4	4	4	4	4	Field is being managed as grazing land for the majority of the year; animals are actively grazed on the pasture; field can have one seasonal forage harvest but must primarily be used for grazing.
Crop	Potatoes	4	4	5	1	4	Potatoes actively growing in field, even if short term rotation.
Crop	Orchard	2	2	2	1	2	Any type of crop grown in an orchard, including, but not limited to, apples, pears, cherries, grapes, etc.
Crop	Nursey	1	1	2	1	2	A managed setting where plants are propagated and grown to a desired age or size.
Crop	Unmanaged	1	1	2	1	2	No, or very low, management of field. Typically, a "wild" grass stand is growing. Material not harvested annually.
Crop	Small grain	4	4	4	3	4	All small grain crops including wheat and barley.
Crop	Strawberry	2	3	4	1	3	Strawberry
Crop	Vegetable	2	2	2	2	2	All vegetable crops grown for commercial sales.
Crop	Other	3	3	3	3	3	Any other type of crop not categorized in this list.
Developed	Gravel	1	1	2	1	2	Gravel mining area, active or inactive.
Developed	Commercial Turf Grass	2	4	2	1	3	Managed and fertilized turf grass including commercial turfgrass, golf courses, parks, sports fields, and cemeteries. Not residential tuff grass.

Developed	Residential Turf Grass	2	3	1	1	2	Turf or lawn associated with residences; may be manicured and fertilized.
Developed	Roads	1	1	2	1	2	Paved, public roadways; does not include private, gravel or unmaintained roads
Developed	Commercial	1	1	2	1	2	Impermeable and permeable surfaces for commercial purposes, including businesses, industrial, driveway, and parking surfaces.
Developed	Residential	1	1	2	1	2	High or low density residential including impermeable (i.e., driveway, hardscaping) and permeable (i.e., lawn, garden) surfaces
Developed	Unmanaged	1	1	2	1	2	Unmanaged permeable areas associated with roadways, commercial, or residential properties.
Farmstead	Crop	1	1	2	1	2	A farmstead (i.e., buildings, house) associated with a crop farm.
Farmstead	Dairy	2	2	2	2	2	A farmstead (i.e., buildings, house, manure storage) associated with a dairy farm.
Farmstead	Other Animal	3	3	3	3	3	A farmstead (i.e., buildings, house, manure storage, heavy use area) associated with a livestock property (may include horses, beef cattle, pigs, goats, etc.).
Riparian/ Streambank	Riparian/ Streambank	1	1	2	2	2	Any area adjacent to a waterway or waterbody with permanent or semi-permanent vegetation.
Forest	Forest	1	1	2	2	2	Natural or managed forest stand.
Water	Water	1	1	1	1	1	Any waterbody including lakes, stream, river, or ditch (perennial or seasonal).
Wetland	Wetland	1	2	1	2	2	Seasonal or perennial wetlands.

Pollutant Rankings Key	
1	very unlikely to export pollutant (no pathway) / no or very low contribution
2	unlikely to export /low or very low contribution of pollutant
3	somewhat likely to export/ potential for a moderate contribution
4	likely export pathways/ potential for a moderate to high contribution
5	very likely an export pathways/ greatest contribution of pollutant

Appendix C. Total acreage and Critical Source Areas (CSA) by land use category. The total watershed acreage includes only the portion of the Fishtrap Watershed located in Washington State.

Land Use	Total acres of land use in watershed (acres)	Land use acreage classified as CSA[1] (acres)	Acreage classified as CSA within land use	Land use acreage classified as CSA / Total acres in watershed (*9,363 acres*)	Land use acreage classified as CSA / Total CSA acres in watershed (*2,669 acres*)
TOTAL Watershed	***9,363***	***2,669***	***NA***	***29%***	***100%***
Crop *Total*	***6,600***	***2,339***	***35%***	***25%***	***88%***
Blueberry	933	224	24%	2%	8%
Caneberry	1,183	8	1%	0%	0%
Corn	1,393	552	40%	6%	21%
Fallow	2	0	19%	0%	0%
Forage	2,165	1,268	59%	14%	48%
Nursery	8	1	12%	0%	0%
Orchard	2	0	0%	0%	0%
Other	19	1	5%	0%	0%
Pasture	100	54	54%	1%	2%
Potatoes	338	76	23%	1%	3%
Small Grain	110	42	38%	0%	2%
Strawberry	3	0	0%	0%	0%
Unmanaged	344	113	33%	1%	4%
Vegetable	0	0	0%	0%	0%
Farmstead *Total*	***391***	***102***	***26%***	***1%***	***4%***
Crop	52	4	8%	0%	0%
Dairy	213	66	31%	1%	2%
Other Animal	127	32	25%	0%	1%
Developed *Total*	***1,878***	***105***	***6%***	***1%***	***4%***
Commercial	224	2	1%	0%	0%
Gravel	1	0	0%	0%	0%
Residential	1,190	39	3%	0%	1%
Road	199	57	28%	1%	2%
Comm. Turf Grass	211	0	0%	0%	0%
Res. Turf Grass	16	3	17%	0%	0%
Unmanaged	37	5	13%	0%	0%
Natural Space *Total*	***494***	***124***	***25%***	***1%***	***5%***
Forest	184	17	9%	0%	1%
Riparian	240	98	41%	1%	4%
Water	70	10	14%	0%	0%
Wetland	0	0	0%	0%	0%

[1]*CSA = Critical Source Area with rating of medium-high or high.*

Appendix D. NRCS surface water quality conservation management practices for cropland and farmstead by outreach audience type.

	Cropland Practices												
Audience	Irrigation Water Management	Structure for Water Control	Nutrient Management	Setbacks	Prescribed Grazing	Conservation Cover / Cover Crop / Conservation Crop Rotation	Field Border	Filter Strip	Riparian Forest Buffer	Vegetative Treatment Area	Waste Transfer	Underground Outlet (Ditch Cover) / Drainage Ditch Covering	Watering Facility/ Livestock pipeline
NRCS Practice Standard Code	449	587	590/ 634	590	528	327/340 /328	386	393	391	635	634	620/775	614/516
Dairy *	x	x	x	x	x	x	x	x	x	x	x	M	
Cattle/Equine*	M	x	x	x	x		x		x	x	x	x	M
Potato	M	x	x	x		M	x	x	x			x	
Berry	x	x	x	x		M	x	x	M			M	

**Crops associated with Dairy include forage and corn; crop associated with Cattle and Equine is pasture.*

	Farmstead Practices						
Audience	Roof Runoff Structure/ Outlet	Heavy Use Area	Fence	Waste Storage Facility	Waste Facility Closure	Roofs and Covers	Agrichemical Handling Facility
NRCS Practice Standard Code	558	561	382	313	360	367	309
Dairy	x		x	M		x	
Cattle/Equine	x	x	x	x	x	x	
Potato					M		x
Berry					M		x